2014 Work Plan

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

Permit #4-0101-00171/00011

Submitted to:

Mr. Peter Innes
Supervisor of Natural Resources
NYSDEC Region 4
1130 N. Westcott Rd.
Schenectady, NY 12306

Submitted by:

City of Albany
Department of General Services
Rapp Road Waste Management Facility
525 Rapp Rd.
Albany, NY 12205

Draft November 25, 2013
Revised _____, 2013

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2014 Work Plan
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City of Albany, New York

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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 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 Preserve Commission (APBPC) 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 City of Albany shall submit a final work plan to the IHMT for final approval and sign-off.

The 2014 work plan schedule identifies tasks that remain to be performed in the Phase III enhancement areas, where restoration activities initiated in 2012 and largely completed in 2013 have restored existing wetland and upland barrens habitats in the eastern and western sectors of the project site. Phase III areas are located on either side of the Phase II constructed stream and wetland habitats built in 2011 in the former Fox Run Mobile Home Park. The Phase III follow-up restoration activities in 2014 will complete a significant portion of the critical habitat linkage in the Preserve, which will culminate with the final closure and restoration of the landfill cap in future phases of the project. Follow-up restoration activities which are defined in appropriate sections of this work plan will also occur in Phase II areas during 2014, specifically the vernal pond and selected forested wetland locations, where wetland modifications were undertaken in 2013 to improve hydrological conditions supportive of the planned target community types.

Approximately 50-75% of the sand needs for capping and restoring the landfill have been acquired and stockpiled on the site, depending on actual sand depth requirements. This is sufficient to cover the GAL portion of the landfill. Future sand needs will be determined based on outcomes of the test plot study that is looking at appropriate sand depth requirements for supporting Pitch Pine Scrub Oak barrens vegetation. In the meantime, the City will look for opportunities to take advantage of outside development projects with Pine Bush sands where excess sand may be available, and acquire additional sand as needed in the future from approved sources. Given current stockpiles, the need to acquire sand will not occur for approximately 8-10 years, upon final closure of the landfill.

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 2014 Work Plan 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. nursery operations 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 (by NYSDEC and APBPC) 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 informed of the status of restoration work and to allow participants an opportunity to address unforeseen issues and make necessary refinements 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 (containing Article 24 Freshwater Wetlands: 4-0101-00171/00015; Article 15 Section 401 Water Quality Certification: 4-0101-00171/00016; and Article 11-0535, 6 NYCRR 182, Endangered/Threatened Species License): includes requirements, stipulated conditions, roles and responsibilities, performance requirements and outcomes to guide the permittee.
- Temporary Revocable Permit issued by the Albany Pine Bush Preserve Commission (2010 TRP issued March 22, 2010; 2011 TRP issued February, 2011; 2012 TRP issued April 18, 2012; 2013 TRP issued April 5, 2013, with an addendum issued May 22, 2013 via email).
- New York District USACE Permit # NAN-2005-01137
- USFWS Biological Opinion dated May 20, 2010 and revised August 4, 2010.
- Albany Rapp Road Landfill Ecosystem Mitigation, Restoration & Enhancement Plan (June 2009): 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, June 2009): 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 2014 Work Plan

The 2014 Phase III Work Plan consists of two principle components: the annual work schedule and map highlighting the Phase III areas where restoration enhancement 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.

2014 Context Map and 2014 Work Plan Schedule

Attachment A. 2014 Context Map—this year's continuation of the Phase III restoration activities will focus on conducting enhancement seeding of existing upland and wetland communities to the east and west of the 2011 Phase II restoration construction zone. Considerable progress was made within the Phase III restoration area during 2013, with tree clearing and grubbing and aggressive invasive species management. Enhancement seeding with native species will occur based on the 2013 late summer assessment of the response from the native soil seedbank, which was anticipated to be considerable in some locations given the increased light levels resulting from the clearing and grubbing treatments. Activities will continue to take place in both Phase I and Phase II areas, including maintenance and operations in the constructed native nursery; woody planting, maintenance, and monitoring in the test plots; and maintenance and monitoring in the constructed streams, wetlands, and uplands. These areas are depicted in Context Map immediately following this section.

Attachment B. 2013 Work Plan Schedule—the work schedule enumerates tasks to be conducted during the 2014 project season. The schedule includes tasks that were initiated in 2013 and will be completed in 2014, such as PIII enhancement seeding activities, vernal pond and wetland modification follow-up treatments, and planting of woody species in the test plots. Several tasks are ongoing, such as invasive species control, seed collection, faunal surveys, and vegetation and hydrological monitoring. The schedule timeline projects work activity into 2015.

Technical Work Plans

Attachment C. Nursery Operations & Maintenance—identifies 2014 nursery bed maintenance activities needed to mitigate erosion risk and to ensure weed control, proper irrigation, and seed productivity. The plan lists herbicides needed to control invasive weedy species and aphids.

Attachment D. Seed/Plant Collection and Acquisition—identifies target species for 2014 collections from the Preserve and from within the approved 50-mile geographic radius surrounding the Preserve, as well as seed donated by APBPC and seed available from approved commercial sources.

Attachment E. Test Plot Planting, Maintenance & Monitoring—identifies the location, layout, and monitoring protocols, methods, and scheduling 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. 2014 will be the third year of test plot monitoring activities. The work plan contains a planting plan for woody species.

Attachment F. Phase II Vernal Pond & Wetland Modifications—in 2013, three locations within the Phase II area were identified where modifications to elevations occurred to improve hydrological conditions supportive of the planned target community types. These areas include the vernal pond, forested wetlands in the central sector of the Phase II area, and riparian forested wetlands in the vicinity of the newly constructed pump house located on the south side of the southern stream reach. Persistent high water levels that occurred during an unprecedented year of rainfall in 2013 prevented successful seeding of the second application of the sphagnum propagation material. Attachment F provides the process to follow to determine if additional Pine

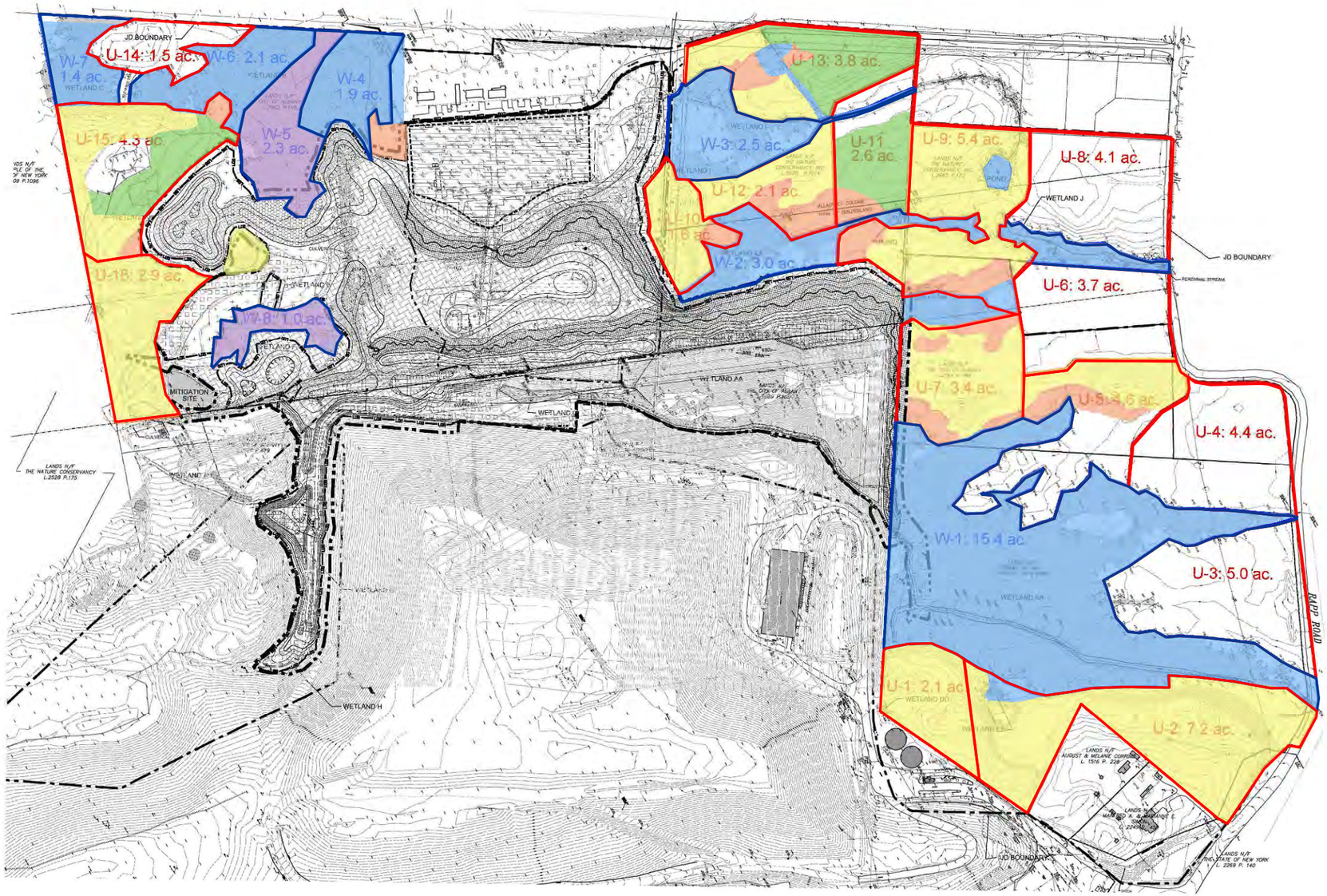
Bush Vernal Pond wetland species seed and Sphagnum moss propagules are to be re-seeded in 2014. Follow-up treatments in riparian forested wetland in the vicinity of the pump house will be undertaken to improve retention of hydrology in constructed soils with low organic content.

Attachment G. Invasive Plant Management—identifies target species to be controlled and managed in 2014.

Attachment H. Phase III Enhancement—identifies management units, methods, and strategies for conducting restoration and enhancement seeding activities in the Phase III areas where clearing, grubbing, and thinning activities were completed in 2013.

Attachment I. Soil & Hydrologic Monitoring—identifies the hydrological monitoring activities for 2014, according to Appendix 3 Monitoring Plan & Performance Criteria contained in the permitted restoration plan.

Attachment J. Ecological Monitoring—provides monitoring protocols, methods, sampling locations, and scheduling for conducting ongoing ecological monitoring of vegetation and wildlife encompassing the Phase II constructed wetlands, streams, and uplands; and in a representative location within the Phase III enhancement area. 2014 will be the third year of vegetation monitoring in the Phase II and Phase III areas.



Phase III Project Areas

- Upland Units
- Wetland Units

Phase III Enhancement Seeding

Albany Rapp Road Landfill
Albany, NY

City of Albany
One Conners Blvd.
Albany, New York

Phase III Enhancement Seeding*

- Forested Wetland Enhancement Mix (28.08 Acres)
- Mesic Meadow Enhancement Mix (4.52 Acres)
- PPSOB Enhancement Mix (4.62 Acres)
- PPSOB Mix (26.37 Acres)
- Wet Meadow Enhancement Mix (3.36 Acres)

* Seeding areas are estimated and have not been surveyed with GPS.

N

0 200 400 800 Feet

1 inch = 400 feet when printed on 11x17

Coordinate System:
NY State Plane East

AES Project #: 09-0636

Seeding_Plan_20130830.mxd

Applied Ecological Services, Inc.
120 W. Main St.
West Dundee, Illinois 60018
Phone: 847-844-9385
Email: info@appliedeco.com
www.appliedeco.com

Last modified:
Aug 30, 2013
Mapped by: mlb

Attachment B. 2014 Work Plan Schedule (includes continuation of activities into 2015)
Albany Rapp Road Landfill Ecosystem Mitigation, Restoration & Enhancement Plan

Due Dates	General Task/ SpecificTask (Year)	2014												2015												Roles/ Responsibilities	Location of Task Specific Information			
	(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 Mgmnt Plan	DEC Permit
	1. Construction Management																													
	a. Prepare and distribute weekly onsite activity reports/notifications per TRP	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	Consultant				
	b. Attend weekly landfill construction meetings 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	Consultant				
	c. Conduct SWPPP inspections and reporting	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	Consultant				p. 13
	d. Conduct special meetings, site visits, comunications and follow-up reporting	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	Consultant				
	e. Weekly management team meetings 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	Consultant				
	2. Construction Oversight																													
	a. Conduct Construction Oversight 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	Consultant				
	b. Prepare and distribute daily and weekly reports 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	Consultant				
	3. Annual Work Plan																													
30-Jan	a. Prepare and submit Draft Annual Work Plan	x							x	x	x	x	x	x							x	x	x	x	x	Consultant				p. 18
	b. Coordinate TRP approval (concurrent w/ submittal of final approved work plan)		x	x	x										x	x	x									Consultant/City				p. 18
	c. Coordinate and attend Interagency Habitat Management Team meeting(s) and follow-up communications for review/approval and finalization of Annual Work Plan	x	x	x	x									x	x	x	x									Consultant/City				p. 18
	4. Annual Compliance Report																													
1-Dec	a. Prepare and submit Annual Compliance Report									x	x	x										x	x	x		Consultant/City				p. 18
	b. Follow-up discussions, communications w/ agencies and IHMT	x	x										x	x	x										x	Consultant/City				
	5. Nursery Operations & Maintenance																										p. 20, 21			
	a. Conduct nursery maintenance (watering, weeding, and cultivating)				x	x	x	x	x	x	x						x	x	x	x	x	x	x			Consultant/City/Contract				
	b. Nursery bed soil amendments.			x	x	x	x	x	x	x	x					x	x	x	x	x	x	x	x			Consultant/City/Contract				
	6. Seed/Plant Collection & Acquisition																										p. 20, 21			
	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	x	Consultant				
	b. Acquire collection permits 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	Consultant				
	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	x			Consultant				
	d. Conduct hand seed collections within APBP/sites in 50-mile radius/onsite nursery					x	x	x	x	x	x	x						x	x	x	x	x	x	x		Consultant	p. 20, 21/65 - 66			
	e. Clean, process, inventory and store seed	x	x	x					x	x	x	x	x	x	x	x						x	x	x	x	Consultant				
	f. Identify commercially available seed, plants and woody material	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	Consultant				
	7. Test Plot Planting, Maintenance & Monitoring																													
	a. Repair any Test Plot erosion				x	x	x	x	x	x	x						x	x	x	x	x	x	x			Contractor				
	b. Install trees and shrubs in test plots.				x	x																				City/Contractor				
	c. Conduct Test Plot maintenance (mowing, weed control conducted under Task 9))					x	x	x	x	x	x							x	x	x	x	x	x			Consultant/City				
	d. Conduct annual performance monitoring, analysis and reporting (including faunal surveys for birds and butterflies to be conducted concurrently with faunal surveys in Task 13)			x	x	x	x	x	x	x	x	x	x			x	x	x	x	x	x	x	x	x	x	Consultant				

Due Dates	General Task/ SpecificTask (Year)	2014												2015												Roles/ Responsibilities	Location of Task Specific Information			
	(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 Mgmnt Plan	DEC Permit
	8. Phase II Vernal Pond & Wetland Modifications																													
	a. Conduct second sphagnum planting in vernal pond.				x	x	x																			City/Contractor				
	b. Amend soils in selected areas with bentonite clay or polyachrylimide materials.				x	x	x																			City/Contractor				
	9. Invasive Plant Management																													
	a. Conduct herbaceous species management in Phase II and III and selected areas (e.g. all restoration construction zones, test plots, sand stockpile areas, and selected enhancement areas)					x	x	x	x	x	x							x	x	x	x	x	x			Consultant	p. 39 - 42		p. 27 - 49	
	b. Conduct Phragmites follow-up control (entire site)								x	x	x										x	x	x			Consultant			p. 43	
	c. Conduct woody control throughout restoration area.	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	Consultant	p. 43 - 45		p. 28 - 47	
	d. Conduct oriental bittersweet control (entire site)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	Consultant			p. 30 - 31	
	10. Plans & Specifications																													
	a. Prepare plans and specifications for erosion control issues as neecded, and for potential test plot on AIL.																									Consultant				
	11. Phase III Enhancement																													
	a. Conduct mowing as directed to prep for native seeding (to remove woody vegetation that may interfere with proper seed drill operation, in W5, parts of U12, U10 utility ROW, and any other areas that have heavy woody regrowth).			x	x	x																				City				
	b. Cover crop seeding for minor repairs as needed.																									City				
	c. Enhancement seeding (based on fall 2013 assessment of seedbank response and assessment of appropriate areas for lupine)			x	x	x																				City/Consultant				
	12. Soil & Hydrologic Monitoring																													
	a. Pre-monitoring calibration of Telog sensors and re-install soil moisture sensors			x	x											x	x									Consultant				
	b. Conduct hydrology monitoring, analysis and reporting				x	x	x	x	x	x	x	x	x				x	x	x	x	x	x	x	x	x	Consultant	p. 104 - 106			p. 13
	c. End of season removal of soil moisture sensors to store for 2014 use											x												x		Consultant				
	13. Ecological Monitoring																													
	a. Conduct vegetation monitoring, analysis and reporting					x	x		x	x		x	x					x	x		x	x		x	x	Consultant				
	b. Conduct wetland analysis and reporting in Phase II restoration								x	x											x	x				Consultant				
	c. Conduct bird, butterfly and moth surveys, analysis and reporting (see also Test Plots Task 7d)				x	x	x	x	x	x	x	x	x				x	x	x	x	x	x	x	x	x	Consultant				
	d. Conduct reptile and amphibian surveys, analysis and reporting			x	x	x	x		x	x		x	x			x	x	x	x		x	x		x	x	Consultant				

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

I. Nursery replanting

a. Soil testing during nursery construction in 2011 determined that sands excavated onsite would be of higher pH than desired, but were within a reasonable range to allow lowering with amendments of ferric sulfate as determined by bench tests. These treatments proved to be effective where applied on the eastern nursery, as evidenced by beds that have been more consistently productive since establishment. Stunted growth and mortality in some sectors of the nursery prompted a re-sampling of pH in 2013 to determine if changes were occurring that required followup amendments. This is not uncommon, as pH amendments are generally not a one-time fix, particularly where pH levels are above 7.5 and have a very strong buffering capacity and are not as easily acidified. The preliminary pH sampling also found significant variability in some areas of the nursery (5.99 – 8.31), which might be explained as the result of the excavator spreading sand extracted from varying depths within the pit. Some areas appear to have received top and shallow subsoils that have organic staining. Deeper soils with high pH contain higher quantities of some chemical constituents such as cations, than are found in the topsoils which support the Pine Bush ecosystem types and associated plants. An example is the frostweed (*Helianthemum canadense*) bed in which a majority of the plants are stunted or appear to be in a dormant condition. The nursery amendments will follow the same plan and quantities used in 2011 (1/2 ton ferric sulfate per acre) with refinements made based on the results of additional pH testing to fine tune the amendment strategy (forthcoming by mid November). While a pH amendment is recommended to correct this problem in the frostweed bed, enough plants may have already succumbed to nutrient deficiency to necessitate replanting with a more vigorous crop. This can be accomplished by overseeding with wild lupine (*Lupinus perennis*) into the existing rows. Lupine is a fast grower, high seed producer, and germinates quickly. The addition of extra bed space for lupine simply provides a larger, readily available seed source for use in the restoration.

II. Nursery maintenance—irrigation, weed control, erosion control, soil amendment

a. Maintenance on the beds including irrigation, hand weeding, spot application of herbicide and if necessary mechanical cultivation. The appropriate technique applied will be determined by watering needs throughout the growing season and weed pressure in the spring.
    i. Irrigation will be done as needed to maintain consistent, adequate soil moisture conditions. Watering will occur more frequently as plants begin to produce buds to encourage higher yields.
    ii. Hand weeding will be done using hand tools such as hoes and shovels.
    iii. Spot application of herbicide will be done with a back pack sprayer or similar small volume spraying equipment.

III. Harvest Estimates

a. Based on the proposed model, the nursery should be able to produce 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, and at no one time are all beds producing their peak yields.

b. These are the numbers used in estimating production yields in the specialty locations. Thus, (2.65 acres) x (100 lbs/ac) = 265 lbs annual nursery seed production at peak production. 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. A conservative yield, once full production is underway (after first or second year of growth) may be roughly **150-200 lbs** annually for the planned Albany operation. This nursery has not yet achieved these production yields in part because of the late first year planting in 2011 (July/August during severe heat and drought) followed by drought and associated stresses in 2012, all of which co-occurred during the early nursery establishment. Under these conditions, even with supplemental irrigation, plants will require more time reach peak production. With more favorable growing conditions in 2013, bed production has been improving for some species. With correction of the high pH conditions measured in underproductive areas of the nursery in 2014, increasing areas of the nursery will come into full production within the next year or so.

c. Seed will be hand-harvested from the nursery beds. Harvest times will vary depending on the species, requiring regular monitoring of each production bed during flowering and seed-ripening periods to determine the appropriate window for collections to occur.

IV. Herbicide plan

a. Nursery staff will use the following herbicides to limit weed competition with desired nursery crops (see attached Material Safety Data Sheets).
   i. Glyphosate IPA Salt (Razor®Pro)
   ii. Triclopyr Triethylamine salt (Garlon 3A™)
   iii. Triclopyr (Garlon 4 Ultra™)
   iv. Pendimethalin (LESCO PRE-M AquaCap™)
   v. Safer Soap(Aphid Killer)

b. Herbicide will be applied in the nursery area as part of the invasive species management plan.

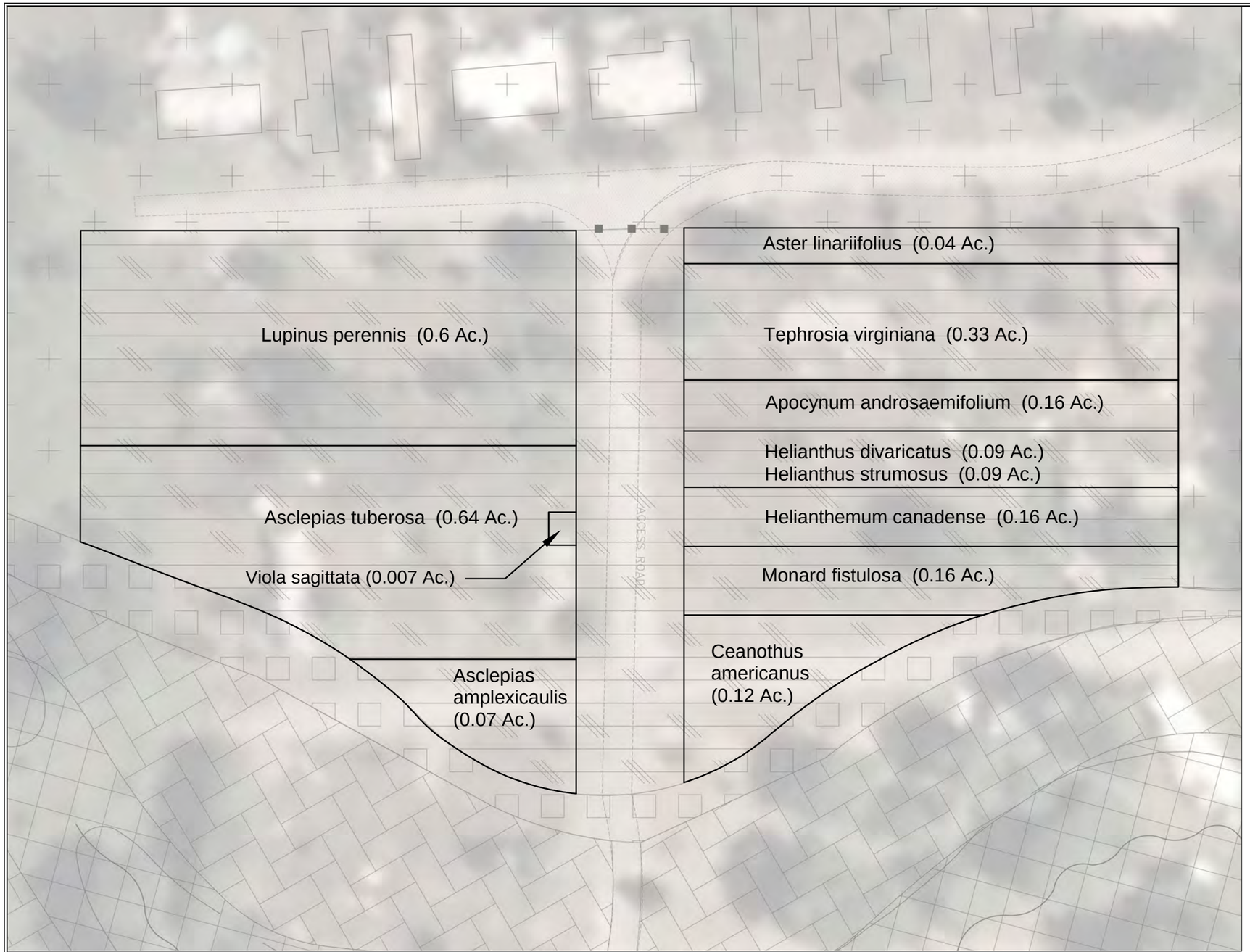
c. Areas applied will be clearly marked with the type of herbicide applied and the manufacture recommended re-entry interval.

d. Contractor will follow all label precautions and restrictions

Proposed Schedule for Initial Nursery Maintenance and Seed Collection

March 2014	Assessment of nursery beds and implementation of weeding as necessary and apply soil amendments
March/April 2014	Application of approved pre-emergent herbicide with backpack sprayer along rows (re-application every 6-8 weeks)

April 2014	Lupine seeding in *Helianthemum* bed
April-September 2014	Weed control and maintenance in production beds as required
	Supplemental irrigation if determined necessary
September 2014	Begin thrashing and refining of late summer harvest
November 2014	2014 collections complete and refining process beginning
2013 – 2016	Peak seed harvest years in production beds
2017	First rotation of weakening fields



Nursery Composition

Apocynum androsaemifolium (0.16 Ac.)
Asclepias amplexicaulis (0.07 Ac.)
Asclepias tuberosa (0.64 Ac.)
Aster linariifolius (0.04 Ac.)
Ceanothus americanus (0.12 Ac.)
Helianthemum canadense (0.16 Ac.)
Helianthus divaricatus (0.09 Ac.)
Helianthus strumosus (0.09 Ac.)
Lupinus perennis (0.6 Ac.)
Monard fistulosa (0.16 Ac.)
Tephrosia virginiana (0.33 Ac.)
Viola sagittata (0.007 Ac.)

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 30 60 120 Feet

Scale: 1" = 60'

To Scale When Printed at 11 x 17

S:090636:112513

Albany Rapp Road Landfill

Albany, New York

City of Albany, Dept. of General Services

One Connors Blvd.

Albany, New York

Phase II 2012 Work Report

Nursery Construction and Operations

AES Proj. #:	09-0636
Designed By:	JL
Drawn By:	WCC
Checked By:	JL
File:	Phase II Work Plan 2012.dwg
Date:	01/28/2013
Coordinate System:	N/A

Applied Ecological Services, Inc.
17921 Smith Road, P.O. Box 256
Brodhead, WI 53520
Phone: (608) 897-8641 Fax: (608) 897-8486
www.appliedeco.com
Email: info@appliedeco.com

C.1

SHEET_X_OF_Y

For Chemical Emergency, Spill, Leak, Fire, Exposure, or Accident,
Call CHEMTREC Day or Night: 1-800-424-9300.
For Medical Emergencies Only, Call 1-877-325-1840.

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Razor® Pro
Synonyms: Isopropylamine Salt of Glyphosate; Glyphosate IPA Salt
EPA Reg. No.: 228-366

Company Name: Nufarm Americas Inc.
150 Harvester Drive, Suite 200
Burr Ridge, IL 60527

Date of Issue: March 27, 2007 **Supersedes:** March 23, 2005
Sections Revised: New or updated information all sections

2. HAZARDS IDENTIFICATION

Emergency Overview:
Appearance and Odor: Clear, viscous greenish/yellow solution with little odor.
Warning Statements: Keep out of reach of children. CAUTION. Causes moderate eye irritation. Harmful if swallowed or inhaled. Do not get in eyes or on clothing. Avoid breathing vapor or spray mist.

Potential Health Effects:
Likely Routes of Exposure: Skin contact and inhalation.
Eye Contact: The undiluted product may cause pain, redness and tearing based on toxicity studies.
Skin Contact: Slightly toxic and slightly irritating based on toxicity studies.
Ingestion: Slightly toxic based on toxicity studies. No significant adverse health effects are expected to develop if only small amounts (less than a mouthful) are swallowed.
Inhalation: Low inhalation toxicity.
Medical Conditions Aggravated by Exposure: None known.

See Section 11: TOXICOLOGICAL INFORMATION for more information.

Potential Environmental Effects:
Available data on similar formulations suggest that this product would be slightly to moderately toxic to aquatic organisms and practically non-toxic to avian species, honeybees and earthworms.

See Section 12: ECOLOGICAL INFORMATION for more information.

3. COMPOSITION / INFORMATION ON INGREDIENTS

COMPONENT	CAS NO.	% BY WEIGHT
Glyphosate, N-(phosphonomethyl) glycine, in the form of its isopropylamine salt	38641-94-0	41.0
Other Ingredients Including:		59.0
Ethoxylated Tallowamines	61791-26-2	

4. FIRST AID MEASURES

If in Eyes: Hold eye open and rinse slowly and gently with water for 15 to 20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.
If Swallowed: Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by the poison control center or doctor. Do not give anything by mouth to an unconscious person.
If Inhaled: Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth-to-mouth, if possible. Call a poison control center or doctor for further treatment advice.
If on Skin: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15 to 20 minutes. Call a poison control center or doctor for treatment advice.

5. FIRE FIGHTING MEASURES

Flash Point: Not applicable due to aqueous formulation
Autoignition Temperature: Not determined **Flammability Limits:** Not determined

Extinguishing Media: In case of fire, use water (flood with water), dry chemical, CO_2, or alcohol foam.
Special Fire Fighting Procedures: Firefighters should wear NIOSH/MSHA approved self-contained breathing apparatus and full fire-fighting turn out gear. Dike area to prevent runoff and contamination of water sources. Dispose of fire control water later.
Unusual Fire and Explosion Hazards: Containers will burst from internal pressure under extreme fire conditions. If water is used to fight fire or cool containers, dike to prevent runoff contamination of municipal sewers and waterways.
Hazardous Decomposition Materials (Under Fire Conditions): May produce gases such as oxides of carbon, nitrogen, and phosphorous.

National Fire Protection Association (NFPA) Hazard Rating:
Rating for this product: Health: 1 **Flammability:** 1 **Reactivity:** 0
Hazards Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions: Wear appropriate protective gear for the situation. See Personal Protection information in Section 8.
Environmental Precautions: Prevent material from entering public sewer systems or any waterways. Do not flush to drain. Large spills to soil or similar surfaces may necessitate removal of topsoil. The affected area should be removed and placed in an appropriate container for disposal.
Methods for Containment: Dike spill using absorbent or impervious materials such as earth, sand or clay. Collect and contain contaminated absorbent and dike material for disposal.
Methods for Cleanup and Disposal: Pump any free liquid into an appropriate closed container. Thoroughly scrub floor or other impervious surface with a strong industrial detergent and rinse with water. Collect washings for disposal. Decontaminate tools and equipment following cleanup. See Section 13: DISPOSAL CONSIDERATIONS for more information.
Other Information: Large spills may be reportable to the National Response Center (800-424-8802) and to state and/or local agencies.

7. HANDLING AND STORAGE

Handling:
Do not get in eyes or on clothing. Avoid breathing vapor or spray mist. Users should wash hands before eating, drinking, chewing gum, using tobacco or using the toilet. Remove clothing immediately if pesticide

gets inside. Then wash thoroughly and put on clean clothing. Remove Personal Protective Equipment (PPE) immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

Spray solutions of this product should be mixed, stored and applied using only stainless steel, aluminum, fiberglass, plastic or plastic-lined containers.

DO NOT MIX, STORE OR APPLY THIS PRODUCT OR SPRAY SOLUTIONS OF THIS PRODUCT IN GALVANIZED STEEL OR UNLINED STEEL (EXCEPT STAINLESS STEEL) CONTAINERS OR SPRAY TANKS. This product or spray solutions of this product react with such containers and tanks to produce hydrogen gas which may form a highly combustible gas mixture. This gas mixture could flash or explode, causing serious personal injury, if ignited by open flame, spark, welder's torch, lighted cigarette or other ignition source.

Storage:
STORE ABOVE 10ºF (-12ºC) TO KEEP PRODUCT FROM CRYSTALLIZING. Crystals will settle to the bottom. If allowed to crystallize, place in a warm room 68ºF (20ºC) for several days to redissolve and shake, roll or agitate to mix well before using. Do not contaminate water, foodstuff, feed or seed by storage or disposal.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering Controls:
Where engineering controls are indicated by specific use conditions or a potential for excessive exposure, use local exhaust ventilation at the point of generation.

Personal Protective Equipment:
Eye/Face Protection: To avoid contact with eyes, wear chemical goggles or shielded safety glasses. An emergency eyewash or water supply should be readily accessible to the work area.
Skin Protection: To avoid contact with skin, wear long pants, long-sleeved shirt, socks and shoes. An emergency shower or water supply should be readily accessible to the work area.
Respiratory Protection: Not normally required. If vapors or mists exceed acceptable levels, wear NIOSH approved air-purifying respirator with cartridges/canisters approved for use against pesticides.
General Hygiene Considerations: Personal hygiene is an important work practice exposure control measure and the following general measures should be taken when working with or handling this material: 1) do not store, use and/or consume foods, beverages, tobacco products, or cosmetics in areas where this material is stored; 2) wash hands and face carefully before eating, drinking, using tobacco, applying cosmetics or using the toilet.

Exposure Guidelines:

	OSHA		ACGIH		
Component	TWA	STEL	TWA	STEL	Unit
Isopropylamine Salt of Glyphosate	NE	NE	NE	NE	
Ethoxylated Tallowamines	NE	NE	NE	NE	

NE = Not Established

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance and Odor: Clear, viscous greenish/yellow solution with little odor.

Boiling Point:	Not determined	**Solubility in Water:**	Soluble
Density:	9.67 pounds/gallon	**Specific Gravity:**	1.160 @ 20ºC
Evaporation Rate:	Not determined	**Vapor Density:**	Not determined

Freezing Point:	10ºF (-12ºC)	**Vapor Pressure:**	Not determined
pH:	4.5 – 5.5	**Viscosity:**	29.5 cps @ 20ºC

Note: Physical data are typical values, but may vary from sample to sample. A typical value should not be construed as a guaranteed analysis or as a specification.

10. STABILITY AND REACTIVITY

Chemical Stability: This material is stable under normal handling and storage conditions.
Conditions to Avoid: Excessive heat. Do not store near heat or flame.
Incompatible Materials: Strong oxidizing agents: bases and acids. This product reacts with galvanized steel or unlined steel (except stainless steel) to produce hydrogen gas that may form a highly combustible gas mixture which could flash or explode.
Hazardous Decomposition Products: Under fire conditions may produce gases such as oxides of carbon, nitrogen, and phosphorous.
Hazardous Reactions: Hazardous polymerization will not occur.

11. TOXICOLOGICAL INFORMATION

Toxicological Data:
Data from laboratory studies conducted on a similar, but not identical, formulation:
Oral: Rat LD_{50}: >5,000 mg/kg
Dermal: Rat LD_{50}: >5,000 mg/kg
Inhalation: Rat 4-hr LC_{50}: >2.05 mg/l
Eye Irritation: Rabbit: Moderately irritating
Skin Irritation: Rabbit: Slightly irritating
Skin Sensitization: Not a contact sensitizer in guinea pigs following repeated skin exposure.

Subchronic (Target Organ) Effects: Repeated overexposure to glyphosate may decrease body weight gains and effects to liver. The surfactant component of this product is reported to cause irritation to the eyes and skin and may contribute to the irritation potential reported for this herbicide. Ingestion may produce gastrointestinal irritation, nausea, vomiting and diarrhea.
Carcinogenicity / Chronic Health Effects: Prolonged overexposure to glyphosate may cause effects to the liver. There was no evidence of carcinogenicity in animal studies using glyphosate. EPA has given glyphosate a Group E classification (evidence of non-carcinogenicity in humans).
Reproductive Toxicity: In laboratory animal studies with glyphosate, effects on reproduction have been seen only at doses that produced significant toxicity to the parent animals.
Developmental Toxicity: In animal studies, glyphosate did not cause birth defects in animals; other effects were seen in the fetus only at doses which caused toxic effects to the mother.
Genotoxicity: Glyphosate has produced no genetic changes in a variety of standard tests using animals and animal or bacterial cells.

Assessment Carcinogenicity: None listed with ACGIH, IARC, NTP or OSHA.

See Section 2: HAZARDS IDENTIFICATION for more information.

12. ECOLOGICAL INFORMATION

Ecotoxicity:
Data on Glyphosate technical:

96-hour LC_{50} Bluegill:	120 mg/l	Bobwhite Quail 8-day Dietary LC_{50}:	>4,500 ppm
96-hour LC_{50} Rainbow Trout:	86 mg/l	Mallard Duck 8-day Dietary LC_{50}:	>4,500 ppm
48-hour LC_{50} Daphnia:	780 mg/l		

Environmental Fate:
In the environment, salts of glyphosate rapidly dissociate to glyphosate, which adsorbs strongly to soil and is expected to be immobile in soil. Glyphosate is readily degraded by soil microbes to AMPA (aminomethyl phosphonic acid) that is further degraded to carbon dioxide. Glyphosate and AMPA are unlikely to enter ground water due to their strong adsorptive characteristics. Terrestrially-applied glyphosate has the potential to move into surface waters through soil erosion because it may be adsorbed to soil particles suspended in the runoff. Aquatic applications registered for certain formulations may also result in glyphosate entering surface waters. Complete degradation is slow, but dissipation in water is rapid because glyphosate is bound in sediments and has low biological availability to aquatic organisms. These characteristics suggest a low potential for bioconcentration in aquatic organisms and this has been verified by laboratory investigations of glyphosate bioconcentration in numerous marine and freshwater organisms with and without soil. The maximum whole body bioconcentration factors for fish were observed to be less than 1X. Bioconcentration factors for sediment dwelling mollusks and crayfish tended to be slightly higher, but were always less than 10X. In addition, any residues accumulated in organisms were rapidly eliminated.

13. DISPOSAL CONSIDERATIONS

Waste Disposal Method:
Wastes resulting from the use of this product that cannot be used or chemically reprocessed should be disposed of in a landfill approved for pesticide disposal or in accordance with applicable Federal, state or local procedures. Emptied container retains vapor and product residue. Observe all label safeguards until container is destroyed.

Container Handling and Disposal:
Plastic Bottles and Non-Returnable Plastic Drums: Do not reuse container. Triple rinse container. Then puncture and dispose of in a sanitary landfill, or by incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.
Returnable/Refillable Containers: Close all openings which have been opened during use and replace all caps. Contact Nufarm Customer Service at 1-800-345-3330, to arrange for return of the empty refillable container.

14. TRANSPORTATION INFORMATION

Follow the precautions indicated in Section 7: HANDLING AND STORAGE of this MSDS.

DOT
Non Regulated – See 49 CFR 173.132(b)(3)

IMDG
Non Regulated – See IMDG 2.6.2.1.3

IATA
Non Regulated – See IATA 3.6.1.5.3

15. REGULATORY INFORMATION

U.S. Federal Regulations:

TSCA Inventory: This product is exempted from TSCA because it is solely for FIFRA regulated use.

SARA Hazard Notification/Reporting:
Hazard Categories Under Criteria of SARA Title III Rules (40 CFR Part 370): Immediate

Section 313 Toxic Chemical(s): None

Reportable Quantity (RQ) under U.S. CERCLA: None

RCRA Waste Code: None

State Information:
Other state regulations may apply. Check individual state requirements.

California Proposition 65: Not listed

16. OTHER INFORMATION

This Material Safety Data Sheet (MSDS) serves different purposes than and DOES NOT REPLACE OR MODIFY THE EPA-ACCEPTED PRODUCT LABELING (attached to and accompanying the product container). This MSDS provides important health, safety and environmental information for employers, employees, emergency responders and others handling large quantities of the product in activities generally other than product use, while the labeling provides that information specifically for product use in the ordinary course.

Use, storage and disposal of pesticide products are regulated by the EPA under the authority of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) through the product labeling, and all necessary and appropriate precautionary, use, storage, and disposal information is set forth on that labeling. It is a violation of Federal law to use a pesticide product in any manner not prescribed on the EPA-accepted label.

Although the information and recommendations set forth herein (hereinafter “Information”) are presented in good faith and believed to be correct as of the date hereof, Nufarm Americas Inc. makes no representations as to the completeness or accuracy thereof. Information is supplied upon the condition that the persons receiving same will make their own determination as to its suitability for their purposes prior to use. In no event will Nufarm Americas Inc. be responsible for damages of any nature whatsoever resulting from the use of or reliance upon Information. NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OF ANY OTHER NATURE ARE MADE HEREUNDER WITH RESPECT TO INFORMATION OR THE PRODUCT TO WHICH INFORMATION REFERS.

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Dow AgroSciences LLC encourages and expects you to read and understand the entire (M)SDS, as there is important information throughout the document. We expect you to follow the precautions identified in this document unless your use conditions would necessitate other appropriate methods or actions.

1. Product and Company Identification

Product Name
GARLON* 3A Herbicide

COMPANY IDENTIFICATION
Dow AgroSciences LLC
A Subsidiary of The Dow Chemical Company
9330 Zionsville Road
Indianapolis, IN 46268-1189
USA

Customer Information Number: 800-992-5994
SDSQuestion@dow.com

EMERGENCY TELEPHONE NUMBER

24-Hour Emergency Contact: 800-992-5994
Local Emergency Contact: 352-323-3500

2. Hazards Identification

Emergency Overview
Color: Pink
Physical State: Liquid.
Odor: Ammoniacal
Hazards of product:

DANGER! Combustible liquid and vapor. Causes severe eye burns. May cause allergic skin reaction. May cause skin irritation. May be harmful if swallowed. Vapor explosion hazard. Evacuate area. Keep upwind of spill. Stay out of low areas. Eliminate ignition sources. Toxic fumes may be released in fire situations.

OSHA Hazard Communication Standard
This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Potential Health Effects
Eye Contact: May cause severe irritation with corneal injury which may result in permanent impairment of vision, even blindness. Chemical burns may occur. Vapor of amines may cause

swelling of the cornea resulting in visual disturbances such as blurred or hazy vision. Bright lights may appear to be surrounded by halos. Effects may be delayed and typically disappear spontaneously.
Skin Contact: Brief contact is essentially nonirritating to skin. Prolonged contact may cause slight skin irritation with local redness. Repeated contact may cause skin burns. Symptoms may include pain, severe local redness, swelling, and tissue damage.
Skin Absorption: Prolonged skin contact is unlikely to result in absorption of harmful amounts.
Skin Sensitization: Has caused allergic skin reactions when tested in guinea pigs. With the dilute mix, no allergic skin reaction is expected.
Inhalation: Brief exposure (minutes) is not likely to cause adverse effects. Prolonged excessive exposure to mist may cause adverse effects.
Ingestion: Low toxicity if swallowed. Small amounts swallowed incidentally as a result of normal handling operations are not likely to cause injury; however, swallowing larger amounts may cause injury.
Aspiration hazard: Based on available information, aspiration hazard could not be determined.
Effects of Repeated Exposure: For the active ingredient(s): In animals, effects have been reported on the following organs: Liver. Kidney. For the minor component(s): Ethanol. In humans, effects have been reported on the following organs: Central nervous system. Liver. Signs and symptoms of excessive exposure may include: Central nervous system depression. May cause dizziness and drowsiness. Headache.
Cancer Information: Ethanol when not consumed in an alcoholic beverage is not classifiable as a human carcinogen.
Birth Defects/Developmental Effects: For the active ingredient(s): Has been toxic to the fetus in laboratory animals at doses toxic to the mother.
Reproductive Effects: For similar active ingredient(s). Triclopyr. In laboratory animal studies, effects on reproduction have been seen only at doses that produced significant toxicity to the parent animals.

3. Composition Information

Component	CAS #	Amount
Triclopyr Triethylamine Salt	57213-69-1	44.4 %
Triethylamine	121-44-8	3.0 %
Ethylenediamine tetraacetic acid	60-00-4	2.3 %
Ethanol	64-17-5	2.1 %
Balance	Not available	48.2 %

4. First-aid measures

Description of first aid measures

General advice: First Aid responders should pay attention to self-protection and use the recommended protective clothing (chemical resistant gloves, splash protection). If potential for exposure exists refer to Section 8 for specific personal protective equipment.
Inhalation: Move person to fresh air. If person is not breathing, call an emergency responder or ambulance, then give artificial respiration; if by mouth to mouth use rescuer protection (pocket mask etc). Call a poison control center or doctor for treatment advice.
Skin Contact: Take off contaminated clothing. Wash skin with soap and plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice. Wash clothing before reuse. Shoes and other leather items which cannot be decontaminated should be disposed of properly.
Eye Contact: Wash immediately and continuously with flowing water for at least 30 minutes. Remove contact lenses after the first 5 minutes and continue washing. Obtain prompt medical consultation, preferably from an ophthalmologist. Suitable emergency eye wash facility should be immediately available.
Ingestion: Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by the poison control center or doctor. Never give anything by mouth to an unconscious person.

Most important symptoms and effects, both acute and delayed

Aside from the information found under Description of first aid measures (above) and Indication of immediate medical attention and special treatment needed (below), no additional symptoms and effects are anticipated.

Indication of immediate medical attention and special treatment needed

Chemical eye burns may require extended irrigation. Obtain prompt consultation, preferably from an ophthalmologist. If burn is present, treat as any thermal burn, after decontamination. Exposure to amine vapors may cause minor transient edema of the corneal epithelium (glaucopsia) with blurred vision, blue haze and halos around bright objects. Effects disappear in a few hours and temporarily reduce ability to drive vehicles. No specific antidote. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient. Have the Safety Data Sheet, and if available, the product container or label with you when calling a poison control center or doctor, or going for treatment.

5. Fire Fighting Measures

Suitable extinguishing media

To extinguish combustible residues of this product use water fog, carbon dioxide, dry chemical or foam. Dry chemical fire extinguishers. Carbon dioxide fire extinguishers. Foam. General purpose synthetic foams (including AFFF type) or protein foams are preferred if available. Alcohol resistant foams (ATC type) may function.

Special hazards arising from the substance or mixture

Hazardous Combustion Products: Under fire conditions some components of this product may decompose. The smoke may contain unidentified toxic and/or irritating compounds. Combustion products may include and are not limited to: Nitrogen oxides. Hydrogen chloride. Carbon monoxide. Carbon dioxide.

Unusual Fire and Explosion Hazards: This material will not burn until the water has evaporated. Residue can burn. May produce flash fire. Vapors are heavier than air and may travel a long distance and accumulate in low lying areas. Ignition and/or flash back may occur. If exposed to fire from another source and water is evaporated, exposure to high temperatures may cause toxic fumes.

Advice for firefighters

Fire Fighting Procedures: Keep people away. Isolate fire and deny unnecessary entry. Stay upwind. Keep out of low areas where gases (fumes) can accumulate. Eliminate ignition sources. To extinguish combustible residues of this product use water fog, carbon dioxide, dry chemical or foam. Contain fire water run-off if possible. Fire water run-off, if not contained, may cause environmental damage. Review the "Accidental Release Measures" and the "Ecological Information" sections of this (M)SDS.

Special Protective Equipment for Firefighters: Wear positive-pressure self-contained breathing apparatus (SCBA) and protective fire fighting clothing (includes fire fighting helmet, coat, trousers, boots, and gloves). Avoid contact with this material during fire fighting operations. If contact is likely, change to full chemical resistant fire fighting clothing with self-contained breathing apparatus. If this is not available, wear full chemical resistant clothing with self-contained breathing apparatus and fight fire from a remote location. For protective equipment in post-fire or non-fire clean-up situations, refer to the relevant sections.

6. Accidental Release Measures

Personal precautions, protective equipment and emergency procedures: Evacuate area. Refer to Section 7, Handling, for additional precautionary measures. Keep unnecessary and unprotected personnel from entering the area. Only trained and properly protected personnel must be involved in clean-up operations. Keep personnel out of low areas. Keep upwind of spill. Ventilate area of leak or spill. Eliminate all sources of ignition in vicinity of spill or released vapor to avoid fire or explosion. Vapor explosion hazard. Keep out of sewers. Use appropriate safety equipment. For additional information, refer to Section 8, Exposure Controls and Personal Protection.

Environmental precautions: Prevent from entering into soil, ditches, sewers, waterways and/or groundwater. See Section 12, Ecological Information.

Methods and materials for containment and cleaning up: Pump with explosion-proof equipment. If available, use foam to smother or suppress. Contain spilled material if possible. Small spills: Absorb with materials such as: Clay. Dirt. Sand. Sweep up. Collect in suitable and properly labeled containers. Large spills: Contact Dow AgroSciences for clean-up assistance. See Section 13, Disposal Considerations, for additional information.

7. Handling and Storage

Handling

General Handling: Keep out of reach of children. Keep away from heat, sparks and flame. No smoking, open flames or sources of ignition in handling and storage area. Electrically ground and bond all equipment. Use of non-sparking or explosion-proof equipment may be necessary, depending upon the type of operation. Containers, even those that have been emptied, can contain vapors. Do not cut, drill, grind, weld, or perform similar operations on or near empty containers. Vapors are heavier than air and may travel a long distance and accumulate in low lying areas. Ignition and/or flash back may occur. Do not get in eyes. Avoid contact with skin and clothing. Avoid prolonged or repeated contact with skin. Do not swallow. Avoid breathing vapor. Wash thoroughly after handling. Keep container closed. Use with adequate ventilation. See Section 8, EXPOSURE CONTROLS AND PERSONAL PROTECTION.

Storage

Minimize sources of ignition, such as static build-up, heat, spark or flame. Store in a dry place. Store in original container. Keep container tightly closed. Do not store near food, foodstuffs, drugs or potable water supplies.

8. Exposure Controls / Personal Protection

Exposure Limits

Component	List	Type	Value
Triclopyr Triethylamine Salt	Dow IHG	TWA	2 mg/m3 D-SEN
Triethylamine	ACGIH	TWA	1 ppm SKIN
	ACGIH	STEL	3 ppm SKIN
	OSHA Table Z-1	PEL	100 mg/m3 25 ppm
Ethanol	OSHA Table Z-1	PEL	1,900 mg/m3 1,000 ppm
	ACGIH	STEL	1,000 ppm

RECOMMENDATIONS IN THIS SECTION ARE FOR MANUFACTURING, COMMERCIAL BLENDING AND PACKAGING WORKERS. APPLICATORS AND HANDLERS SHOULD SEE THE PRODUCT LABEL FOR PROPER PERSONAL PROTECTIVE EQUIPMENT AND CLOTHING.
A "skin" notation following the inhalation exposure guideline refers to the potential for dermal absorption of the material including mucous membranes and the eyes either by contact with vapors or by direct skin contact.
It is intended to alert the reader that inhalation may not be the only route of exposure and that measures to minimize dermal exposures should be considered.
A D-SEN notation following the exposure guideline refers to the potential to produce dermal sensitization, as confirmed by human or animal data.

Personal Protection

Eye/Face Protection: Use chemical goggles. If exposure causes eye discomfort, use a full-face respirator.

Skin Protection: Use protective clothing chemically resistant to this material. Selection of specific items such as face shield, boots, apron, or full body suit will depend on the task.

Hand protection: Use gloves chemically resistant to this material. Examples of preferred glove barrier materials include: Butyl rubber. Natural rubber ("latex"). Neoprene. Nitrile/butadiene rubber ("nitrile" or "NBR"). Polyethylene. Ethyl vinyl alcohol laminate ("EVAL"). Polyvinyl chloride ("PVC" or "vinyl"). NOTICE: The selection of a specific glove for a particular application and duration of use in a workplace should also take into account all relevant workplace factors such as, but not limited to: Other chemicals which may be handled, physical requirements (cut/puncture protection, dexterity, thermal protection), potential body reactions to glove materials, as well as the instructions/specifications provided by the glove supplier.

Respiratory Protection: Respiratory protection should be worn when there is a potential to exceed the exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, wear respiratory protection when adverse effects, such as respiratory irritation or discomfort have been experienced, or where indicated by your risk assessment process. In misty atmospheres, use an approved particulate respirator. The following should be effective types of air-purifying respirators: Organic vapor cartridge with a particulate pre-filter.

Ingestion: Use good personal hygiene. Do not consume or store food in the work area. Wash hands before smoking or eating.

Engineering Controls

Ventilation: Use engineering controls to maintain airborne level below exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, use only with adequate ventilation. Local exhaust ventilation may be necessary for some operations.

9. Physical and Chemical Properties

Appearance	
Physical State	Liquid.
Color	Pink
Odor	Ammoniacal
Odor Threshold	No test data available
pH	9.5 (@ 10 %) *pH Electrode*
Melting Point	Not applicable
Freezing Point	No test data available
Boiling Point (760 mmHg)	No test data available.
Flash Point - Closed Cup	43 °C (109 °F) *Setaflash Closed Cup ASTMD3828*
Evaporation Rate (Butyl Acetate = 1)	No test data available
Flammable Limits In Air	**Lower**: No test data available **Upper**: No test data available
Vapor Pressure	Not applicable
Vapor Density (air = 1)	Not applicable
Specific Gravity (H2O = 1)	1.1385 *Digital Density Meter (Oscillating Coil)*
Solubility in water (by weight)	Soluble
Autoignition Temperature	No test data available
Decomposition Temperature	No test data available
Dynamic Viscosity	12.5 mPa.s @ 25 °C
Kinematic Viscosity	No test data available
Explosive properties	No *Thermal* No *Mechanical Impact @ 8 inches* No *Mechanical Impact @ 15 inches* No *Mechanical Impact @ 20.25 inches*
Oxidizing properties	No *EPA OPPTS 830.6314 (Oxidizing or Reducing Action)*
Liquid Density	1.1385 g/cm3 @ 20 °C *Digital density meter*

10. Stability and Reactivity

Reactivity
No dangerous reaction known under conditions of normal use.
Chemical stability
Thermally stable at recommended temperatures and pressures.

Possibility of hazardous reactions
Polymerization will not occur.
Conditions to Avoid: Active ingredient decomposes at elevated temperatures.

Incompatible Materials: Avoid contact with: Oxidizers.
Hazardous decomposition products
Decomposition products depend upon temperature, air supply and the presence of other materials. Decomposition products can include and are not limited to: Hydrogen chloride. Nitrogen oxides.

11. Toxicological Information

Acute Toxicity
Ingestion
As product: LD50, Rat 1,847 mg/kg
Dermal
As product: LD50, Rabbit > 5,000 mg/kg
Inhalation
LC50, 4 h, Aerosol, Rat > 2.6 mg/l
Maximum attainable concentration. No deaths occurred at this concentration.
Eye damage/eye irritation
May cause severe irritation with corneal injury which may result in permanent impairment of vision, even blindness. Chemical burns may occur. Vapor of amines may cause swelling of the cornea resulting in visual disturbances such as blurred or hazy vision. Bright lights may appear to be surrounded by halos. Effects may be delayed and typically disappear spontaneously.
Skin corrosion/irritation
Brief contact is essentially nonirritating to skin. Prolonged contact may cause slight skin irritation with local redness. Repeated contact may cause skin burns. Symptoms may include pain, severe local redness, swelling, and tissue damage.
Sensitization
Skin
Has caused allergic skin reactions when tested in guinea pigs. With the dilute mix, no allergic skin reaction is expected.
Respiratory
No relevant data found.
Repeated Dose Toxicity
For the active ingredient(s): In animals, effects have been reported on the following organs: Liver. Kidney. For the minor component(s): Ethanol. In humans, effects have been reported on the following organs: Central nervous system. Liver. Signs and symptoms of excessive exposure may include: Central nervous system depression. May cause dizziness and drowsiness. Headache.
Chronic Toxicity and Carcinogenicity
Ethanol when not consumed in an alcoholic beverage is not classifiable as a human carcinogen. For similar active ingredient(s). Triclopyr. Did not cause cancer in laboratory animals.
Developmental Toxicity
For the active ingredient(s): Has been toxic to the fetus in laboratory animals at doses toxic to the mother. For the active ingredient(s): Did not cause birth defects in laboratory animals.
Reproductive Toxicity
For similar active ingredient(s). Triclopyr. In laboratory animal studies, effects on reproduction have been seen only at doses that produced significant toxicity to the parent animals.
Genetic Toxicology
For the active ingredient(s): In vitro genetic toxicity studies were negative. For the minor component(s): Ethanol. Animal genetic toxicity studies were negative in some cases and positive in other cases.

12. Ecological Information

Toxicity

Material is slightly toxic to aquatic organisms on an acute basis (LC50/EC50 between 10 and 100 mg/L in the most sensitive species tested).

Fish Acute & Prolonged Toxicity
LC50, rainbow trout (Oncorhynchus mykiss), 96 h: 400 mg/l
Aquatic Invertebrate Acute Toxicity
EC50, eastern oyster (Crassostrea virginica), static, 48 h, shell growth inhibition: 56 - 87 mg/l
LC50, water flea Daphnia magna, static, 48 h, immobilization: > 1,000 mg/l

Persistence and Degradability

Data for Component: **Triclopyr Triethylamine Salt**

Chemical degradation (hydrolysis) is expected in the environment. Biodegradation under aerobic static laboratory conditions is high (BOD20 or BOD28/ThOD > 40%).
Chemical degradation (hydrolysis) is expected in the environment.

Data for Component: **Triethylamine**

Material is readily biodegradable. Passes OECD test(s) for ready biodegradability. Material is inherently biodegradable (reaches > 20% biodegradation in OECD test(s) for inherent biodegradability).

OECD Biodegradation Tests:

Biodegradation	Exposure Time	Method	10 Day Window
96 %	21 d	OECD 301A Test	pass
25 - 34 %	28 d	OECD 302C Test	Not applicable

Indirect Photodegradation with OH Radicals

Rate Constant	Atmospheric Half-life	Method
9.26E-11 cm3/s	0.116 d	Estimated.

Theoretical Oxygen Demand: 3.49 mg/mg

Data for Component: **Ethylenediamine tetraacetic acid**

Material is inherently biodegradable (reaches > 20% biodegradation in OECD test(s) for inherent biodegradability).

OECD Biodegradation Tests:

Biodegradation	Exposure Time	Method	10 Day Window
37 %	14 d	OECD 302B Test	Not applicable

Theoretical Oxygen Demand: 1.37 mg/mg

Data for Component: **Ethanol**

Material is readily biodegradable. Passes OECD test(s) for ready biodegradability.

OECD Biodegradation Tests:

Biodegradation	Exposure Time	Method	10 Day Window
> 70 %	5 d	OECD 301D Test	pass

Indirect Photodegradation with OH Radicals

Rate Constant	Atmospheric Half-life	Method
3.58E-12 cm3/s	2.99 d	Estimated.

Theoretical Oxygen Demand: 2.08 mg/mg

Bioaccumulative potential

Data for Component: **Triclopyr Triethylamine Salt**

Bioaccumulation: Bioconcentration potential is low (BCF < 100 or Log Pow < 3).
Partition coefficient, n-octanol/water (log Pow): 0.196 - 0.309 Shake flask (OECD 107 Test)
Bioconcentration Factor (BCF): 1; invertebrate; Measured

Data for Component: **Triethylamine**

Bioaccumulation: Bioconcentration potential is low (BCF < 100 or Log Pow < 3).

Partition coefficient, n-octanol/water (log Pow): 1.45 Measured
Bioconcentration Factor (BCF): < 4.9; common carp (Cyprinus carpio); Measured

Data for Component: **Ethylenediamine tetraacetic acid**
Bioaccumulation: Bioconcentration potential is low (BCF < 100 or Log Pow < 3).
Partition coefficient, n-octanol/water (log Pow): -5.005 Estimated.
Bioconcentration Factor (BCF): 1.1; fish; Measured

Data for Component: **Ethanol**
Bioaccumulation: Bioconcentration potential is low (BCF < 100 or Log Pow < 3).
Partition coefficient, n-octanol/water (log Pow): -0.31 Measured

Mobility in soil

Data for Component: **Triclopyr Triethylamine Salt**
Partition coefficient, soil organic carbon/water (Koc): 4,523 Estimated.
Henry's Law Constant (H): 3.724E-14 atm*m3/mole; 25 °C Estimated.

Data for Component: **Triethylamine**
Mobility in soil: Potential for mobility in soil is very high (Koc between 0 and 50).
Partition coefficient, soil organic carbon/water (Koc): 11 - 146 Estimated.
Henry's Law Constant (H): 1.49E-04 - 1.86E-03 atm*m3/mole; 25 °C Measured

Data for Component: **Ethylenediamine tetraacetic acid**
Mobility in soil: Potential for mobility in soil is high (Koc between 50 and 150).
Partition coefficient, soil organic carbon/water (Koc): 98**Henry's Law Constant (H):** 7.7E-16 atm*m3/mole Estimated.

Data for Component: **Ethanol**
Mobility in soil: Potential for mobility in soil is very high (Koc between 0 and 50).
Partition coefficient, soil organic carbon/water (Koc): 1.0 Estimated.
Henry's Law Constant (H): 5.00E-06 atm*m3/mole; 25 °C Measured

13. Disposal Considerations

If wastes and/or containers cannot be disposed of according to the product label directions, disposal of this material must be in accordance with your local or area regulatory authorities. This information presented below only applies to the material as supplied. The identification based on characteristic(s) or listing may not apply if the material has been used or otherwise contaminated. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste identification and disposal methods in compliance with applicable regulations. If the material as supplied becomes a waste, follow all applicable regional, national and local laws.

14. Transport Information

DOT Non-Bulk
NOT REGULATED

DOT Bulk
Proper Shipping Name: COMBUSTIBLE LIQUID, N.O.S.
Technical Name: TRIETHYLAMINE, ETHANOL
Hazard Class: COMBUSTIBLE LIQUID **ID Number:** NA1993 **Packing Group:** PG III

IMDG
Proper Shipping Name: FLAMMABLE LIQUID, N.O.S.
Technical Name: TRIETHYLAMINE, ETHANOL
Hazard Class: 3 **ID Number:** UN1993 **Packing Group:** PG III
EMS Number: f-e,s-e

ICAO/IATA

Proper Shipping Name: FLAMMABLE LIQUID, N.O.S.
Technical Name: TRIETHYLAMINE, ETHANOL
Hazard Class: 3 **ID Number:** UN1993 **Packing Group:** PG III
Cargo Packing Instruction: 366
Passenger Packing Instruction: 355

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. Additional transportation system information can be obtained through an authorized sales or customer service representative. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the material.

15. Regulatory Information

OSHA Hazard Communication Standard

This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Sections 311 and 312

Immediate (Acute) Health Hazard	Yes
Delayed (Chronic) Health Hazard	Yes
Fire Hazard	Yes
Reactive Hazard	No
Sudden Release of Pressure Hazard	No

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Section 313

This product contains the following substances which are subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and which are listed in 40 CFR 372.

Component	CAS #	Amount
Triethylamine	121-44-8	3.0%

Pennsylvania (Worker and Community Right-To-Know Act): Pennsylvania Hazardous Substances List and/or Pennsylvania Environmental Hazardous Substance List:

The following product components are cited in the Pennsylvania Hazardous Substance List and/or the Pennsylvania Environmental Substance List, and are present at levels which require reporting.

Component	CAS #	Amount
Triethylamine	121-44-8	3.0%
Ethylenediamine tetraacetic acid	60-00-4	2.3%
Ethanol	64-17-5	2.1%

Pennsylvania (Worker and Community Right-To-Know Act): Pennsylvania Special Hazardous Substances List:

To the best of our knowledge, this product does not contain chemicals at levels which require reporting under this statute.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) Section 103

This product contains the following substances which are subject to CERCLA Section 103 reporting requirements and which are listed in 40 CFR 302.4.

Component	CAS #	Amount
Triethylamine	121-44-8	3.0%
Ethylenediamine tetraacetic acid	60-00-4	2.3%
Ethanol	64-17-5	2.1%

California Proposition 65 (Safe Drinking Water and Toxic Enforcement Act of 1986)

WARNING: This product contains a chemical(s) known to the State of California to cause cancer.
California Proposition 65 (Safe Drinking Water and Toxic Enforcement Act of 1986)
WARNING: This product contains a chemical(s) known to the State of California to cause birth defects or other reproductive harm.

Toxic Substances Control Act (TSCA)
All components of this product are on the TSCA Inventory or are exempt from TSCA Inventory requirements under 40 CFR 720.30

16. Other Information

Hazard Rating System

NFPA	Health	Fire	Reactivity
	3	2	0

Revision
Identification Number: 50634 / 1016 / Issue Date 05/25/2011 / Version: 6.4
DAS Code: XRM-3724
Most recent revision(s) are noted by the bold, double bars in left-hand margin throughout this document.

Legend

N/A	Not available
W/W	Weight/Weight
OEL	Occupational Exposure Limit
STEL	Short Term Exposure Limit
TWA	Time Weighted Average
ACGIH	American Conference of Governmental Industrial Hygienists, Inc.
DOW IHG	Dow Industrial Hygiene Guideline
WEEL	Workplace Environmental Exposure Level
HAZ_DES	Hazard Designation
Action Level	A value set by OSHA that is lower than the PEL which will trigger the need for activities such as exposure monitoring and medical surveillance if exceeded.

Dow AgroSciences LLC urges each customer or recipient of this (M)SDS to study it carefully and consult appropriate expertise, as necessary or appropriate, to become aware of and understand the data contained in this (M)SDS and any hazards associated with the product. The information herein is provided in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ between various locations. It is the buyer's/user's responsibility to ensure that his activities comply with all federal, state, provincial or local laws. The information presented here pertains only to the product as shipped. Since conditions for use of the product are not under the control of the manufacturer, it is the buyer's/user's duty to determine the conditions necessary for the safe use of this product. Due to the proliferation of sources for information such as manufacturer-specific (M)SDSs, we are not and cannot be responsible for (M)SDSs obtained from any source other than ourselves. If you have obtained an (M)SDS from another source or if you are not sure that the (M)SDS you have is current, please contact us for the most current version.

Dow AgroSciences LLC encourages and expects you to read and understand the entire (M)SDS, as there is important information throughout the document. We expect you to follow the precautions identified in this document unless your use conditions would necessitate other appropriate methods or actions.

1. Product and Company Identification

Product Name
GARLON* 4 Ultra Herbicide

COMPANY IDENTIFICATION
Dow AgroSciences LLC
A Subsidiary of The Dow Chemical Company
9330 Zionsville Road
Indianapolis, IN 46268-1189
USA

Customer Information Number: 800-992-5994
SDSQuestion@dow.com

EMERGENCY TELEPHONE NUMBER

24-Hour Emergency Contact: 800-992-5994
Local Emergency Contact: 352-323-3500

2. Hazards Identification

Emergency Overview
Color: Yellow
Physical State: Liquid.
Odor: Mild
Hazards of product:

WARNING! May cause allergic skin reaction. May cause eye irritation. May cause skin irritation. May be harmful if swallowed. Isolate area. Toxic fumes may be released in fire situations.

OSHA Hazard Communication Standard
This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Potential Health Effects
Eye Contact: May cause slight eye irritation. Corneal injury is unlikely.
Skin Contact: Brief contact may cause moderate skin irritation with local redness. May cause drying and flaking of the skin.

Skin Absorption: Prolonged skin contact is unlikely to result in absorption of harmful amounts.
Skin Sensitization: Prolonged or frequently repeated skin contact may cause allergic skin reactions in some individuals. Has demonstrated the potential for contact allergy in mice.
Inhalation: Prolonged exposure is not expected to cause adverse effects.
Ingestion: Low toxicity if swallowed. Small amounts swallowed incidentally as a result of normal handling operations are not likely to cause injury; however, swallowing larger amounts may cause injury.
Effects of Repeated Exposure: For the active ingredient(s): In animals, effects have been reported on the following organs: Blood. Kidney. Liver.
Cancer Information: In long-term animal studies with ethylene glycol butyl ether, small but statistically significant increases in tumors were observed in mice but not rats. The effects are not believed to be relevant to humans. If the material is handled in accordance with proper industrial handling procedures, exposures should not pose a carcinogenic risk to man.
Birth Defects/Developmental Effects: For the active ingredient(s): Has been toxic to the fetus in laboratory animals at doses toxic to the mother.
Reproductive Effects: The data presented are for the following material: Triclopyr. In laboratory animal studies, effects on reproduction have been seen only at doses that produced significant toxicity to the parent animals.

3. Composition Information

Component	CAS #	Amount
Triclopyr-2-butoxyethyl ester	64700-56-7	60.5 %
Ethylene glycol monobutyl ether	111-76-2	0.5 %
Balance	Not available	39.0 %

4. First-aid measures

Description of first aid measures

Inhalation: Move person to fresh air. If person is not breathing, call an emergency responder or ambulance, then give artificial respiration; if by mouth to mouth use rescuer protection (pocket mask etc). Call a poison control center or doctor for treatment advice.
Skin Contact: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.
Eye Contact: Hold eyes open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eyes. Call a poison control center or doctor for treatment advice.
Ingestion: Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by the poison control center or doctor. Never give anything by mouth to an unconscious person.

Most important symptoms and effects, both acute and delayed

Aside from the information found under Description of first aid measures (above) and Indication of immediate medical attention and special treatment needed (below), no additional symptoms and effects are anticipated.

Indication of immediate medical attention and special treatment needed

No specific antidote. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient. Have the Safety Data Sheet, and if available, the product container or label with you when calling a poison control center or doctor, or going for treatment.

5. Fire Fighting Measures

Suitable extinguishing media

Water fog or fine spray. Dry chemical fire extinguishers. Carbon dioxide fire extinguishers. Foam. Alcohol resistant foams (ATC type) are preferred. General purpose synthetic foams (including AFFF) or protein foams may function, but will be less effective. Water fog, applied gently may be used as a blanket for fire extinguishment.
Extinguishing Media to Avoid: Do not use direct water stream. May spread fire.

Special hazards arising from the substance or mixture

Hazardous Combustion Products: During a fire, smoke may contain the original material in addition to combustion products of varying composition which may be toxic and/or irritating. Combustion products may include and are not limited to: Nitrogen oxides. Hydrogen chloride. Carbon monoxide. Carbon dioxide. Phosgene.
Unusual Fire and Explosion Hazards: Container may rupture from gas generation in a fire situation. Violent steam generation or eruption may occur upon application of direct water stream to hot liquids.

Advice for firefighters

Fire Fighting Procedures: Keep people away. Isolate fire and deny unnecessary entry. Use water spray to cool fire exposed containers and fire affected zone until fire is out and danger of reignition has passed. Fight fire from protected location or safe distance. Consider the use of unmanned hose holders or monitor nozzles. Immediately withdraw all personnel from the area in case of rising sound from venting safety device or discoloration of the container. Do not use direct water stream. May spread fire. Move container from fire area if this is possible without hazard. Burning liquids may be moved by flushing with water to protect personnel and minimize property damage. Water fog, applied gently may be used as a blanket for fire extinguishment. Contain fire water run-off if possible. Fire water run-off, if not contained, may cause environmental damage. Review the "Accidental Release Measures" and the "Ecological Information" sections of this (M)SDS.
Special Protective Equipment for Firefighters: Wear positive-pressure self-contained breathing apparatus (SCBA) and protective fire fighting clothing (includes fire fighting helmet, coat, trousers, boots, and gloves). Avoid contact with this material during fire fighting operations. If contact is likely, change to full chemical resistant fire fighting clothing with self-contained breathing apparatus. If this is not available, wear full chemical resistant clothing with self-contained breathing apparatus and fight fire from a remote location. For protective equipment in post-fire or non-fire clean-up situations, refer to the relevant sections.

6. Accidental Release Measures

Personal precautions, protective equipment and emergency procedures: Isolate area. Keep unnecessary and unprotected personnel from entering the area. Refer to Section 7, Handling, for additional precautionary measures. Use appropriate safety equipment. For additional information, refer to Section 8, Exposure Controls and Personal Protection.

Environmental precautions: Prevent from entering into soil, ditches, sewers, waterways and/or groundwater. See Section 12, Ecological Information.
Methods and materials for containment and cleaning up: Contain spilled material if possible. Small spills: Absorb with materials such as: Clay. Dirt. Sand. Sweep up. Collect in suitable and properly labeled containers. Large spills: Contact Dow AgroSciences for clean-up assistance. See Section 13, Disposal Considerations, for additional information.

7. Handling and Storage

Handling

General Handling: Keep out of reach of children. Do not swallow. Avoid breathing vapor or mist. Avoid contact with eyes, skin, and clothing. Use with adequate ventilation. Wash thoroughly after handling. See Section 8, EXPOSURE CONTROLS AND PERSONAL PROTECTION.

Storage

Store in a dry place. Store in original container. Keep container tightly closed when not in use. Do not store near food, foodstuffs, drugs or potable water supplies.

8. Exposure Controls / Personal Protection

Exposure Limits

Component	List	Type	Value
Triclopyr-2-butoxyethyl ester	Dow IHG	TWA	2 mg/m3 D-SEN

RECOMMENDATIONS IN THIS SECTION ARE FOR MANUFACTURING, COMMERCIAL BLENDING AND PACKAGING WORKERS. APPLICATORS AND HANDLERS SHOULD SEE THE PRODUCT LABEL FOR PROPER PERSONAL PROTECTIVE EQUIPMENT AND CLOTHING.
A D-SEN notation following the exposure guideline refers to the potential to produce dermal sensitization, as confirmed by human or animal data.

Personal Protection

Eye/Face Protection: Use safety glasses (with side shields).
Skin Protection: Use protective clothing chemically resistant to this material. Selection of specific items such as face shield, boots, apron, or full body suit will depend on the task. Remove contaminated clothing immediately, wash skin area with soap and water, and launder clothing before reuse or dispose of properly. Items which cannot be decontaminated, such as shoes, belts and watchbands, should be removed and disposed of properly.

Hand protection: Use gloves chemically resistant to this material. Examples of preferred glove barrier materials include: Butyl rubber. Chlorinated polyethylene. Neoprene. Polyethylene. Ethyl vinyl alcohol laminate ("EVAL"). Examples of acceptable glove barrier materials include: Natural rubber ("latex"). Viton. Polyvinyl chloride ("PVC" or "vinyl"). Nitrile/butadiene rubber ("nitrile" or "NBR"). NOTICE: The selection of a specific glove for a particular application and duration of use in a workplace should also take into account all relevant workplace factors such as, but not limited to: Other chemicals which may be handled, physical requirements (cut/puncture protection, dexterity, thermal protection), potential body reactions to glove materials, as well as the instructions/specifications provided by the glove supplier.

Respiratory Protection: Respiratory protection should be worn when there is a potential to exceed the exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, wear respiratory protection when adverse effects, such as respiratory irritation or discomfort have been experienced, or where indicated by your risk assessment process. For most conditions no respiratory protection should be needed; however, if discomfort is experienced, use an approved air-purifying respirator. The following should be effective types of air-purifying respirators: Organic vapor cartridge with a particulate pre-filter.
Ingestion: Use good personal hygiene. Do not consume or store food in the work area. Wash hands before smoking or eating.

Engineering Controls

Ventilation: Use local exhaust ventilation, or other engineering controls to maintain airborne levels below exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, general ventilation should be sufficient for most operations.

9. Physical and Chemical Properties

Appearance	
Physical State	Liquid.
Color	Yellow
Odor	Mild
pH	3.36 (@ 1 %) *pH Electrode* (1% aqueous suspension)
Melting Point	Not applicable
Freezing Point	No test data available
Boiling Point (760 mmHg)	No test data available.
Flash Point - Closed Cup	> 100 °C (> 212 °F) *Pensky-Martens Closed Cup ASTM D 93*
Evaporation Rate (Butyl Acetate = 1)	No test data available
Flammable Limits In Air	**Lower**: No test data available **Upper**: No test data available

Vapor Pressure	No test data available
Vapor Density (air = 1)	No test data available
Specific Gravity (H2O = 1)	1.11 *Digital Density Meter (Oscillating Coil)*
Solubility in water (by weight)	emulsifies
Partition coefficient, n-octanol/water (log Pow)	No data available for this product.
Autoignition Temperature	> 325 °C (> 617 °F) *Literature*
Decomposition Temperature	No test data available
Dynamic Viscosity	23.4 mPa.s @ 20 °C
Kinematic Viscosity	No test data available
Liquid Density	1.11 g/cm3 @ 20 °C *Digital density meter*

10. Stability and Reactivity

Reactivity
No dangerous reaction known under conditions of normal use.
Chemical stability
Thermally stable at typical use temperatures.

Possibility of hazardous reactions
Polymerization will not occur.
Conditions to Avoid: Exposure to elevated temperatures can cause product to decompose. Generation of gas during decomposition can cause pressure in closed systems.

Incompatible Materials: Avoid contact with: Strong acids. Strong bases. Strong oxidizers.
Hazardous decomposition products
Decomposition products depend upon temperature, air supply and the presence of other materials. Decomposition products can include and are not limited to: Hydrogen chloride. Nitrogen oxides. Phosgene.

11. Toxicological Information

Acute Toxicity
Ingestion
LD50, Rat, female 3,200 mg/kg
Dermal
LD50, Rat, male and female > 5,000 mg/kg
Inhalation
LC50, 4 h, Aerosol, Rat, male and female > 5.05 mg/l
Eye damage/eye irritation
May cause slight eye irritation. Corneal injury is unlikely.
Skin corrosion/irritation
Brief contact may cause moderate skin irritation with local redness. May cause drying and flaking of the skin.
Sensitization
Skin
Prolonged or frequently repeated skin contact may cause allergic skin reactions in some individuals. Has demonstrated the potential for contact allergy in mice.
Repeated Dose Toxicity
For the active ingredient(s): In animals, effects have been reported on the following organs: Blood. Kidney. Liver.
Chronic Toxicity and Carcinogenicity
In long-term animal studies with ethylene glycol butyl ether, small but statistically significant increases in tumors were observed in mice but not rats. The effects are not believed to be relevant to humans.

If the material is handled in accordance with proper industrial handling procedures, exposures should not pose a carcinogenic risk to man. The data presented are for the following material: Triclopyr. Did not cause cancer in laboratory animals.

Carcinogenicity Classifications:

Component	List	Classification
Ethylene glycol monobutyl ether	ACGIH	Confirmed animal carcinogen with unknown relevance to humans.; Group A3

Developmental Toxicity

For the active ingredient(s): Has been toxic to the fetus in laboratory animals at doses toxic to the mother. For the active ingredient(s): Did not cause birth defects in laboratory animals.

Reproductive Toxicity

The data presented are for the following material: Triclopyr. In laboratory animal studies, effects on reproduction have been seen only at doses that produced significant toxicity to the parent animals. The data presented are for the following material: Butoxyethanol. In animal studies, did not interfere with reproduction. For the minor component(s): Available data are inadequate to determine effects on reproduction.

Genetic Toxicology

For the active ingredient(s): In vitro genetic toxicity studies were negative. For the active ingredient(s): Animal genetic toxicity studies were negative.

12. Ecological Information

Toxicity

Based largely or completely on information for similar material(s). Material is highly toxic to aquatic organisms on an acute basis (LC50/EC50 between 0.1 and 1 mg/L in the most sensitive species tested). Material is slightly toxic to birds on an acute basis (LD50 between 501 and 2000 mg/kg).

Fish Acute & Prolonged Toxicity

For similar material(s): LC50, bluegill (Lepomis macrochirus), 96 h: 0.44 - 1.2 mg/l
LC50, rainbow trout (Oncorhynchus mykiss), 96 h: 0.98 - 2.6 mg/l
LC50, Atlantic silverside (Menidia menidia), 96 h: 0.77 mg/l

Aquatic Invertebrate Acute Toxicity

For similar material(s): EC50, water flea Daphnia magna, 48 h, immobilization: 0.35 - 2.0 mg/l
EC50, eastern oyster (Crassostrea virginica), 96 h, shell growth inhibition: 0.30 mg/l
LC50, grass shrimp (Palaemonetes pugio), 96 h, lethality: > 1.8 mg/l
LC50, water flea Daphnia magna, 48 h, lethality: 0.43 mg/l

Aquatic Plant Toxicity

For similar material(s): EbC50, green alga Pseudokirchneriella subcapitata (formerly known as Selenastrum capricornutum), biomass growth inhibition, 72 h: 11 mg/l

Toxicity to Above Ground Organisms

Based on information for a similar material: oral LD50, bobwhite (Colinus virginianus): 1,350 mg/kg

Persistence and Degradability

For similar material(s): Biodegradation under aerobic static laboratory conditions is moderate (BOD20 or BOD28/ThOD between 10 and 40%).

Biological oxygen demand (BOD): For similar material(s):

BOD 5	BOD 10	BOD 20	BOD 28
26 %	36 %		48 %

Bioaccumulative potential

Bioaccumulation: For the active ingredient(s): Bioconcentration potential is low (BCF < 100 or Log Pow < 3).

Mobility in soil

Mobility in soil: For the active ingredient(s):, Potential for mobility in soil is low (Koc between 500 and 2000).

13. Disposal Considerations

If wastes and/or containers cannot be disposed of according to the product label directions, disposal of this material must be in accordance with your local or area regulatory authorities. This information presented below only applies to the material as supplied. The identification based on characteristic(s) or listing may not apply if the material has been used or otherwise contaminated. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste identification and disposal methods in compliance with applicable regulations. If the material as supplied becomes a waste, follow all applicable regional, national and local laws.

14. Transport Information

DOT Non-Bulk
NOT REGULATED

DOT Bulk
NOT REGULATED

IMDG
Proper Shipping Name: ENVIRONMENTALLY HAZARDOUS SUBSTANCES, LIQUID, N.O.S
Technical Name: Contains Triclopyr-2-butoxyethyl Ester
Hazard Class: 9 **ID Number:** UN3082 **Packing Group:** PG III
EMS Number: f-a,s-f
Marine pollutant.: Yes

ICAO/IATA
Proper Shipping Name: ENVIRONMENTALLY HAZARDOUS SUBSTANCES, LIQUID, N.O.S
Technical Name: Contains Triclopyr-2-butoxyethyl Ester
Hazard Class: 9 **ID Number:** UN3082 **Packing Group:** PG III
Cargo Packing Instruction: 964
Passenger Packing Instruction: 964
Additional Information

MARINE POLLUTANT
Contains Triclopyr-2-butoxyethyl Ester

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. Additional transportation system information can be obtained through an authorized sales or customer service representative. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the material.

15. Regulatory Information

OSHA Hazard Communication Standard
This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Sections 311 and 312

Immediate (Acute) Health Hazard	Yes
Delayed (Chronic) Health Hazard	Yes
Fire Hazard	No

Reactive Hazard	No
Sudden Release of Pressure Hazard	No

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Section 313
This product contains the following substances which are subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and which are listed in 40 CFR 372.

Component	CAS #	Amount
Triclopyr-2-butoxyethyl ester	64700-56-7	60.5%

Pennsylvania (Worker and Community Right-To-Know Act): Pennsylvania Hazardous Substances List and/or Pennsylvania Environmental Hazardous Substance List:
To the best of our knowledge, this product does not contain chemicals at levels which require reporting under this statute.
Pennsylvania (Worker and Community Right-To-Know Act): Pennsylvania Special Hazardous Substances List:
To the best of our knowledge, this product does not contain chemicals at levels which require reporting under this statute.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) Section 103
To the best of our knowledge, this product does not contain chemicals at levels which require reporting under this statute.

California Proposition 65 (Safe Drinking Water and Toxic Enforcement Act of 1986)
This product contains no listed substances known to the State of California to cause cancer, birth defects or other reproductive harm, at levels which would require a warning under the statute.

Toxic Substances Control Act (TSCA)
All components of this product are on the TSCA Inventory or are exempt from TSCA Inventory requirements under 40 CFR 720.30

16. Other Information

Hazard Rating System

NFPA	Health	Fire	Reactivity
	2	1	0

Revision
Identification Number: 1001102 / 1016 / Issue Date 09/15/2011 / Version: 5.4
DAS Code: GF-1529
Most recent revision(s) are noted by the bold, double bars in left-hand margin throughout this document.

Legend

N/A	Not available
W/W	Weight/Weight
OEL	Occupational Exposure Limit
STEL	Short Term Exposure Limit
TWA	Time Weighted Average
ACGIH	American Conference of Governmental Industrial Hygienists, Inc.
DOW IHG	Dow Industrial Hygiene Guideline
WEEL	Workplace Environmental Exposure Level
HAZ_DES	Hazard Designation
Action Level	A value set by OSHA that is lower than the PEL which will trigger the need for activities such as exposure monitoring and medical surveillance if exceeded.

Dow AgroSciences LLC urges each customer or recipient of this (M)SDS to study it carefully and consult appropriate expertise, as necessary or appropriate, to become aware of and understand the data contained in this (M)SDS and any hazards associated with the product. The information herein is provided in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ between various locations. It is the buyer's/user's responsibility to ensure that his activities comply with all federal, state, provincial or local laws. The information presented here pertains only to the product as shipped. Since conditions for use of the product are not under the control of the manufacturer, it is the buyer's/user's duty to determine the conditions necessary for the safe use of this product. Due to the proliferation of sources for information such as manufacturer-specific (M)SDSs, we are not and cannot be responsible for (M)SDSs obtained from any source other than ourselves. If you have obtained an (M)SDS from another source or if you are not sure that the (M)SDS you have is current, please contact us for the most current version.

1301 East 9th Street, Suite 1300, Cleveland, OH 44114-1849
EMERGENCY PHONE: LESCO: (800) 321-5325
CHEMTREC: (800) 424-9300

DATE ISSUED: 8/22/05
SUPERSEDES: NEW

I. PRODUCT IDENTIFICATION

PRODUCT NAME: LESCO PRE-M AquaCap ™ Herbicide
Chemical Family: Aniline derivative
Chemical Name/Synonyms: Pendimethalin

II. COMPOSITION/INFORMATION ON INGREDIENTS

CHEMICAL NAME	%(by/wt.)	CAS #	PEL/TLV
Pendimethalin	38.7	40487-42-1	3 mg/M^3
Proprietary ingredients	61.3	NA	NE

III. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: Primary Route(s) of Entry: Eyes, Skin, Inhalation, Ingestion
POTENTIAL HEALTH EFFECTS: Causes eye irritation. Harmful if absorbed through skin. Avoid contact with skin, eyes and clothing.
EYE: Causes moderate eye irritation.
SKIN: Harmful if absorbed through skin. May cause slight irritation to the skin.
INHALATION: Relatively nontoxic after short-term inhalation.
INGESTION: Relatively nontoxic after single ingestion.
MEDICAL CONDITIONS AGGRAVATED: No data available
POTENTIAL ENVIRONMENTAL HAZARDS: This product is toxic to fish. DO NOT apply directly to water, to areas where surface water is present, or to intertidal areas below the mean high water mark. Drift and runoff from treated areas may be hazardous to aquatic organisms in adjacent aquatic sites. DO NOT contaminate water when disposing of equipment washwaters or rinsate.

IV. FIRST AID MEASURES

EYES: Hold eye open and rinse slowly and gently with water for 15 – 20 minutes. Remove contact lenses, if present, after first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.
SKIN: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15 – 20 minutes. Call a poison control center or doctor for treatment advice.
INHALATION: Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. Cal a poison control center or doctor for further treatment advice.
INGESTION: Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to by a poison control center or doctor. Do not give anything by mouth to an unconscious person.
NOTES TO MEDICAL DOCTOR:
Symptoms: orange-red colored urine caused by dye (not associated with methemoglobinemia)
Antidote: no known specific antidote
Treatment: treat symptomatically

V. FIRE FIGHTING MEASURES

Flash Point (Method Used): > 230F
Auto Ignition Temperature: ND
Lower Explosion Limits: NA
Upper Explosion Limits: NA
NFPA/HMIS Rating: Health: 1 Fire: 1 Reactivity: 1
EXTINGUISHING MEDIA: [x] Foam [ ] Alcohol Foam [x] CO_2 [x] Dry Chemical [x] Water Spray [ ] Other

EXPLOSION HAZARDS: In case of fire and/or explosion do not breathe fumes. Keep containers cool by spraying with water if exposed to fire.
FIRE FIGHTING PROCEDURES: Firefighters should wear self-contained breathing apparatus and chemical-protective clothing. Collect contaminated extinguishing water separately, do not allow to reach sewage or effluent systems. Dispose of fire debris and contaminated extinguishing water in accordance with official regulations.
HAZARDOUS COMBUSTION PRODUCTS: If product is heated above decomposition temperature, toxic vapors will be released. If product is involved in a fire, carbon monoxide, carbon dioxide, nitrogen oxides can be released.

VI. ACCIDENTAL RELEASE MEASURES

RELEASE NOTES:
Personal Precautions – Take appropriate measures. Clear area. Shut off source of leak only under safe conditions. Extinguish sources of ignition nearby and downwind. Ensure adequate ventilation. Wear suitable personal protective clothing and equipment.
Environmental Precautions – Do not discharge into the subsoil/soil. Do not discharge into drains/surface waters/groundwater. Contain contaminated water/firefighting water.
Cleanup – Dike spillage. Pick up with suitable absorbent material. Place into suitable containers for reuse or disposal in a licensed facility. Spilled substance/product should be recovered and applied according to label rates whenever possible. If application of spilled substance/product is not possible, then spills should be contained, solidified, and placed in suitable containers for disposal. After decontamination, spill area can be washed with water. Collect wash water for approved disposal.

VII. HANDLING AND STORAGE

GENERAL PROCEDURES:
Handling – Ensure adequate ventilation. Provide good ventilation of working area (local exhaust ventilation if necessary). Avoid all sources of ignition, heat, sparks, open flame. No smoking. Keep container tightly sealed. Protect contents from the effects of light. Protect against heat. Protect from air. Handle and open container with care. Do not open until ready to use. Once container is opened, content should be used up as soon as possible. Provide means for controlling leaks and spills. Do not return residues to the storage containers. Follow label warnings even after container is emptied. Avoid contact with skin, eyes and clothing. Avoid inhalation of mists/vapors. Wear suitable personal protective clothing and equipment. Keep away from oxidizing substances.
Storage – DO NOT STORE BELOW 15F. Extended storage at temperatures below 15F can result in the formation of crystals on the bottom of container. If crystallization does occur, store the container on its side at room temperature (70F) and rock occasionally until crystals dissolve. Keep only in original container in a cool, dry, well-ventilated place away from ignition sources, heat or flame. Protect containers from physical damage. Protect against contamination.
OTHER PRECAUTIONS: Keep away from incompatible substances. Keep away from foods and animal feeds. Keep away from textiles and similar materials. Keep out of reach of children.

VIII. EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS: When handlers use closed systems, enclosed cabs, or aircraft in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides (40 CFR 170.240 (d)(4-6)), the handler PPE requirements may be reduced or modified as specified in the WPS.
PERSONAL PROTECTION EQUIPMENT:

EYES AND FACE: Safety glasses with side-shield. Tightly fitting safety goggles (chemical goggles). Wear face shield if splashing hazard exists.
RESPIRATORY: Supplied air respirators should be worn if large quantities of mist/dust are generated or prolonged exposure possible.
GLOVES: Chemical resistant protective gloves to prevent skin contact
PROTECTIVE CLOTHING: Long sleeved shirt and long pants, shoes plus socks

WORK HYGENIC PRACTICES: Wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet. Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing. Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.
COMMENTS: Following manufacturer's instruction for cleaning and maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

IX. PHYSICAL AND CHEMICAL PROPERTIES

BOILING POINT: ND
MELTING POINT: ND
VAPOR DENSITY (air = 1): ND
ODOR: Faint odor, nutty
APPEARANCE: Dark orange aqueous solution
pH: 7 – 8
SPECIFIC GRAVITY: 1.165 – 1.185 g/cm3
EVAPORATION RATE: NDA
VAPOR PRESSURE: ND
SOLUBILITY IN WATER: Soluble
PERCENT VOLATILE: NA
BULK DENSITY (lbs./gal): 9.76

X. STABILITY AND REACTIVITY

CONDITIONS TO AVOID: Avoid sources of ignition, heat, sparks, open flame. Avoid extreme temperatures. Avoid prolonged exposure to extreme heat. Void contamination. Void electro-static discharge. Avoid prolonged storage.
STABILITY: Stable
POLYMERIZATION: Will not occur
INCOMPATIBLE MATERIALS: Oxidizing agents; corrosive effect on brass, mild steel
HAZARDOUS DECOMPOSITION PRODUCTS:
No hazardous decomposition products if stored and handled as indicated. Prolonged thermal loading can result in products of degradation being given off. Possible thermal decomposition products are carbon monoxide, carbon dioxide, nitrogen oxide. Stable at ambient temperature. If product is heated above decomposition temperature, toxic vapors and hazardous fumes may be released.

XI. TOXICOLOGICAL INFORMATION

EYE EFFECTS: Rabbit: Mildly irritating
SKIN EFFECTS: Rabbit: Mildly irritating (Primary skin irritation text)
DERMAL LD_{50}: Rat: >5000 mg/kg
ORAL LD_{50}: Rat: >5000 mg/kg
INHALATION LC_{50}: (4 hr) Rat: > 5.23 mg/L
SENSITIZATION: Buehler test/Guinea pig: Non-sensitizing
ACUTE EFFECTS FROM OVEREXPOSURE: May cause slight but temporary irritation to the eyes. May cause slight irritation to the skin. Relatively nontoxic after single ingestion, short-term inhalation, short-term skin contact.
CHRONIC EFFECTS FROM OVEREXPOSURE: Pendimethalin:
Genetic Toxicity – No mutagenic effect was found in various tests with microorganisms and mammals.
Reproductive Toxicity – The results of animal studies gave no indication of a fertility impairing effect.
Developmental Toxicity/Teratogenicity – No indications of a developmental toxic/teratogenic effect were seen in animal studies.
Experiences in Humans – Pendimethalin is a strongly orange-red compound – virtually an aniline dye. Cases have been described of orange-yellow coloration of urine following heavy exposure of workers to the dust of pendimethalin. Despite its structure as both a nitro-compound and aromatic amine, exposure to pendimethalin is NOT associated with methemoglobinemia.
CARCINOGENICITY: Pendimethalin: In long-term studies in mice in which the substance was given by feed, a carcinogenic effect was not observed. In long-term studies in rats the substance induced thyroid tumors. A marked decrease in body weight gain and an increase in benign thyroid proliferative lesions were observed in the lifetime study at the highest dose tested.

IARC: Not listed
NTP: Not listed
OSHA: Not listed
OTHER: Not listed

XII. ECOLOGICAL INFORMATION

ENVIRONMENTAL DATA: This product is toxic to fish Do not apply directly to water, to areas where surface water is present, or to intertidal areas below the mean high water mark. Drift and runoff from treated areas may be hazardous to aquatic organisms in adjacent aquatic sites. Do not contaminate water when disposing of equipment washwaters or rinsate.
ECOTOXICOLOGICAL INFORMATION: Data on pendimethalin:
Fish
Rainbow trout, 96 hr, LC50: 0.89 mg/l
Aquatic Invertebrates
Daphnia magna, 48 hr, EC50: 0.977 mg/l
Aquatic Plants
Green algae, 72 hr, EC50: 0.0081 mg/l
Algae, EC50: 0.055 ppm
Other Terrestrial Non-Mammals
Mallard duck, LD50: 1,421 mg/kg
Honeybee, LD50: 49.8
Acutely harmful to terrestrial organisms

XIII. DISPOSAL CONSIDERATIONS

DISPOSAL METHODS:
Do not contaminate water, food, or feed by storage or disposal.
Pesticide Disposal: Pesticide wastes are toxic. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact our State Pesticide or Environmental control Agency, or the Hazardous Waste representative at the nearest EPA Regional office for guidance. RCRA: DO28.
Container Disposal: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, by incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.

XIV. TRANSPORTATION INFORMATION:

DOT Transportation: Less than 2452 gal – Not Regulated
Proper Shipping Name: Less than 2452 gal – None
Greater than 2452 gal – Environmentally hazardous substances, liquid, N.O.S.
Hazard Class: Less than 2452 gal – None
Greater than 2452 gal – Class 9
Marine Pollution #1: NA **HM 181 Shipping Name:** NA
U.S. Surface Freight Class: Equal to or greater than 2452 gal = RQ, Environmentally hazardous substances, liquid, N.O.S. (ethylene dichloride), 9, UN 3082, PG III, ERG 171

XV. REGULATORY INFORMATION – UNITED STATES

SARA TITLE III (SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT):
SEC 311/312(HAZARD CATEGORIES):
Y Immediate (Acute Health)
Y Delayed (Chronic Health)
N Fire
N Sudden Release of Pressure
N Reactivity

SEC 302 (Extremely Hazardous Substance): NA
SEC 304 (Emergency Release Notification): NA
SEC 313 (Toxic Chemicals): Pendimethalin (CAS #40487-42-1)
CERCLA RQ: 100 lbs (ethylene dichloride, CAS #107-06-2)
CAA RQ: NA

EPA Registration No.: 241-416-10404

NOTE: NA=Not Applicable; ND=Not Determined; NE=Not Established

Preparation and distribution of this Material Safety Data Sheet is done for LESCO, Inc., pursuant to the OSHA Hazard Communication Standard (29 CFR 1910.1200).

The information contained herein is based on available data. However, no warranty is expressed or implied regarding the accuracy of this data or the results to be obtained from the use thereof; and you should make your investigation to determine safety for the use you contemplate. LESCO makes no warranty of merchantability of fitness for a particular use, nor is there any other express or implied warranty except as may be specifically provided otherwise on product.

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For further information, contact: LESCO, Inc. • 1301 East 9th Street, Suite 1300 • Cleveland, OH 44114-1849 or (800) 321-5325.

Material Safety Data Sheet

MSDS No: **1050**

Domestic Emergency Phone	**800-424-9300**
International Emergency Phone	**703-527-3887**
Information Phone	**800-800-1819**
Intl Info Phone:	**717-626-2125**

Woodstream Corporation
69 North Locust Street
Lititz, PA 17543

SECTION I: MATERIAL IDENTIFICATION

Product Number/Size: 5118GAL 1 Gallon
Trade Name: Safer® Brand Insect Killing Soap CONC II
Also Known As: Insecticidal Soap Killer
Description: Liquid Insecticide Concentrate
Chemical Composition: Liquid Concentrate
Regulatory Licenses: EPA Reg. No. 42697-60

SECTION II: INGREDIENTS

Hazardous Ingredient (s)	% BY WT	CAS #	OSHA/TWA	PEL/STEL	ACGIH/TWA	TLV/STEL
Potassium Salts of Fatty Acids	<50.0	N/A	NE	NE	NE	NE
Ethyl alcohol	<30.0	64-17-5	1900 mg/m3	NE	1880 mg/m3	NE

SECTION III: PHYSICAL DATA

Boiling Point: 80°C (176°F)
Vapor Pressure (mm Hg): Not Determined
Vapor Density (AIR=1): Not Determined
Bulk Density: 7.6750
Freezing Point: Not Determined
Solubility in Water: Complete
Appearance: Amber Liquid
Viscosity: 3 cSt.
Odor: Alcohol, Lardy
Specific Gravity (Water=1): 0.93
Percent, Volitile by Volume %: Not Determined
Evaporation Rate (Xylene=1): Not Determined
Physical State: Liquid
pH: 10.6-10.8

SECTION IV: FIRE AND EXPLOSION HAZARD DATA

Flash Point (method): 72 F
Autoignition Temp.: N/A
Flammable Lel: Not Determined
Flammable Uel: Not Determined
Hazardous Products of Combustion: Not Determined
NFPA Health Rating: 2
NFPA Fire Rating: 3
NFPA Reactivity Rating: 0
Extinguishing Material: Alcohol Foam

Special Fire Fighting Procedures:

SECTION V: HEALTH HAZARD DATA

General Statement: Material is considered hazardous per 29 CFR 1910.1200. Avoid contact with skin, eyes and clothing.
Occupational Exposure Limit: See Section II

Effects of Over Exposure: Not Determined
Carcinogenicity: None listed per OSHA, NTP, or IARC.
Chronic Effects: Ethanol has been shown to be a developmental toxin from chronic ingestion; such effects are not anticipated from appropriate use of this product.

Rec. Exp. Limits: See Section II
Potential Health Effects: None Expected
Acute Oral: >5000 mg/kg
Acute Dermal: > 2000 mg/kg
Acute Inhalation: >5.00 mg/l
Eye Irritation: Irritation clearing in 8-21 days
Skin Irritation: Severe irritation at 72 hours
Sensitization: Not a sensitizer

Route of Entry	Symptoms/Effects of	First Aid
Skin	Irritation	Wash with plenty of soap and water. Get medical attention.
Inhalation	None Expected	Remove victim to fresh air. If not breathing, give artificial respiration, preferably mouth to mouth. Get medical attention.
Eye	Irritation	Hold eyelids open and flush with a steady, gentle stream of water for 15 minutes. Get medical attention.
Ingestion	None Expected	If swallowed, promptly drink large amounts of water. Never give liquids to an unconscious person. Get medical attention.

SECTION VI: REACTIVITY DATA

Stability: Stable

Conditions to avoid: HEAT AND OPEN FLAME

Materials to avoid: Concentrated mineral supplements (fertilizers), strong oxidizers, acids.

Hazardous Decomposition: Not Determined

Conditions to avoid: HEAT AND OPEN FLAME

Hazardous Polymerization: None Will Occur

Conditions to avoid: HEAT AND OPEN FLAME

SECTION VII: SPILL OR LEAK PROCEDURES

Steps to be taken if material is released or spilled: Rinse with abundant water and mop up.

Waste Disposal Method: Be aware that the waste owner has responsibility for final disposal. Regulations may also apply to empty containers, liners, or rinsate. Laws may change or be reinterpreted; state and local regulations may be different from Federal regulations. This information applies to materials as manufactured; contamination or processing may change waste characteristics and requirements.

Product Disposal Method: PESTICIDE DISPOSAL: Wastes resulting from use of this product may be disposed of on site or at an approved waste disposal facility.
CONTAINER DISPOSAL:
If Empty: Do not reuse this container. Place in trash or offer for recycling if available.
If Partly Filled: Call your local solid waste agency for disposal instructions. Never place unused product down any indoor or outdoor drain.

SECTION VIII: SPECIAL PROTECTION INFORMATION

Respiratory Protection: In typical applications, no engineering contrls should be needed; if industrial hygiene surveys show that occupational exposure limits may be exceeded, use NIOSH approved respirator with organic vapor/dust/mist

Protective Gloves: Protective gloves (nitrile) recommended

Eye Protection: Recommended to avoid contact of material directly into eyes.

Protective Clothing: None required under normal use conditions.

Ventilation: None required under normal use conditions.

Other Protective Equipment: None required under normal use conditions.

Protection Note: Personal protection information provided in this Section is based upon general information as to normal uses and conditions. Where special or unusual uses or conditions exist, it is suggested that the expert assistance of an industrial hygienist or other qualified professional be sought.

SECTION IX: SPECIAL PRECAUTIONS

Storage and Handling: Store away from heat, out of reach of children. Do not contaminate water, food or feed by storage or disposal. Do not reuse container.

Other Precautions: None

Precaution Note: None

SECTION X: ECOLOGICAL INFORMATION

Ecotoxicity: May be hazardous to aquatic invertebrates. Do not apply directly to water; do not contaminate water by cleaning of equipment or disposal of washwaters.

Environmental Fate: Not persistent.

cartridges.

SECTION XI: TRANSPORTATION INFORMATION

DOT HAZARD DESCRIPTION

DOT Proper Shipping Name: Ethanol Solution
Identification Number: UN1170
DOT Hazard Class/Division: Class 3, Flammable Liquid
Packaging Group: II
Packaging Instructions: 49 CFR 173.242
Special Instructions: Label Code 3- Flammable Sticker Required
Placard: Flammable
Emergency Response Guide#: 129
US Surface Freight Class: Not Available

IATA CLASSIFICATION

IATA Proper Shipping Name: Ethanol Solution
IATA Identification Number:
IATA Hazard Class/Division: Class 3 (flammable liquid)
Packaging Group: II
IATA Bulk Packaging Inst: 305
IATA Shipping Notes: None

IMO CLASSIFICATION

IMO Proper Shipping Name: Ethanol Solution
IMO Identification Number:
IMO Hazard Class/Division: Class 3, Flammable Liquid
Packaging Group: II
IMO Shipping Notes: None
IMO Bulk Packaging Inst: P001
IMO Stowage Category: A

SECTION XII: REGULATORY INFORMATION

SARA Title III: Not Regulated
SARA Product Classification: Reporting not required unless TPQ exceeded in inventory
Acute: N/A
Chronic: N/A
Fire: N/A
Reactivity: N/A
Pressure Generating: N/A
311/312 Hazard Categories: Not Subject
313 Reportable Ingredients: Not Subject
TSCA Regulatory: None Listed
State Regulations: In the U.S.A. states such as Pennsylvania, New Jersey, California, Vermont, Massachusetts and Rhode Island may all have components of this product listed; consult specific state regulatory requirements for additional
Proposition 65 Statement: None listed
European Classification:

SECTION XIII: OTHER INFORMATION

Memo: While this information and recommendations set forth are believed to be accurate as of the date hereof, Woodstream Corp. makes no warranty with respect hereto and disclaims all liability from reliance thereon.

Date MSDS Prepared: 1/24/2012
Supercedes Date:

Contact: Mark Mongiovi
Title: Regulatory Affairs

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

1) Planning

a) An experienced Ecological Consultant will collect native seed within the restricted geographic region approved in the project permit.

b) 2014 collections will be focused on augmenting the current seed available for the GAL and any enhancement areas. Seed collection will take place for large-quantity collection of species most useful in erosion control and which are not available for purchase or being produced in the onsite nursery. Collections would be targeted to offset future needs of the restoration.

c) Sites will be harvested on private land only after permission is granted by land owners and in accordance with local, state and federal laws.

d) Any necessary permitting for specialized collections of approved sensitive or protected species will be obtained prior to commencement of collection. All permits will be requested by and issued to the City of Albany.

e) Permits for collection sites will be acquired and maintained as necessary.

2) Execution

a) The nursery will maintain the necessary staff to properly operate and maintain the nursery and to meet the project seed collection needs.

b) Collections will target native species of the restored communities, with particular attention given to species that demonstrate erosion control effectiveness, drought tolerance, and those with populations that maximize collection efficiencies. Table 1 contains a listing of species targeted for collection in 2014.

c) Seed of commercially available native species targeted for the project will not be hand collected in the field. Such commercially available native seed will only be accepted if it can be verified to have been sourced from within the 50 mile genetic radius required for the project (or otherwise approved by IHMT), and if it is of good quality. Based upon previous research and purchases, commercially-sourced seed acquired from within the approved 50-mile radius is typically available for little blue stem (*Schizachyrium scoparium*), dotted horse mint (*Monarda punctata*), round-headed bush clover (*Lespedeza capitata*), and smooth blue aster (*Aster laevis*). Black-eyed Susan (*Rudbeckia hirta*) sourced outside of the 50-mile radius will also be purchased for application in selected and approved areas of the restoration project.

d) Only 1/3 of the seed from any one population shall be collected, unless populations are large and self sustaining; then up to 2/3 of the population shall be collected. If, however, a population is to be destroyed (via earthmoving, etc.), full populations shall be collected or rescued for transplant to the restoration site.

e) Collections will be done by hand, hand clippers, bags and mechanical devices whenever it is permitted. Collectors will take care to not disturb remnant populations and to minimize spreading of noxious weeds and other such materials.

f) Appropriate preparation of each species of seed will be done by drying, soaking, as well as properly tagging individual collections with proper scientific name and site source. The seed of each species will be stored in accordance with the proper conditions required to maintain seed viability and shelf life.

g) Dried and partially processed seed will be shipped and finished cleaned at a facility designated by the City.

3) Proposed Schedule for Seed Collection

April 15, 2014	Permits shall be renewed.
June/October, 2014	Major species collections take place.
November, 2014	Seed will be cleaned.
2013-2016	Peak seed harvest on nursery production beds.
2017	First nursery bed rotation will occur.

Table 1. Seed Collection List for 2014

Land Fill Cap					
Botanical Name	**Common Name**	**Matrix**	**Needs collection**	**Can purchase**	**In stock**
Grasses, Sedges, etc.					
Andropogon gerardii	Big blue stem		x		
Carex pensylvanica	Pennsylvania sedge		x		
Carex swanii	Swan's sedge		x		X
Cyperus houghtonii	Houghton's sedge		x		X
Danthonia spicata	Poverty oats		x		X
Elymus hystrix	Canada wild rye		x		X
Panicum acuminatum	Western panic grass		x		X
Panicum linearifolium	Slim-leaf panic grass		x		X
Sorgastrum nutans	Indian grass		x		X
Schizachyrium scoparium	Little bluestem grass			x	
Forbs					
Anemone virginiana	Thimbleweed		x		
Apocynum andraesimifolium	Spreading dogbane	x			
Arabis glabra	Tower mustard				X
Asclepias syriaca	Common milkweed		x		X
Asclepias tuberosa	Butterfly milkweed	x			
Aster ericoides	Heath aster		x		
Aureolaria flava	Smooth yellow false foxglove		x		
Ceanothus americana	New Jersey tea	x	x		

Commandra umbellata	Bastard toad flax		x		
Desmodium canadense	Showy tick trefoil		x		X
Desmodium glutinosum	Pointed-leaved tick trefoil		x		
Diodia teres	Poor joe		x		X
Helianthemum canadense	Frostweed		x		
Helianthus divarictatus	Woodland sunflower	x	x		X
Helianthus strumosus	Wood-sunflower	x	x		X
Ionactis linearifolius	Stiff aster		x		X
Lupinus perennis	Wild lupine	x			
Monarda fistulosa	Wild bergamot				
Monarda punctata	Dotted horse mint	x			X
Potentilla arguta	Prairie cinquefoil		x		
Pseudognaphalium obtusifolium	Sweet everlasting		x		X
Rosa carolina	Prairie rose		x		
Solidago juncea	Early goldenrod		x		X
Solidago nemoralis	Grey goldenrod		x		X
Thalictrum revolutum	Skunk meadow rue		x		
Tephrosia virginiana	Goat's rue	x			
Viola sagittata	Arrow-leaf violet		x		X
Trees and Shrubs					
Comptonia perigrina	Sweet fern		x		
Gaylusscia baccata	Huckleberry		x		
Prunus pumila	Sand Cherry		x		
Quercus ilicifolia	Bear Oak				
Quercus prinoides	Dwarf chinquapin oak				
Vaccinium pallidum	Low blueberry		x		

Table 2. Collection locations within the 50-mile approved radius from the Albany Landfill project site.

ID Site	Site Name	Origin	State	Distance in miles
NY01	Albany Pine Bush Preserve, Albany, NY	Albany	NY	0
NY02	Hwy 88, Richmondville, NY	Schoharie County	NY	40
NY03	Bernie Braun Property, Richmondville, NY	Schoharie County	NY	40
NY04	Saratoga National Monument, Stillwater, NY	Saratoga County	NY	20
NY05	Constantine Construction & Farm, Inc., Albany NY	Albany	NY	0
NY06	Albany Rd Power lines, Albany, NY	From RR tracks to Albany Rd	NY	0

ID Site	Site Name	Origin	State	Distance in miles
NY07	Blueberry Hill, Albany, NY	Albany County	NY	0
NY08	Rogers Island, Fort Edward, NY	Columbia County	NY	45
NY09	Peebles Island	Waterford, Ny	NY	10
NY10	Rapp Rd, Colonie, NY	Albany County	NY	0
NY11	Renssaeler Lake Rest Area, Fulton Rd, Albany, NY	Albany County	NY	0
NY12	Kings Rd, Colonie, NY	Albany	NY	0
NY13	Hwy 88, Cobleskill, NY	Schoharie County	NY	35
NY14	Cobleskill Water Treatment Plant, Cobleskill, NY	Schoharie County	NY	40
NY15	Hwy 88 Bog	Otsego County	NY	45
NY16	Route 146, Rotterdam, NY	Albany County	NY	10
NY17	Diesels property, Nassau, NY	Rensselaer County	NY	12
NY18	Powerlines, Glens Fall, NY	Warren County	NY	45
NY19	Construction area, Albany, NY	Albany Pine Bush	NY	0
NY20	Nassau Powerlines, Rice rd, Nassau, NY	Rensselaer County	NY	12
NY21	Rose Sneiders, School House Rd, Nassau, NY	Rensselaer County	NY	12
NY22	Willow Street Powerlines, Albany, NY	Albany County	NY	0
NY23	Lake Desolation Rd, Lake Desolation, NY	Saratoga County	NY	35
NY24	Crossgate Powerlines, Albany NY	Albany County	NY	0
NY25	88 Brickhouse, Duanesburg, NY	Schenectady County	NY	14
NY26	Hwy 10, Mureau, NY	Saratoga County	NY	50
NY27	Peggy Ann Road Powerlines,	Warren County	NY	45
NY28	Route 7 RR tracks, Richmondville, NY	Schoharie County	NY	40
NY29	Pine Bush Bog, Albany, NY	Albany Pine Bush	NY	45
NY30	Fred Shaven Property, Nassau, NY	School House Rd	NY	12
NY31	Herb Dytric Property, Rice Rd, Nassau, NY	Rensselaer County	NY	12
NY32	Kings Rd RR, Colonie, NY	Albany County	NY	0
NY33	Vly Creek, New Scotland, NY	Albany County	NY	7
NY34	Benson Rd, Caroga Lake, NY	Fulton County	NY	49
NY35	Tom Snyder, Rice RD, Nassau NY	Rensselaer County	NY	12
NY36	Tom Bushinski's property, Rt 145, Middleburgh, NY	Schoharie County	NY	29
NY37	Hwy 81, Greenville, NY	Green County	NY	20
NY38	Wolf Creek Falls Preserve, Altamont, NY	Albany County	Ny	15
NY39	Madison Ave Extension, Albany, NY	Albany County	NY	0
NY40	Apollo Rd, Albany, NY	Albany Pine Bush	NY	0
NY41	Old State Rd, Albany, NY	Albany Pine Bush	NY	0
NY42	Tivoli Park, Albany, NY	Albany County	NY	0
NY43	Ravena Powerlines, Ravena, NY	Albany County	NY	13
NY44	Mureau Powerlines, Mureau, NY	Saratoga County	NY	40
NY45	58 Lester Parkway, Greenwich NY	Saratoga County	NY	32

ID Site	Site Name	Origin	State	Distance in miles
NY46	Joralomen Park, Ravena, NY	Albany County	NY	14
NY47	Winn Preserve, Knox, NY	Albany County	NY	18
NY48	Saratoga Airfield, Saratoga Springs, NY	Saratoga County	NY	30
NY49	Curry Rd Powerlines, Albany, NY	Albany County	NY	0
NY50	Barren Field, Dollar Gen, Cocksackie, NY	Green County	NY	20
NY51	Hwy 9W, Ravena, NY	Albany county	NY	15
NY51	RPI Tech Park, Troy, NY	Rensselaer County	NY	6
NY52	Duanesburg Church Rd, Duanesburg, NY	Schenectady County	NY	25
ME01	TNC, Kennebunk preserve, Kennebunk, NY	York County	MA	140

Table 3. Seed Inventory with itemized removals

Species	Common Name	Total Collected (oz) 2009-2012	PII Seed Mix Deduction (oz)	Nursery Production Deduction (oz)	PII Plug Production Deduction (oz)	Test Plot Mix Deduction (oz)	PII Repair Mix Deduction (oz)	Nursery Overseeding Deduction (oz)	Nursery Border Seeding (oz)	Total Removed (oz)	Total Available (oz)
Actaea pachypoda	White baneberry	1								0	1
Actaea rubra	Red baneberry	1	0.05							0.05	0.95
Agalinis tenuifolia	Slender false foxglove	2.37	1.77		0.6					2.37	0
Ageratina altissima	White snakeroot	616.18	160				17.78			177.78	438.4
Agrimonia parviflora	Small-flowered agrimony	18.16	14				1.6			15.6	2.56
Alisma subcordatum	American water plantain	43.09	15		1.21		4.48			20.69	22.4
Allium tricoccum	Wild leek	0.2	0.2							0.2	0
Amphicarpaea bracteata	Hog peanut	0.04	0.04							0.04	0
Anaphalis margaritacea	Pearly everlasting	0.64								0	0.64
Andropogon gerardii	Big bluestem	353.24	212							212	141.24
Anemone cylindrica	Candle anemone	8.74	4.5			4.24				8.74	0
Anemone virginiana	Thimbleweed	24	1				0.02	3.46		4.48	19.52
Apios americana	Groundnut	0.5	0.5							0.5	0
Apocynum androsaemifolium	Spreading dogbane	1.32		0.68						0.68	0.64
Apocynum cannabinum	Dogbane	31.9	23		8.9					31.9	0
Apocynum sibiricum	Clasping dogbane	4	4							4	0
Aquilegia canadensis	Columbine	8.68	0.56				0.04			0.6	8.08
Arabis glabra	Tower mustard	385	2.61						0.3	2.91	382.09
Arisaema triphylum	Jack-in-the-pulpit	7.5								0	7.5
Aronia melanocarpa	Black chokeberry	0.05	0.05							0.05	0
Asclepias amplexicaulis	Blunt milkweed	0.76		0.76						0.76	0
Asclepias incarnata	Swamp milkweed	53.71	50		3.71					53.71	0

Species	Common Name	Total Collected (oz) 2009-2012	PII Seed Mix Deduction (oz)	Nursery Production Deduction (oz)	PII Plug Production Deduction (oz)	Test Plot Mix Deduction (oz)	PII Repair Mix Deduction (oz)	Nursery Overseeding Deduction (oz)	Nursery Border Seeding (oz)	Total Removed (oz)	Total Available (oz)
Asclepias syriaca	Common milkweed	267.38	10			3.78	0.04		3	16.82	250.56
Asclepias tuberosa	Butterfly milkweed	11.18		5.36	4.32					9.68	1.5
Aureolaria flava	Yellow false foxglove	8.66			0.34					0.34	8.32
Bidens spp	Beggar ticks	170.88	120				15.36			135.36	35.52
Blephilia ciliata	Downy woodmint	0.5	0.5							0.5	0
Boehmeria cylindrica	Small-spike false nettle	200.28	135				21.76			156.76	43.52
Bromus kalmii	Arctic brome	12.15								0	12.15
Calla palustris	Calla lily	3.24			3.24					3.24	0
Campanula rotundifolia	Harebell	0.05			0.02					0.02	0.03
Carex annectens	Yellowfruit sedge	43.6	25		2.6					27.6	16
Carex bebbii	Bebb's sedge	5.84	5.84							5.84	0
Carex brunescens	Brownish sedge	9.48	5				4.48			9.48	0
Carex comosa	Longhair sedge	226.84	143.5		2.7		27.52			173.72	53.12
Carex crinita	Fringed sedge	144	111		7.4		13.76			132.16	11.84
Carex flava	Yellow sedge	28.32	12							12	16.32
Carex foenea	Dryspike sedge	0.11								0	0.11
Carex folliculata	Northern long sedge	2	2							2	0
Carex frankii	Frank's sedge	6.25	6.25							6.25	0
Carex granularis	Limestone meadow sedge	3.2	3.2							3.2	0
Carex hystericina	Porcupine sedge	382.12	145				24.96			169.96	212.16
Carex intumescens	Great bladder sedge	13.1	10		3.1					13.1	0
Carex lacustris	Lake sedge	39.04	24				3.84			27.84	11.2
Carex lupulina	Hop sedge	262.9	185		13.9		30.72			229.62	33.28
Carex pennsylvanica *	Penn Sedge	86.64								0	83.52
Carex scabrata	Eastern rough sedge	11.92	10							10	1.92

Species	Common Name	Total Collected (oz) 2009-2012	PII Seed Mix Deduction (oz)	Nursery Production Deduction (oz)	PII Plug Production Deduction (oz)	Test Plot Mix Deduction (oz)	PII Repair Mix Deduction (oz)	Nursery Overseeding Deduction (oz)	Nursery Border Seeding (oz)	Total Removed (oz)	Total Available (oz)
Carex scoparia	Broom sedge	338.2	23							23	315.2
Carex squarosa	Squarrose sedge	4.16								0	4.16
Carex sterilis	Fen star sedge	11	11							11	0
Carex stipata	Awlfruit sedge	85.6	52				14.72			66.72	18.88
Carex stricta	Tussock sedge	8.7			8.7					8.7	0
Carex swanii	Swan's sedge	188.16							6	6	182.16
Carex trisperma	Three-seeded sedge	15	15							15	0
Carex utriculata	Northwest Territory sedge	6.66	2.5				2.24			4.74	1.92
Carex vulpinoidea	Fox sedge	473.68	178				21.76			199.76	273.92
Ceanothus americanus	New Jersey tea	413.3		19.5						19.5	393.8
Chamaedaphne calyculata angustifolia	Leatherleaf	1.3	1.3							1.3	0
Chamerion angustifolium	Fireweed	0.31			0.31					0.31	0
Chelone glabra	Turtlehead	1.51	1.15		0.36					1.51	0
Cicuta bulbifera	Bulb-bearing water hemlock	3.64	3				0.64			3.64	0
Cicuta maculata	Spotted water hemlock	2.6	2.6							2.6	0
Cimicifuga racemosa	Black snakeroot	6.7								0	6.7
Cinna arundinacea	Sweet woodreed	45	45							45	0
Cirsium muticum	Swamp thistle	0.5	0.5							0.5	0
Clematis virginiana	Virgin's bower	28.44	15				2.24			17.24	11.2
Comandra umbellata	Bastard toadflax	51.65	0.77							0.77	50.88
Cornus amomum	Silky dogwood	6	6							6	0
Cyperus houghtonii	Houghton's flatsedge	80								0	80
Cyperus schweinitzii *	Schweinitz's flatsedge	21								0	19.52
Cyperus strigosus	Straw-colored flatsedge	1.72	1				0.72			1.72	0

Species	Common Name	Total Collected (oz) 2009-2012	PII Seed Mix Deduction (oz)	Nursery Production Deduction (oz)	PII Plug Production Deduction (oz)	Test Plot Mix Deduction (oz)	PII Repair Mix Deduction (oz)	Nursery Overseeding Deduction (oz)	Nursery Border Seeding (oz)	Total Removed (oz)	Total Available (oz)
Danthonia spicata	Poverty grass	1.08								0	1.08
Decodon verticillatus	Swamp loosestrife	1.6	0.5				0.48			0.98	0.62
Desmodium canadense	Showy ticktrefoil	222.15	60			13.73	0.26			73.99	148.16
Desmodium nudiflorum *	Naked-flowered ticktrefoil	30.4								0	29.76
Dichanthelium acuminatum[1]	Tapered rosette grass	141.36							12	12	129.36
Diervilla lonicera	Dwarf bush honeysuckle	1.54								0	1.54
Diodia teres	Poorjoe	157.26	16				0.14		3.6	19.74	137.52
Doellingeria umbellata[1]	Parasol aster	8.06	2			2.4	0.76			5.16	2.9
Dulichium arundinacea	Threeway sedge	58	10				8.96			18.96	39.04
Echinocystis lobata	Wild cucumber	0.64								0	0.64
Eleocharis acicularis	Needle spikerush	0.66	0.66							0.66	0
Eleocharis obtusa	Blunt spikerush	23.21	4.01				3.52			7.53	15.68
Elymus hystrix	Bottlebrush grass	77.92								0	77.92
Elymus virginicus	Virginia wildrye	12	12							12	0
Epilobium coloratum	Cinnamon willow-herb	159.84	35				12.2			47.2	112.64
Erechtites hieracifolia	Burnweed	416								0	416
Eriophorum angustifolium	Cottongrass	7	2		1.48		1.6			5.08	1.92
Eupatoriadelphus maculatus	Joe Pye weed	1222.72	196				30.72			226.72	996
Eupatorium perfoliatum	Boneset	575.36	168				30.72			198.72	376.64
Eupatorium sessilifolium	Upland boneset	33.9								0	33.9
Euthamia graminifolia[1]	Grass-leaved goldenrod	470.77	80.05				11.2			91.25	379.52
Galium palustre	Common marsh bedstraw	0.79	0.15							0.15	0.64

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Gaylussacia baccata	Huckleberry	32.32								0	32.32
Geranium maculatum	Spotted geranium	2.13	0.53							0.53	1.6
Geranium robertianum	Herb Robert	0.62								0	0.62
Geum sp.	Avens	2.3	2.3							2.3	0
Glyceria canadensis	Rattlesnake mannagrass	92.02	55				11.2			66.2	25.82
Glyceria grandis	American mannagrass	570.4	260				39.68			299.68	270.72
Glyceria striata	Fowl mannagrass	260	260							260	0
Helianthemum bicknellii	Hoary frostweed	7.59	0.67				0.2			0.87	6.72
Helianthemum canadense	Longbranch frostweed	96.04	29	3.86		12.92	0.5			46.28	49.76
Helianthus decapetalus	Thinleaf sunflower	1.7	1.7							1.7	0
Helianthus divaricatus	Woodland sunflower	115.53	0.52	3.52						4.04	111.49
Helianthus strumosus	Pale-leaved sunflower	27.73		3.41						3.41	24.32
Heliopsis helianthoides	Smooth oxeye	0.2								0	0.2
Houstonia cerulea	Bluets	0.4								0	0.4
Hypericum virginicum	Marsh St. John's wort	2.64	2				0.64			2.64	0
Ilex verticillata	Winterberry holly	14	14							14	0
Ionactis linariifolius[1]	Stiff aster	148.56		3.22		1.06			6	10.28	138.28
Iris versicolor	Blueflag iris	26.8	26		0.8					26.8	0
Juncus canadensis	Canada rush	12.84	1				0.96			1.96	10.88
Juncus dudleyi	Dudley's rush	49.86	4.1				0.96			5.06	44.8
Juncus effusus	Common rush	302.38	5.1				0.96			6.06	296.32
Juncus tenuis	Path rush	17.58	13.1				1.92			15.02	2.56
Juncus torreyi	Torrey's rush	72.04	1							1	71.04
Krigia virginica	Dwarf dandelion	1.12						0.8		0.8	0.32

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Leersia orzyoides	Rice cutgrass	70.3	59.1				8			67.1	3.2
Leptoloma cognatum	Fall witchgrass	16								0	16
Lespedeza hirta	Hairy bushclover	5.12								0	5.12
Liatris scariosa nieuwlandii	Nieuland's blazing star	1212								0	1212
Lilium canadense	Canada lily	2.69	2.37				0.32			2.69	0
Lilium philadelphicum	Wood lily	0.96	0.96							0.96	0
Lobelia cardinalis	Cardinal flower	0.65	0.12		0.53					0.65	0
Lobelia inflata	Indian tobacco	3.84								0	3.84
Lobelia siphilitica	Great blue lobelia	0.15	0.09		0.01		0.02			0.12	0.03
Lupinus perennis	Blue lupine	1486.34	160	25.4	29.97	121.7	8.75			345.82	1140.52
Lycopus americanus	Water horehound	176	90		11.44		17.6			119.04	56.96
Lysimachia ciliata	Fringed loosestrife	9.2	7				0.92			7.92	1.28
Lysimachia terrestris	Swamp candles	0.16	0.16							0.16	0
Maianthemum racemosum	Canada mayflower	5.58								0	5.58
Medeola virginiana	Indian cucumber	0.02	0.02							0.02	0
Melampyrum lineare	Cow wheat	14.6	6				0.6			6.6	8
Mentha arvensis	Wild mint	1.4	1.4							1.4	0
Mimulus ringens	Monkey flower	32.92	30		0.04		2.88			32.92	0
Monarda didyma	Bee balm	0.07			0.07					0.07	0
Monarda fistulosa	Wild bergamot	190.35	40	3.2		11.65	0.7			55.55	134.8
Oenothera biennis	Common evening primrose	111.15	29			2.15				31.15	80
Osmorhiza claytonii	Sweet cicely	6.6								0	6.6
Panicum capillare	Witchgrass	80								0	80

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Panicum clandestinum **	Deertongue	80	10							10	41.92
Panicum linearifolium	Slimleaf panicgrass	363.2						12.8	12	24.8	338.4
Penstemon digitalis	Beardtongue	160.88	4				0.4			4.4	156.48
Penstemon hirsutus	Hairy beardtongue	8.13			0.23					0.23	7.9
Penthorum sedoides	Ditch stonecrop	43.2	24				4.48			28.48	14.72
Physostegia virginiana	Obedient plant	0.81	0.08		0.73					0.81	0
Polygonum sagittatum	Tearthumb	17.56	15				1.92			16.92	0.64
Polygonum virginianum	Jumpseed	8.1	6.5				0.64			7.14	0.96
Potentilla arguta	Tall cinquefoil	0.61			0.29					0.29	0.32
Potentilla canadensis	Dwarf cinquefoil	2.56								0	2.56
Pseudognaphalium obtusifolium	Rabbit tobacco	69.41	4			2.27	0.1			6.37	63.04
Pycnanthemum tenuifolium	Mountanmint	118.52	4		0.95					4.95	113.57
Pycnanthemum virginianum	Virginia mountainmint	1.45	1.45							1.45	0
Ranunculus hispidus	Bristly buttercup	0.06	0.06							0.06	0
Rhynchospora alba	White beaksedge	0.15	0.15							0.15	0
Rosa carolina	Carolina rose	14.32	1.84						1	2.84	11.48
Rubus flagellaris	Dewberry	92								0	92
Rudbeckia hirta	Black-eyed susan	70.84	5			1.64				6.64	64.2
Rudbeckia laciniata	Cutleaf coneflower	6.68	5		1.36					6.36	0.32
Sarracenia purpurea	Pitcher plant	0.1	0.1							0.1	0
Scheuchzeria palustris americana	Rannoch rush	2.63	2.63							2.63	0
Scirpus americanus	Chairmaker's bulrush	10	10							10	0
Scirpus atrovirens	Green bulrush	540.83	158.75				36.48			195.23	345.6

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Scirpus cyperinus	Woolgrass	324.14	199		0.42		37.36			236.78	87.36
Scirpus microcarpus	Panicled bulrush	214.65	141		0.37		20.8			162.17	52.48
Scirpus pendulus	Rufous bulrush	170.14	86.75		1.15		11.84			99.74	70.4
Scoenoplectus tabernaemontanii	Softstem bulrush	68.34			1.78					1.78	66.56
Scutellaria lateriflora	Blue skullcap	6	6							6	0
Sicyos angulatus	Bur cucumber	0.62	0.62							0.62	0
Sisyrinchium montanum *	Blue eyed grass	0.5								0	0.32
Solidago gigantea	Giant goldenrod	322.68	107				15.36			122.36	200.32
Solidago hispida	Hairy goldenrod	1.02								0	1.02
Solidago juncea	Early goldenrod	487.6	72				1.2			73.2	414.4
Solidago nemoralis	Gray goldenrod	224.1	89			2.27	0.3	4.53	3	99.1	125
Solidago patula	Roundleaf goldenrod	73	73							73	0
Solidago rugosa	Rough goldenrod	115.51	53			2.41				55.41	60.1
Sorghastrum nutans	Indian grass	607.72	151							151	456.72
Sparganium americarpum	American bur-reed	12.93	12		0.93					12.93	0
Sparganium eurycarpum	Broadfruit bur-reed	14.24	12		2.24					14.24	0
Sphenopholis intermedia **	Slender wedgescale	0.9								0	0.32
Sphenopholis obtusata	Prairie wedgescale	0.82	0.5				0.32			0.82	0
Spiraea alba	Meadowseet	27.68	4				2.88			6.88	20.8
Spiraea tomentosa	Steeplebush	72.76	11				4.48			15.48	57.28
Symphyotrichum cordifolium[1]	Heartleaf aster	49.1								0	49.1
Symphyotrichum ericoides[1]	Heath aster	132.32	40				0.16			40.16	92.16
Symphyotrichum laeve[1]	Smooth aster	89.09	35		3.23	8.24	0.06			46.53	42.56

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Symphyotrichum lanceolatum[1]	Panicled aster	11	11							11	0
Symphyotrichum lateriflorum[1]	Calico aster	192.52	165				21.76			186.76	5.76
Symphyotrichum novae-angliae[1]	New England aster	8	8							8	0
Symphyotrichum patens[1]	Late purple aster	4.79	2.52			2.27				4.79	0
Symphyotrichum pilosum[1]	Frost aster	131.92	2							2	129.92
Symphyotrichum puniceum[1]	Purplestem aster	61.72	39				4.48			43.48	18.24
Symphyotrichum undulatum[1]	Wavy-leaved aster	3.65	1.25			2.4				3.65	0
Tephrosia virginana	Goat's rue	21.65		12.36	9.29					21.65	0
Teucrium canadense	Germander	274.83	70				5.15			75.15	199.68
Thalictrum pubescens	King of the meadow	36.51	20		5.95		1.92			27.87	8.64
Thalictrum revolutum	Waxleaf meadowrue	7.7			4.9					4.9	2.8
Tradescantia ohiensis *	Spiderwort	13.32								0	12.8
Trichostema dichotomum	Bluecurls	28.94	8				1.1			9.1	19.84
Vaccinium macrocarpon	American cranberry	0.1	0.1							0.1	0
Veratrum viride	False helebore	176	140				36			176	0
Verbena hastata	Blue vervain	565.12	200				28.8			228.8	336.32
Verbena urticifolia	White vervain	95.84	20				22.4			42.4	53.44
Viola sagittata	Arrow-leaf violet	0.57		0.25						0.25	0.32
Totals		**20463.83**	**5521.3**	**81.52**	**139.57**	**195.13**	**666.44**	**21.59**	**46.9**	**6672.45**	**13756.78**

***** These species experienced natural drying during storage, slightly reducing their weights.

****** These species were affected by rodent damage in early 2013, with a total loss of 28.66 oz. The problem was corrected with a combination of traps and impermeable storage containers.

[1]The species so denoted are listed with their current scientific name. A key to the old scientific names is as follows:

Dicanthelium acuminatum accepted of syn.: *Panicum acuminatum*
Doellingeria umbellata accepted of syn.: *Aster umbellatus*
Euthamia graminifolia accepted of syn.: *Solidago graminifolia*
Ionactis linariifolius accepted of syn.: *Aster linariifolius*
Sphenopholis intermedia accepted of syn.: *Sphenopholis obtusata*
Symphyotrichum cordifolium accepted of syn.: *Aster cordifolius*
Symphyotrichum ericoides accepted of syn.: *Aster ericoides*
Symphyotrichum laeve accepted of syn.: *Aster laevis*
Symphyotrichum lanceolatum accepted of syn.: *Aster simplex*
Symphyotrichum lateriflorum accepted of syn.: *Aster lateriflorus*
Symphyotrichum novae-angliae accepted of syn.: *Aster novae-angliae*
Symphyotrichum patens accepted of syn.: *Aster patens*
Symphyotrichum pilosum accepted of syn.: *Aster pilosus*
Symphyotrichum puniceum accepted of syn.: *Aster puniceus*
Symphyotrichum undulatum accepted of syn.: *Aster undulatus*

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

Introduction

Second year monitoring of the test plots located on the GAL portion of the landfill cap was completed in 2013, and the results reported in the 2013 Annual Restoration Plan Phase III Compliance Report. Previous work plans have detailed the purpose of the test plots and have provided specifications for constructing, monitoring, analyzing data, and reporting on the information gathered from the test plots (see Attachment 2 in this section, which contains the approved Test Plot Plan Layout & Monitoring Methods, as previously presented in Attachment E of the 2010 Phase I Annual Work Plan, and which contains revised test plot layout details as presented in the 2012 and 2013 Compliance Reports in Figures 01 - 03).

The work plan activities scheduled for 2014 in the test plots and associated areas will focus on the following maintenance, monitoring, and woody planting tasks:

1. Conduct early spring site inspection to determine site stabilization, vegetation maintenance, and invasives and weed control needs. The inspection should provide an assessment of the stability of erosion repairs conducted on the slopes of the test plots in 2013, and an assessment of the effectiveness of the 2013 invasive species and weed control efforts, along with recommendations for control treatments in 2014.
2. Conduct mowing and weed control activities throughout the growing season, targeting species that received management attention in 2013 and which may need follow-up treatments—*Phragmites*, thistle, partridge pea, white clover, honeysuckle, and miscellaneous herbaceous and woody weedy species—in addition to new species that may be identified during the early 2014 site inspection and during periodic site inspections throughout the growing season.
3. Schedule installation of trees and shrubs in the test plots, based on availability of commercially available woody species provided on the approved test plot species list, and according to the woody planting plan presented below and in Figure 04. Woody plantings will be protected by the electric fence which has been installed to discourage deer herbivory. A watering strategy will be devised and implemented in the event of severe drought, particularly if woody plantings occur later than May 30.

Test Plot Woody Planting Plan

Total test plot area (excluding buffers)	**2.389 acres**
Total test plot area (including buffers)	**3.378 acres**
Planting rate (per plan)	**20 stems per acre**
Total woody stems (based on area including buffers)	**68**
Total woody stems (adjusted to achieve significant n)	**140**
Number of species	**10 (see list of species below)**
Number of subplots	**14 (see plot layout for woody plantings)**
Number of stems per subplot	**10 (one stem of each species)**

Planting layout and method: A woody planting subplot has been established in the adjoining halves of the 24" low pH and the 18" low pH plots running the entire length of the plot from north to south (see attached Figure 04). One stem of each of the ten species of woody plants in the list will be installed in a random array surrounding a single randomly flagged location within each of the woody planting subplots as indicated on the attached test plot map. Each flag and each woody stem in the array will be located with GPS at the time of installation. Stems should not be planted within the 10 foot buffer extending from the edge of each subplot (20' total between the 24" low pH and 18" low pH plots).

The following woody plants will be installed in the spring of 2014, before May 15.

Species	Common Name	Total Number of Stems
Trees		
Pinus rigida	Pitch pine	14
	Total Trees	**14**
Shrubs		
Aronia melanocarpa	Black chokeberry	14
Ceanothus americanus	New Jersey tea	14
Corylus americana	Hazelnut	14
Gaylussacia baccata	Black huckleberry	14
Prunus pumila	Sand-cherry	14
Quercus ilicifolia	Scrub oak	14
Quercus prinoides	Dwarf chinquapin oak	14
Salix humilis	Dune willow	14
Vaccinium pallidum	Hillside blueberry	14
	Total Shrubs	**126**
	Total Woody Stems	**140**

4. Conduct third-year test plot monitoring, analysis, and reporting according to the approved methods and test plot layout (see Figure 02). Monitoring will occur during mid- to late-August, to be consistent with the scheduling of the first-year monitoring effort, which occurred August 22 – 24, 2012, and during August 5 – 9, 2013. Monitoring during 2013 included the biomass sampling and root depth measurements that were not conducted in 2012, due to the short 2-month growth period of the native seeding at the time of the August 22-24 monitoring event. The entire suite of monitoring activities will again be conducted in 2014.

Test Plot Monitoring and Data Analysis Methods

Test Plot monitoring methods and test plot layout were refined at the time of the 2012 monitoring to reflect the adjusted plot dimensions. Plot dimensions had been adjusted from the original plan following storm damage in 2011, resulting in a slightly smaller size than the original approved plans (see current plot layout in Figure 01 in Attachment 2). To stabilize the steep slopes against further rill erosion, an approved erosion control system of dispersing swales and straw wattles, and a berm

feature at the base of the test plot "toe of slope" were designed and installed (see Figure 03 in Attachment 2). This adjustment of the plan was determined not to have a significant effect on the test plot program experimental evaluation.

Third-year monitoring of the test plots will occur as close to the first-year monitoring period as possible (no earlier than August 5 and no later than August 24), to optimize comparison of sampling results. A test plot layout and sampling summary is presented in the 2013 Compliance Report. This tabulated information can be used to coordinate and track 2014 and future sampling efforts. Vegetation sampling will be conducted as previously by estimating percent cover by species within 10, randomly placed meter square circular quadrats in each of the 28 treatment blocks (see test plot layout in Figure 02 in Attachment 2). Treatment block layout and alpha-numeric coding is based on 12 blocks with a north-facing aspect (N), 12 with a south-facing aspect (S), and four on the landfill ridge top (R). A series of seven blocks are arranged over varying depths of sand (12", 18", and 24") and sand quality—high pH (B) versus low pH (G)—the low pH representing targeted pine bush ecosystem chemistry. Digital photos will be taken, as previously, to represent conditions within each treatment block at the time of monitoring (see test plot photos in Attachment 7 of the 2012 Compliance Report, and as presented in the 2013 Compliance Report).

Raw vegetation data will be entered into Excel software, and QA/QC checked for entry errors, spelling errors, and confirmation of plant species identifications for any specimens collected during the field sampling. Plant taxa will be floristically analyzed using several classification criteria (see Attachment 5 in the 2012 Compliance Report, and as presented in the 2013 Compliance Report) and raw data will be tabulated and analyzed (see Attachment 6 in the 2012 Compliance Report, and as presented in the 2013 Compliance Report), using absolute and relative frequency (AF, RF; frequency measured as the number of times a species was found in each of the 10 one meter square quadrats in each treatment block), absolute and relative cover (AF, RF; cover measured as the cumulative projected photosynthetic area of each species of plant in each of the ten one meter square quadrats in each block), and importance values (IV, the sum of RF and RC). Basic testing using the raw data (AC and AF) for normality, independence, and several other criteria will be conducted to determine if nonparametric statistical tests (ANOVA) could be used for the analysis of the data. The data will be converted into a matrix format for entry into Mini-tab statistical software, where it will be analyzed for the factorial treatment effects of soil depth, slope position, slope aspect, soil quality using measured plant frequency and cover as performance measures.

In addition to the quadrat sampling and photo documentation of vegetation as described above, additional sampling methods as laid out in the monitoring plan in Attachment 2, will be conducted during the 2014 monitoring period and annually throughout the test plot program. These additional measurements will include a timed meander search, biomass sampling, root depth measurements, and soil sampling and analysis (as necessary). These methods are intended to measure plant performance and preferential soil depth needs of key plant species of the Albany Pine Bush ecosystem when planted on the Albany Landfill.

Attachment 1. Test Plot Monitoring Layout & Sampling Summary

Plot/Subplot ID (sand depth/pH)	Year Established	Sampling Dates	Plot Acreage	Sub-plot Acreage	Number of Quadrats	Photo ID	Restored Community Intercepted
24" – high pH	2012	8/22-24/2012			70	TP-N24B_U	Test Plot
N24BU		8/5-8/2013		.066		TP-N24B_M	Pitch Pine-Scrub Oak
N24BM				.080	(10 Random in	TP-N24B_L	Barrens
N24BL			.592	.055	each of 7 zones	TP-R24B	High pH, 24 inch sand
T24B				.158	for a total of 70)	TP-S24B_U	depth
S24BU				.080		TP-S24B_M	
S24BM				.077		TP-S24B_L	
S24BL				.076			
24" – low pH	2012	8/22-24/2012			70	TP-N24G_U	Test Plot
N24GU		8/5-8/2013		.072		TP-N24G_M	Pitch Pine-Scrub Oak
N24GM				.083	(10 Random in	TP-N24G_L	Barrens
N24GL			.610	.072	each of 7 zones	TP-R24G	Low pH, 24 inch sand
T24G				.153	for a total of 70)	TP-S24G_U	depth
S24GU				.079		TP-S24G_M	
S24GM				.076		TP-S24G_L	
S24GL				.075			
18" – low pH	2012	8/22-24/2012			70	TP-N18G_U	Test Plot
N18GU		8/5-8/2013		.071		TP-N18G_M	Pitch Pine-Scrub Oak
N18GM				.078	(10 Random in	TP-N18G_L	Barrens
N18GL			.571	.068	each of 7 zones	TP-R18G	Low pH, 18 inch sand
T18G				.138	for a total of 70)	TP-S18G_U	depth
S18GU				.074		TP-S18G_M	
S18GM				.071		TP-S18G_L	
S18GL				.071			
12" – low pH	2012	8/22-24/2012			70	TP-N12G_U	Test Plot
N12GU		8/5-8/2013		.078		TP-N12G_M	Pitch Pine-Scrub Oak
N12GM				.081	(10 Random in	TP-N12G_L	Barrens
N12GL			.616	.077	each of 7 zones	TP-R12G	Low pH, 12 inch sand
T12G				.140	for a total of 70)	TP-S12G_U	depth
S12GU				.081		TP-S12G_M	
S12GM				.079		TP-S12G_L	
S12GL				.080			
4 plots/28 subplots					**280 quadrats**	**28 photos**	

Attachment 2. Approved Test Plot Plan Layout & Monitoring Methods, as previously presented in Attachment E of the 2010 Phase I Annual Work Plan with updates.

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) required 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 4, 1-5 acre test plots have been designed collaboratively with the project restoration team and have been installed on the level and side slope surfaces of the older Greater Albany Landfill (GAL) cap. Beginning in 2012, 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.

Methods for designing, installing, managing, monitoring, and reporting test plot results are provided below. A schematic of the test plot layout as revised and approved in 2011 is attached. Due to two heavy tropical storm events in 2011 that severely eroded newly placed capping sands, the test plot configuration was adjusted to shorten the slope distance and to minimize erosion risk. Additional slope stabilization features (straw wattles and dispersing swales) were designed and installed (see attached detail drawings) to ensure sand stabilization during early vegetation establishment.

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. What erosion control methods are needed to stabilize steep side slopes of the landfill cap?
7. 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?
8. 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.

D. Test Plot Design & Installation

The test plot layout has been modified from the original plan presented in the 2010 and 2011 Work Plan, as explained in Attachment E of the 2011 Compliance Report. The modifications made to the test plots are depicted in the attached graphics. Seeding of native seed mixes occurred in late spring 2012 into the late 2011 cover crop and mulch application. The test plot design will continue to consist of the following parameters:

1. Three test plots 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 has been prepared for seeding by removing weedy growth and applying 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 has been seeded with a cover crop and mulched with clean straw. Native seed mixes will be installed in spring 2012 (seeding was conducted over a four-day period from June 26 – June 29). Locally grown trees and shrubs from native seed collections and approved commercial containerized stock will be installed following establishment of soil stabilizing ground cover (anticipated installation in 2013 and early 2014). Native seed will be applied at approved seeding rates designed to achieve optimum vegetation establishment and soil stability. Species lists were developed to be representative of the PP-SOB community, and lists were refined and adjusted during a collaborative review and approval process with the IHMT for the 2010 and 2011work plans, and based on 2010 seed collection results. (See approved native species lists and seeding rates attached, and guidelines in plan specifications Sections 32 92 19 Seeding, 32 93 43 Trees and Shrubs).
8. Seed installation and mulching methods were modified from the 2010 and 2011 work plans to accelerate slope stabilization following a series of slope failures during heavy rains in 2010 and tropical storm events in 2011 (see 2011 Compliance Report Attachment E for details of the seeding and mulching strategy).
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 was installed around the test plots in late 2013 to discourage deer herbivory.

11. Implementation of the woody planting plan will be completed in spring 2014 (by May 15), according to the woody planting plan presented here and in Figure 04.

Woody Planting Plan

Total test plot area (excluding buffers) : **2.389 acres**
Total test plot area (including buffers) : **3.378 acres**
Planting rate (per plan) : **20 stems per acre**
Total woody stems (based on area including buffers) : **68**
Total woody stems (adjusted to achieve significant n) : **140**
Number of species : **10 (see list of species below)**
Number of subplots : **14 (see plot layout for woody plantings)**
Number of stems per subplot : **10 (one stem of each species)**

Planting layout and method: A woody planting subplot has been established in the adjoining halves of the 24" low pH and the 18" low pH plots running the entire length of the plot from north to south (see attached map). One stem of each of the ten species of woody plants in the list will be installed in a random array surrounding a single randomly flagged location within each of the woody planting subplots as indicated on the attached test plot map. Each flag and each woody stem in the array will be located with GPS at the time of installation. Stems should not be planted within the 10 foot buffer extending from the edge of each subplot (20' total between the 24" low pH and 18" low pH plots).

The woody plants will be installed in the spring of 2014, before May 15, using planting methods that comply with specifications for installation and watering.

Species	Common Name	Total Number of Stems
Trees		
Pinus rigida	Pitch pine	14
	Total Trees	**14**
Shrubs		
Aronia melanocarpa	Black chokeberry	14
Ceanothus americanus	New Jersey tea	14
Corylus americana	Hazelnut	14
Gaylussacia baccata	Black huckleberry	14
Prunus pumila	Sand-cherry	14
Quercus ilicifolia	Scrub oak	14
Quercus prinoides	Dwarf chinquapin oak	14
Salix humilis	Dune willow	14
Vaccinium pallidum	Hillside blueberry	14
	Total Shrubs	**126**
	Total Woody Stems	**140**

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. This 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

Deviations from the original test plot construction schedule and layout are explained in the 2011 Compliance Report.

Final Design and Approval of Test Plot Program	February 2010
Partial Construction, Cover Crop Seeding, Mulching	Fall 2010
Final Construction, Cover Crop Seeding, Mulching	Fall 2011
Native Seeding	Summer 2012
Woody plant (trees/shrubs) installation	Fall 2013, Spring 2014
Monitoring and Maintenance of Test Plots	Five to seven years starting spring 2012
Test Plot Results and Recommendations	2017-2019

Attachment E. Proposed Test Plot Seed Mix

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 65% grasses and 35% 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. Lupine seed is now included on the list following issuance of the USFWS Biological Opinion with the USACOE permit process.

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 =65:35**						
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	7.50%	290400	35.588235	2.224265	X	X	X	332.8	
Schizachyrium scoparium	Little bluestem grass	15000	50.00%	1936000	129.06667	8.066667	X	X			
Sorghastrum nutans	Indian grass	12000	7.50%	290400	24.2	1.5125	X		X	232	
			65.00%	2516800							
Grasses, sedges, etc					157	11.80343					
Forbs	Forbs =2-4 lbs										
Botanical Name	Common Name			# of seeds	oz/ac	lb / ac					
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	
Aster laevis	Smooth blue aster	55000	3.00%	116160	2.112	0.132	X		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 umbellatus	Flat topped aster	31500	0.50%	19360	0.6146032	0.038413	X		X	3.64	
Aster undulatum	Wavy-leaf 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	
Gnaphalium obtusifolium	Rabbit tobacco	500000	0.75%	29040	0.05808	0.00363	X		X	7.04	
Helianthemum canadense	Long-branch 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	X	X		
Lupinus perennis	Wild lupine	990	0.80%	30976	31.288889	1.955556	X		X	192	
Monarda fistulosa	Wild bergamot	77800	6.00%	232320	2.9861183	0.186632	X		X	23.68	
Monarda punctata	Dotted Horsemint	93700	4.60%	178112	1.9008751	0.118805	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		X	7.2	
Solidago nemoralis	Old-field goldenrod	300000	4.50%	174240	0.5808	0.0363	X		X	36.78	
Solidago rugosa	Rough-stemmed goldenrod	62500	1.00%	38720	0.61952	0.03872	X		X	28.03	
										667.23	
			35.00%			4.751364				41.70188	

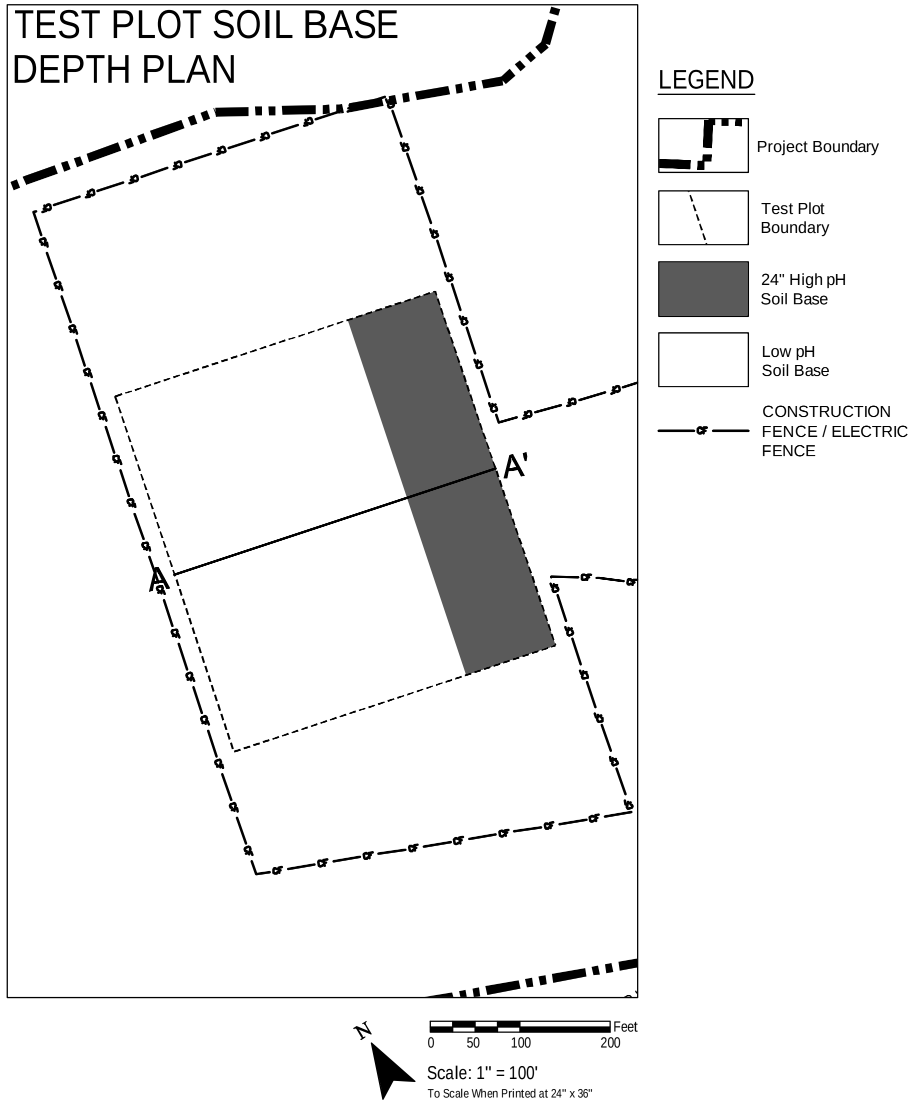
Cover Crop

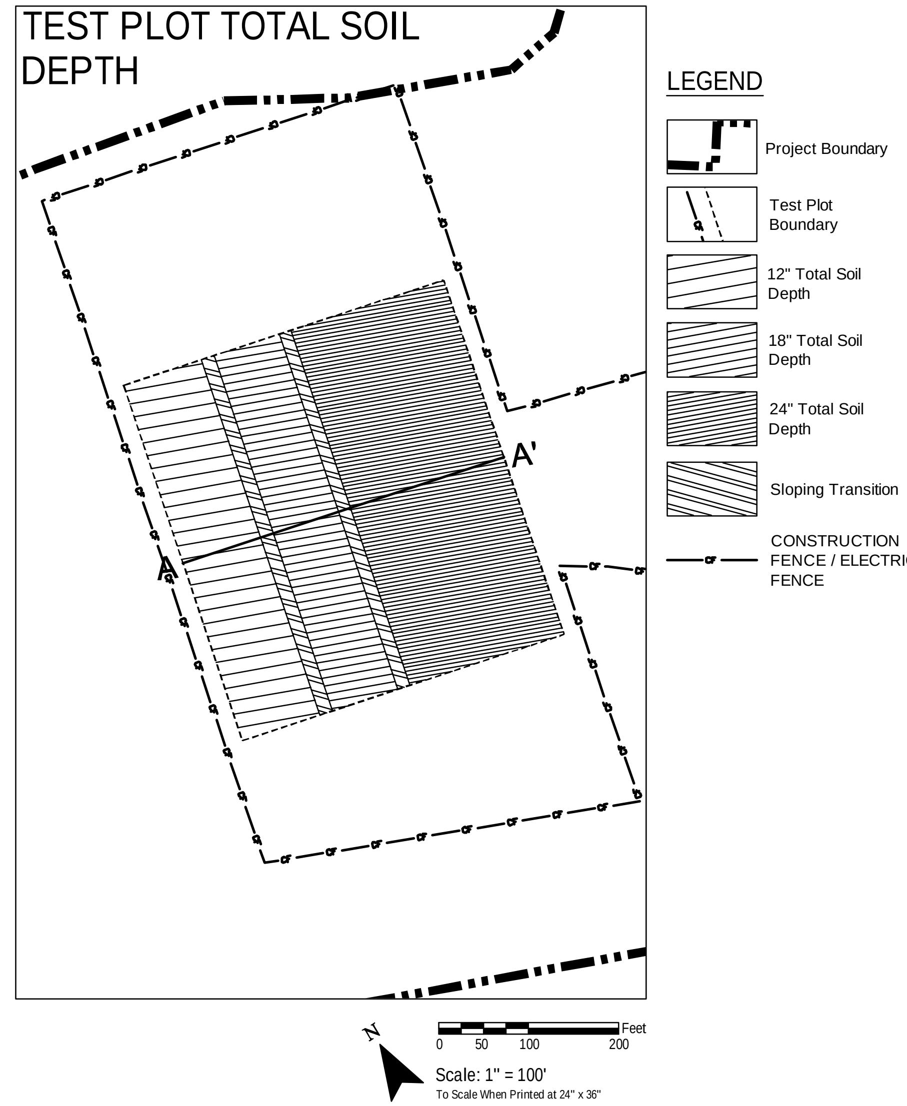
Botanical Name	Common Name	Seeds per oz	% of Mix	# of seeds	oz/ac	lb / ac
Avena sativa	Oats				800	50
Lolium multiflorum	Annual rye				320	20
Hordeum vulgare	Barley				480	30

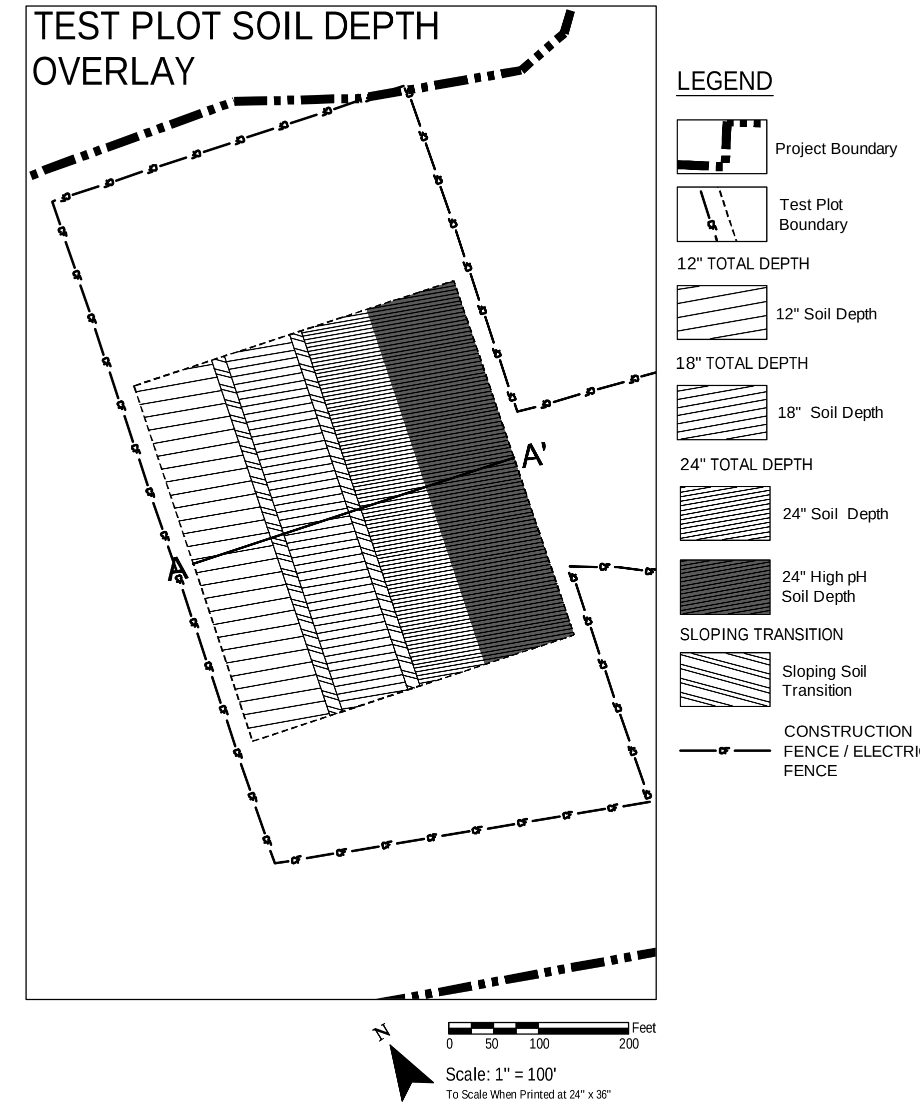
5 trees/ac
15 shrubs/ac Depending on Commercial Availability

Trees and Shrubs

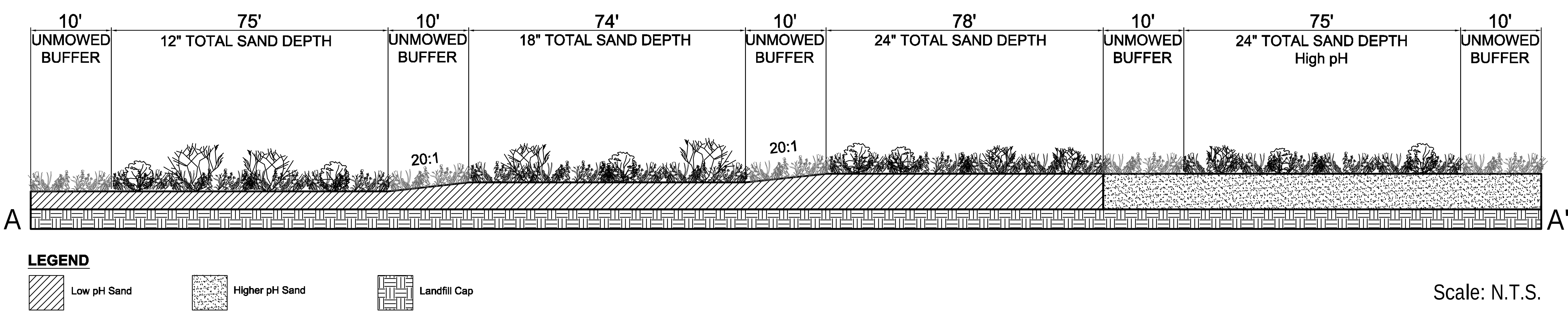
Botanical Name	Common Name	units / ac
Aronia melanocarpa	Black chokeberry	2
Ceanothus americanus	New Jersey tea	
Corylus americana	Hazelnut	
Gaylussacia baccata	Black huckleberry	2
Pinus rigida	Pitch pine	5
Prunus pumila	Sand-cherry	2
Quercus ilicifolia	Scrub oak	2
Quercus prinoides	Dwarf chinquapin oak	2
Salix humilis	Dune willow	2
Vaccinium pallidum	Hillside blueberry	3
Total Trees & Shrubs / zone		**20**







TEST PLOT SECTION A-A'



Scale: N.T.S.

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

Test Plot Plan Cross-section Design

REVISIONS

No: 1	Date: 03-12-2012	By: EM
Description: Revise work plan		
No:	Date:	By:
Description:		
No:	Date:	By:
Description:		
No:	Date:	By:
Description:		

AES Proj. #: 09-0636
Checked:
Approved:
Drawn by: krv
File: 090636Test_Plot_Plan20120312.dwg
Date: 22 March 2011
Coordinate System: NAD NY State Plane, East (ft)

CLOUGH HARBOUR & ASSOCIATES LLP
III Winners Circle, PO Box 5269 · Albany, NY 12205-026
Main: (518) 453-4500 · www.cloughharbour.com

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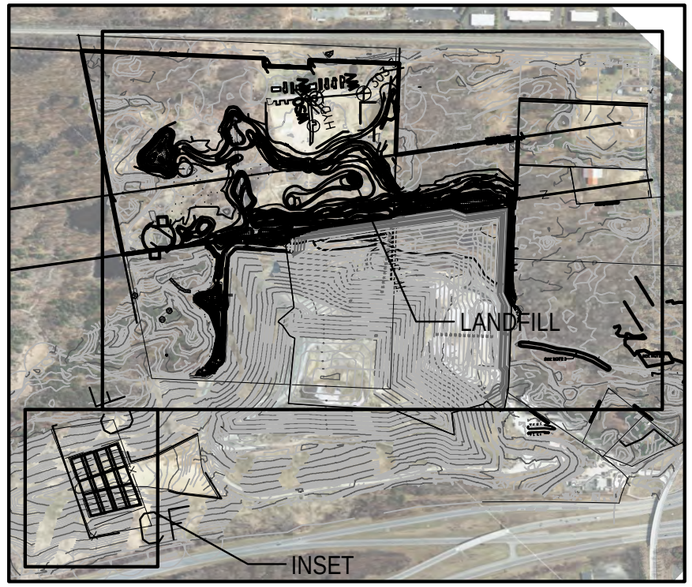
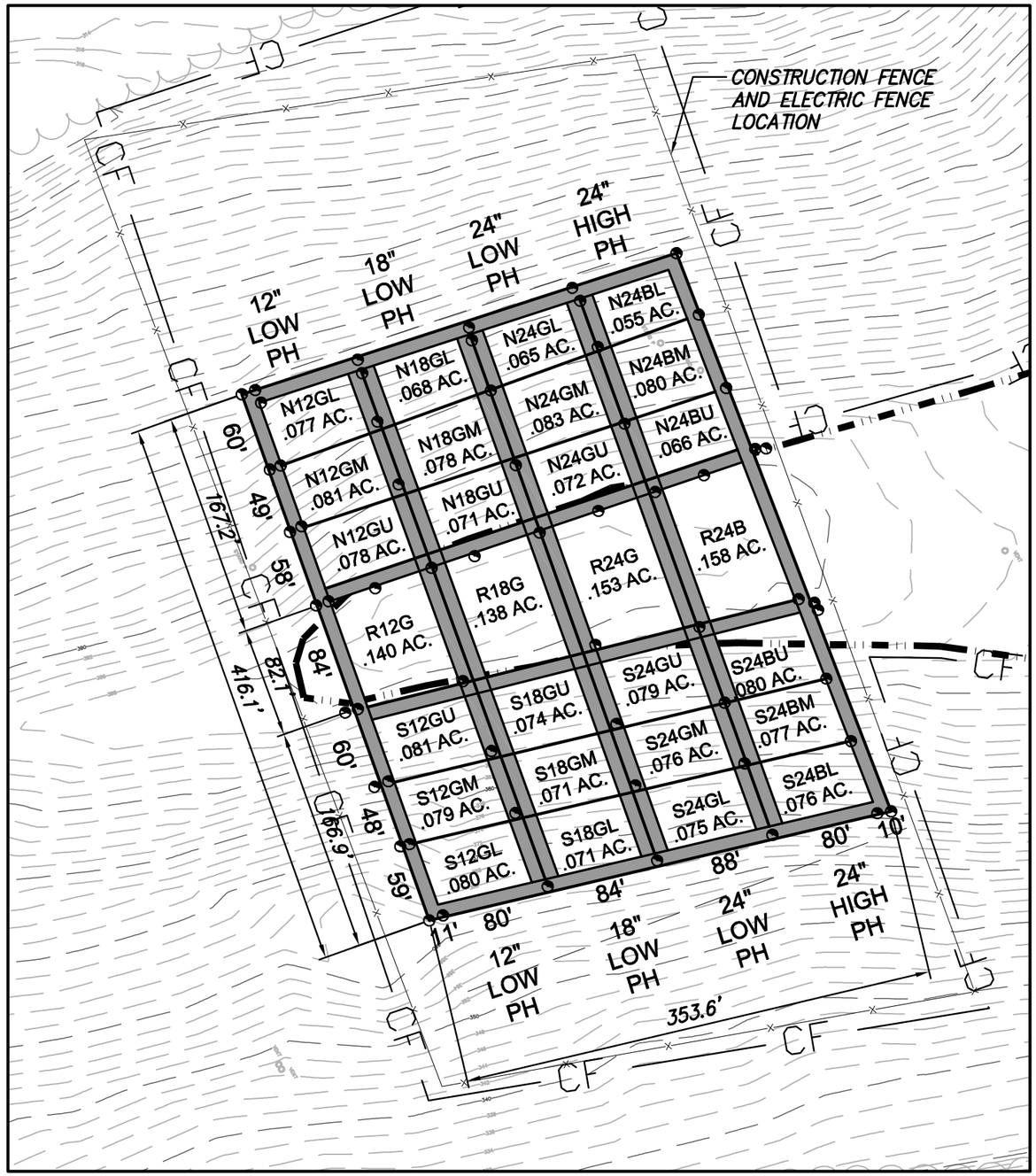
Email: info@appliedeco.com

Sheet Number
FIG 01





TEST PLOT LAYOUT

SCALE: 1"=100'

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ALBANY, NEW YORK

DEPT. OF GENERAL SERVICES

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TEST PLOT MONITORING PLAN

RAPP ROAD LANDFILL
RESTORATION PLAN

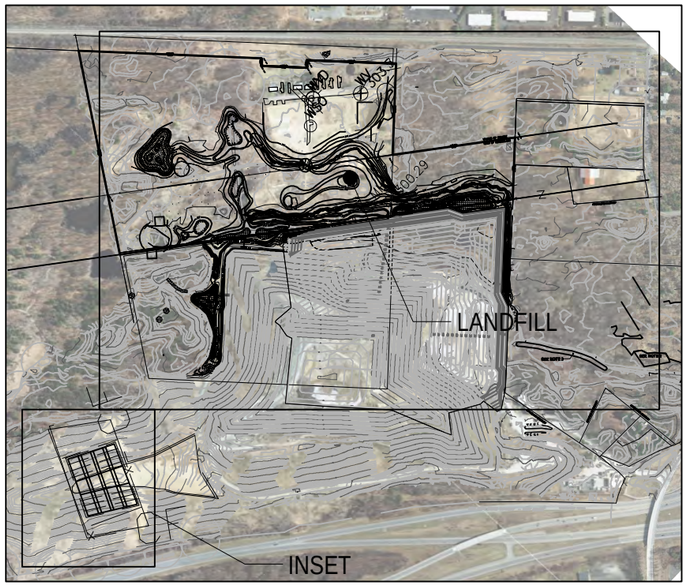
PROJECT NO. 21661

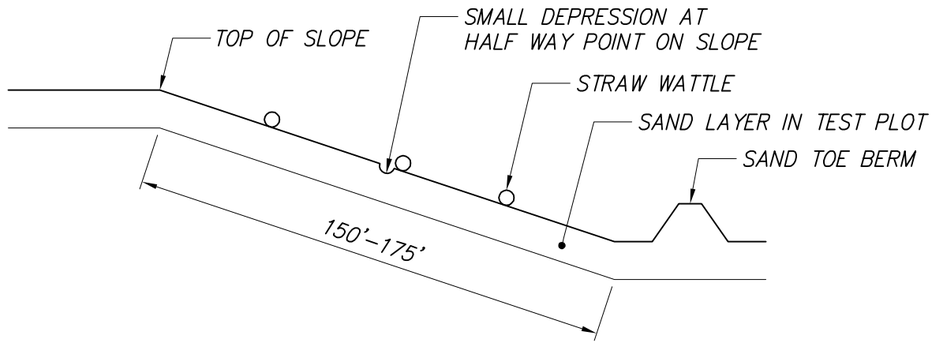
DATE: 11/02/12

FIGURE 02

2014 Work Plan - Albany Rapp Rd. Landfill

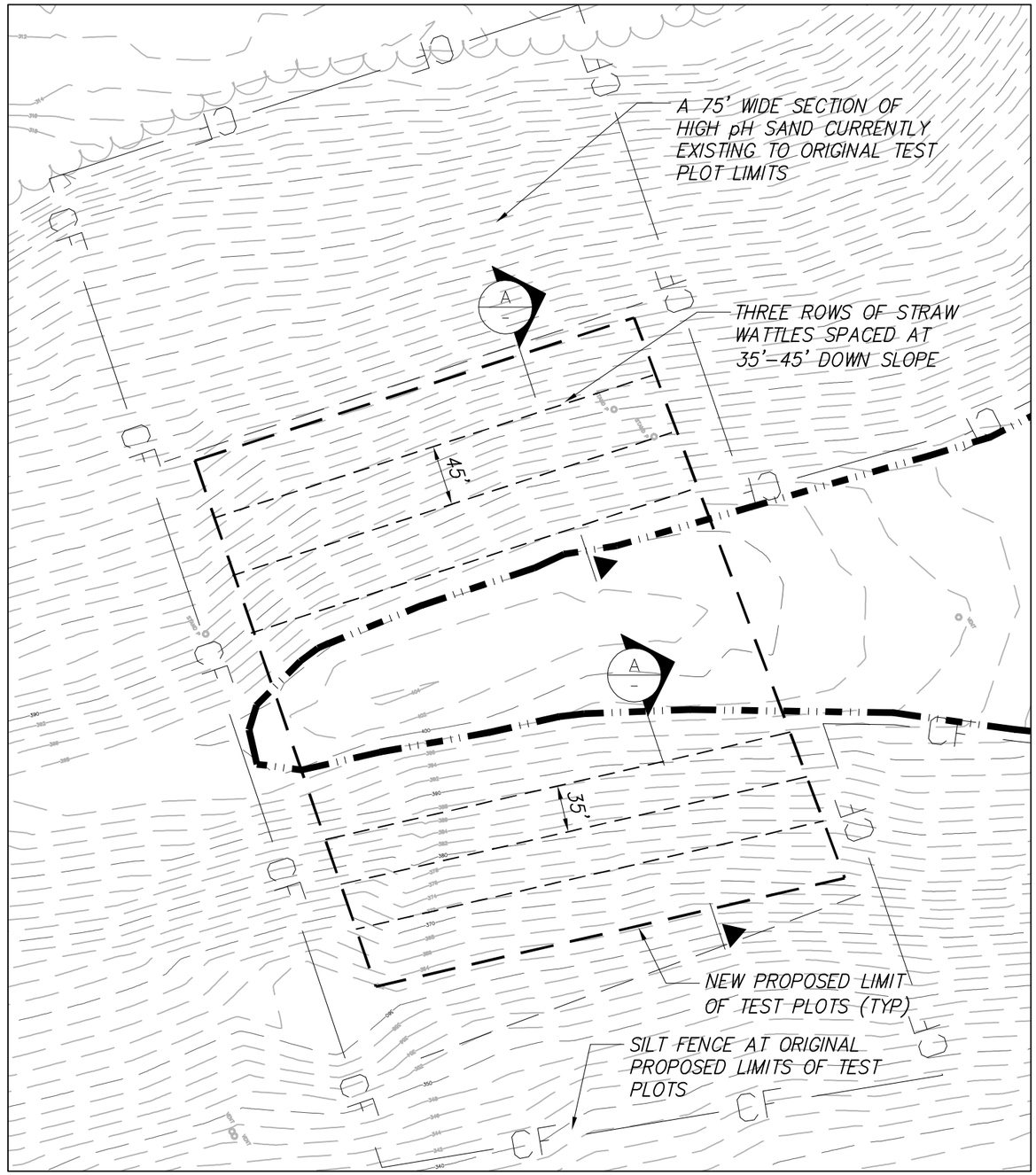
S:090636:112513





SECTION A-A'

NOT TO SCALE



TEST PLOT EROSION CONTROL

SCALE: 1"=100'

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TEST PLOT EROSION CONTROL

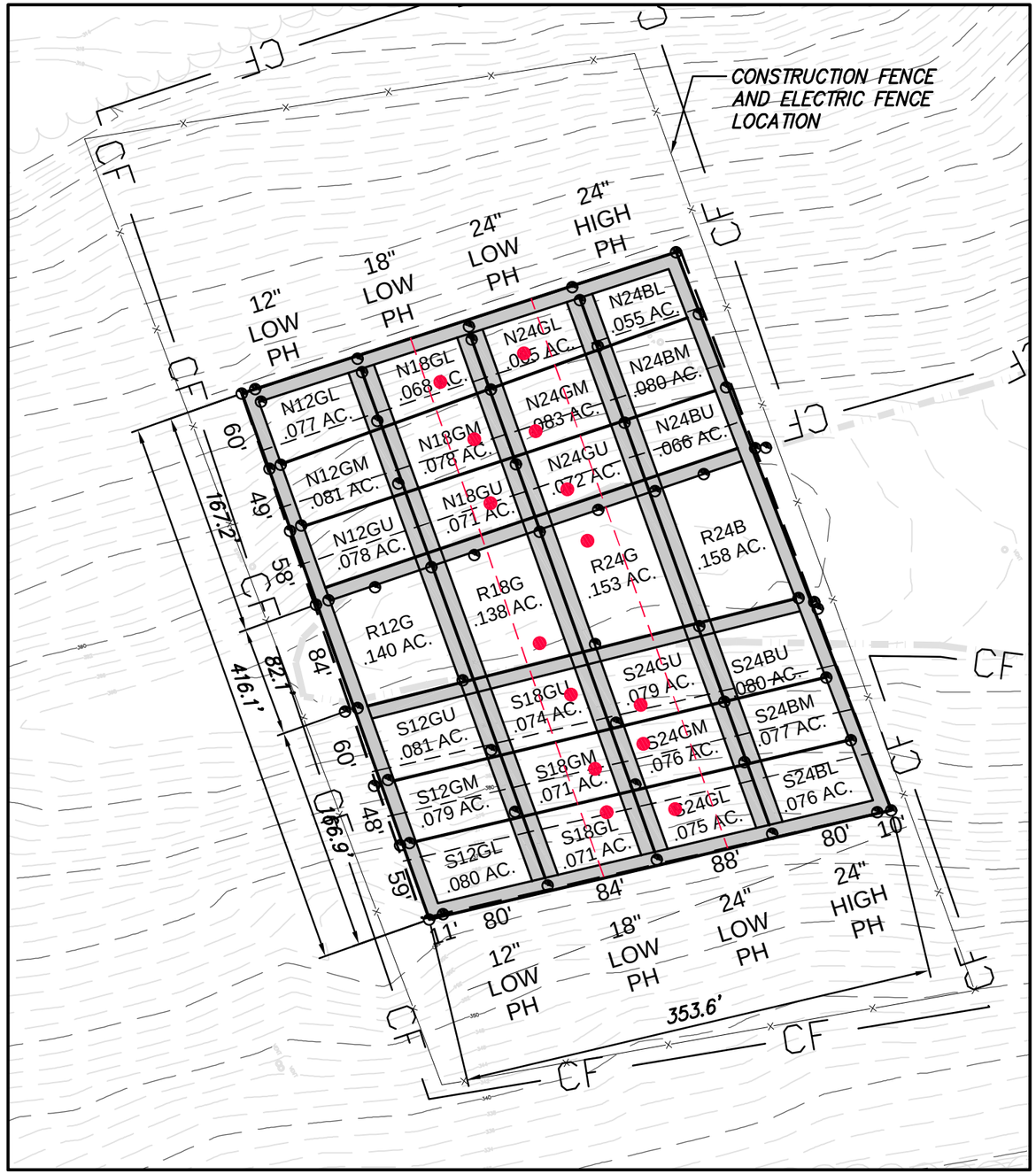
RAPP ROAD LANDFILL
RESTORATION PLAN

PROJECT NO. 21661

DATE: 11/02/12

FIGURE 03

Legend	
●	FLAG LOCATION FOR WOODY PLANTING ARRAY (1 STEM OF EACH OF THE 10 SPECIES)
- - - - -	WOODY PLANTING SUBPLOT BOUNDARY



TEST PLOT LAYOUT

SCALE: 1"=100'

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TEST PLOT WOODY PLANTING PLAN

RAPP ROAD LANDFILL
RESTORATION PLAN

PROJECT NO. 25013

DATE: 10/28/13

FIGURE 04

File: V:\PROJECTS\ANY\K3\25013\CADD\FIGURES\25013-TEST-PLOT-FIGURES.DWG
Saved: 10/28/2013 2:25:13 PM PLotted: 10/28/2013 2:26:16 PM User: Medina, Perry LastSavedBy: 976

Attachment F. Phase II Wetland Enhancement: Vernal Pond Sphagnum Moss Application, PAM Amendment, and Pump House Microtopography

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

Three wetland enhancement activities are proposed to occur as part of the 2014 restoration annual work plan. These activities will include the second application of the Sphagnum moss propagules to the Vernal Pond, a sand amendment to improve hydrological performance in selected areas of the Phase II Forested Wetland Community, and enhancement of microtopography in the vicinity of the Pump House to enhance infiltration and improve wetland performance.

Vernal Pond Sphagnum Moss Application

During 2013, Sphagnum moss was introduced into the Vernal Pond. This planting activity was to occur in two applications. Due to abnormally high levels of precipitation and prolonged high water levels in the vernal pond, conditions were not favorable for the second application of sphagnum propagules. The second preparation and application of sphagnum moss is anticipated to occur in 2014, following the same specifications that were developed for the 2013 planting activity for the June/July collection period. Should field conditions not meet the parameters of the specification, the application will be postponed.

Harvest and Processing Method for Introducing Moss (*Sphagnum* and other species) into the Restored Pine Bush Vernal Pond

Steven I. Apfelbaum and Susan Lehnhardt, May 16, 2013

Preface

This document provides a method for propagating moss (*Sphagnum* and other species) on the prepared mulched surface of the restored Pine Bush Vernal Pond. As provided in the Albany Rapp Road Landfill Ecosystem Mitigation, Restoration & Enhancement Plan (page 18), the restored PBVP will include the dominant and characteristic plant species of this community, including mosses, sedges, grasses, forbs, and shrubs.

Introduction

Mosses have the unique ability to regenerate entire plants from leaf fragments. They also reproduce from spores and also from asexual propagules called "gemae". Sphagnum moss uses the first two reproductive mechanisms and has not been documented to produce gemae. Sporulation occurs typically near the end of the spring growth phase of moss and is indicated by

the development of a small, often inconspicuous reddish brown to dark black capsule within the upper radiating leaflets of the top of sphagnum plants.

Conditions have to be just right for Sphagnum to produce spore capsules (to sporulate). Thus, considerable attention will need to be paid to inspect representative areas of sphagnum growths in the existing Pine Bush Vernal Pond to determine if and where spore capsules are created this year. Once created, spore capsules are very short lived, typically hydrostatically exploding and expelling spores within a few days after the capsules are first noticed. Because spores land close to the mother plants and typically adhere to other moss plants, this behavior will be used to determine when and where to obtain moss collections that are likely to contain recent expelled spores.

Most active moss growth occurs in early spring, and thus, harvesting of moss for transplanting and regenerating it in other locations is best done in early spring. The following provides more details on the procedure to be used in introducing Sphagnum and other mosses to the Pine Bush Vernal Pond restoration areas.

We propose two moss collection periods, timed and geographically sequenced with the initial moss growth, and then with moss sporulation.

Multiple-species of sphagnum moss are likely present in the Pine Bush Preserve collection location. The different Sphagnum species are typically distributed in different locations in a wetland. Some species are found where ground water seeps into the wetland along the perimeter of the wetlands. Others are found in the ground water and rain water mixing zone, growing with sedges and grasses around the perimeter, but not near the edges of the wetland with the upland settings. Still other species are found growing elevationally on hummocks with some species found in the lower wetter and inundated pools of water between hummocks, and others growing at various elevations on the hummocks.

There are many other species of mosses also sought for collection that can also be introduced into the restoration site. These include partially submerged mosses in the sedge/grass zones, mosses growing on the base of former tree stumps, wrapped around the bases of sedge and other plants. All of these mosses are desired to be introduced into the restoration site.

General Sphagnum and Other Moss Collection Process

Immediately after the compost materials are placed in the Pine Bush Vernal Pond, AES should collect several bushel-basket-sized containers of sphagnum and other bog mosses from within the Pine Vernal Pond found within the Pine Bush Preserve. Collections shall be carefully extracted by hand, and in any one location shall only create a hole in the existing moss populations of hand-sized dimension. After pulling the Sphagnum from the existing population, by hand, move the remaining moss and substrates to close the hole/gap created by the removal of the moss for the restoration project.

The collected moss shall be immediately placed in plastic bags to keep it from desiccating and at no time can it warm to greater than 80ºF. Keep the bagged moss out of direct sunlight, in the shade at all times.

Collections can occur over a population with a grab density of up to 6 hand grabs in any square meter of surface area of moss population. Moss collections from stumps or plant stems shall also limit collections in any one location to ensure over 90% of the population is left intact in each square meter of surface area.

In collecting moss, be sure to make collections from lower elevations and higher elevation populations of the moss growths to ensure you are collecting the multiple species of Sphagnum often found in a population.

Moss Collection and Processing Prior to Sporulation (April-May)

1. Use the above method, collecting up to 3 times in April-May from moss populations in the natural areas found in the Pine Bush Vernal Pond, within the Preserve.
2. Refrigerate collected mosses overnight.
3. Within 1-day of collecting the moss, pull from the plastic bag, a large handful at a time, and place moss into a food processor or low speed blender. Add 2 cups of buttermilk and enough water to submerge all moss. Then turn on the food processor in brief 1-3 seconds low speed bursts to fragment the moss specimens. Continue with several additional short bursts and confirm the moss is fragmented. DO NOT PUREE THE MOSS BY CONTINUEING THIS FRAGMENTATION PROCESS MORE THAN NECESSARY. The successful fragmentation process will result in a high percentage of intact individual moss leaves in the buttermilk slurry which you can observe in a tablespoon of sample of the slurry. Do not continue the fragmentation process if you are observing fragments of individual leaves.
4. Pour off the contents of the blender or food processor into a tank or container that can be used to transport the moss-fragmentation slurry to the Job site.
5. Repeat the fragmentation process until all moss has been fragmented.

Moss Collection and Processing after Sporulation (June-July)

1. Use the above method, collecting up to 3 times in June-July from moss populations in the natural areas found in the Pine Bush Vernal Pond, in the preserve. This process should be conducted in all previous collection locations (where the April-May collections occurred) but also with emphasis on specific locations where spore capsules have been observed.
2. Follow the same fragmentation processing steps as above.

Planting of Fragmentation Slurry on Compost Surface at the Pine Bush Vernal Pond Restoration Site

The plantings should occur where the compost material surface is saturated and moist, but minimally inundated. It is often best to apply the slurry prior to a forecast of several days of rainfall or cooler moist periods. The technique for application is as follows:

1. Identify the locations in the restoration site where the compost surface areas are saturated and have less than 1 inch of inundation.

Hand Pumping/Spraying Method

2. Remove large stems or unfragmented sections of the moss in the buttermilk slurry with a colander or hardware cloth filter. Disperse by hand these unfragmented materials onto the surface of the restoration area.
3. Using back pack sprayer pumps (such as Indian Pumps used for fire management) with the largest nozzle hole size, fill the pump with the slurry and water to keep the fragmentation slurry in suspension. You may have to stop occasionally and reach into the intake location, and remove plugs of fragments that have accumulated at the intake hose.
4. Walk around and spray the slurry over the restoration site.

Hydromulcher Spraying Method

5. Add the fragment slurry to a hydroseeder unit and spray the slurry over the surface of the Vernal Pond Restoration area. Attempt to obtain uniform coverage in the locations that meet the saturation and inundation requirements above. We have had to add 500 lbs of hydromulch when we have used hydroseeders so that the spray would carry far enough and provide uniform coverage.

   Should inundated conditions be present at the time of application, use of Hydromulcher will allow uniform coverage over the water surface. Native seed included in the slurry mix should be immersed and soaked in a cloth bag for one hour prior to adding to the slurry mix to ensure seed is imbibed and will sink along with the moss material.

Soil Amendment Using a Hydrophilic Polyacrylamide (PAM) for High-Infiltration Underperforming Sands in the Forested Wetland Zone

Introduction

Some areas within the Phase II forested wetland zone are not establishing wetland vegetation at the densities found in other highly productive areas along the stream corridors. The slow establishment is attributed to the absence of the final organic hydric soil top-dressing of the clean sand substrates that was applied during construction to other successfully established and hydrologically performing forested wetland settings in Phase II. The absence of desirable topsoil in the underperforming areas was due to the limited supply of approved and salvageable hydric topsoil produced and available from the landfill expansion activity.

Hydrological monitoring during 2013, which has been an unusually wet year (immediately following an abnormally hot and dry 2012), has determined that all Telog monitoring stations located within these underperforming areas are demonstrating hydrology consistently (see monitoring results for Telogs 4, 5, 6, and 12 in Table 1 below; factoring in capillary rise above free water in these telogs, saturation is reaching levels close to or at the surface for significant periods of time to exceed the

required 14 consecutive days during the growing season with saturation within 12" of the soil surface). Soil moisture meter data from units located at an elevation approximating that of Telog 12, on the other hand, show variable results (see Table 2 below). SM3 is performing consistently at 12" depth within the rooting zone, and for significant periods within 6" depths. SM5 and SM6 are demonstrating hydrology sporadically and for short duration in both the 12" and 6" soil depths.

It is our opinion that due to the absence of the top-dressed organic soil layer, rapid dry-down is occurring at the surface in these areas immediately following wetting-up during rainfall events. Addition of an amendment, which would function similarly to an organic soil layer to help hold moisture in the rooting zone and to accelerate establishment of the hydrophytic vegetation, is desired. This amendment would help to ensure these areas of the Forested Wetland restoration meet the required wetland mitigation acreages specified in the permit. Such an amendment would contribute to elevating and sustaining the capillary front and overall pieziometric shallow groundwater surface to effectively accelerate the growth of the intended forested wetland plant community, during the effective time of the amendment (2 to 3 years). With the increased vigor of the plant community, the organic fraction in the soil will naturally begin to increase and will continue to develop over time.

A proposed cost effective, low-impact soil amendment is recommended to improve hydrological performance and associated establishment of hydrophytic vegetation in three areas totaling 1.5 acres in the designed Forested Wetland zone in Phase II (see the red and yellow areas in attached Figure 01).

This plan calls for the use of a specific formulation of PAM in combination with bentonite clay to enhance and sustain the wetting-up of these otherwise well drained sand soils. Polymer soil conditioners have been studied and used widely since the 1950s and before, largely in agricultural and construction practices to reduce soil erosion and loss, improve runoff water quality, enhance vegetation growth on steep slopes, to increase aggregation and water holding capacities, for protecting and conserving soil resources, and to enhance seed germination (Lee et al 2010; Busscher et al 2007; Sojka et al 2007; Flanagan et al 2002; Green and Stott 2001; Roa-Espinosa et al 1999). Bentonite will act to reduce soil porosity to enhance water retention along with PAM. PAM is considered inexpensive given its effectiveness at low quantities in influencing physiochemical processes, at targeting critical portions of the soil for treatment, and allowing simplified application strategies (Sojka et al 2007). Since the 1980s and 1990s PAM formulations have improved, and when used as directed, they are considered very safe with minimal exposure risks to humans and other organisms in the environment[1] (Sojka et al 2007). Degradation occurs slowly in soils as a result of several processes including chemical, photo, biological, and even mechanical processes (freezing and thawing), with degradation rates ranging from 10% per year to 7% in 80 days (Sojka et al 2007).

Other treatments considered for improving hydrological conditions in these areas, such as re-grading the surface to a lower elevation and/or importing and applying hydric topsoil, would have to be undertaken at a higher cost and would result in removal or burial of established vegetation. The

[1] Barvenik (1994) and Deskin (1996) summarized the safety considerations for use of PAMs in environmentally sensitive applications and as impacts human safety for exposure during material handling. Their summaries note that the broad class of PAM chemicals in general exhibit a low order of toxicity to mammals, with high acute LD_{50} (lethal dose) by oral and dermal routes (>5 g kg^{-1}). They noted there were no significant adverse effects in chronic oral toxicity studies, no compound-related reproductive lesions in a three-generation study in rats, and only epidemiologic studies saw no association between unintentional occupational exposure to PAMs and tumors, which support the findings from chronic animal studies.

PAM/Bentonite application, on the other hand, will not result in those impacts to the established vegetation. Both materials are applied in a dry granular form, with a hand operated or ATV mounted lawn fertilizer spreader. Once exposed to precipitation or irrigation, the material seeps into the soil. As it moves through the soil, PAM coats the sand grains and contributes to the ability of the sand to electromagnetically hold water, nutrients, cations, and retain developing organic matter and associated soluble fulvic and humic acids. The addition of bentonite clay contributes soil-colloid material that will increase the hydrogen bonding between sand grains, water, nutrients and cations, and also increase the ability of the sand substrates to hold water by reducing soil porosity.

Testing for Optimal PAM Formulation and Application Rate

There are hundreds of specific PAM formulations, and to achieve the desired results it is important to select the proper formulation (Sojka et al 2007). To make that determination for the site specific sand particle size distribution and chemistry for the Pine Bush sands, soil samples were collected from the treatment area to be tested by SOILNET, LLC of Madison, WI, under the direction of one of the leading polymer researchers. The sand was placed in several glass columns two feet in length and treated with different PAM formulations and application rates, after which the rate of water movement through the column was compared with adjacent untreated control columns. The test columns were observed for a period of two weeks to determine the most effective formulation and quantity of PAM needed to allow the sand in the column to become saturated with water and to sustain saturated conditions, allowing minimal vertical movement and loss of water to lower substrate depths.

The lab test demonstrated that PAM would be successful in assisting the underperforming sand areas in holding water within the surface rooting zone as desired, and thereby accelerate the development of forested wetland vegetation and enhance hydrology performance in underperforming areas. The specified PAM formulation will have a residence time in the soil substrates of 2-3 years. The goal is that during this time, the soils will develop and maintain the necessary water holding capacity after the PAM has been bio-metabolized. The addition of Bentonite assures that this additional water holding capacity is accelerated and achieved.

Following are separate specifications for the PAM and bentonite clay amendments that resulted from the lab test.

Specifications for PAM

1. Underperforming areas of the Forested Wetland as mapped in Figure 01, totaling approximately **1.5 acres**, will receive an application of PAM to the soil surface.
2. Based on the results of soil testing in the SoilNet, LLC lab using Pine Bush sand collected from the underperforming areas, PAM application rates are **75 lbs/acre** of product formulation **SoilNet TRIPAM**, prepared in a dry granular form.
3. The City would therefore secure **115 lbs** (75 lbs/acre) of **SoilNet-TRIPAM** from SoilNet, LLC or another appropriate manufacturer or distributor of that product.
4. The PAM must be broadcast with ***a clean and absolutely dry*** hand operated fertilizer spreader such as a small hand operated cyclone spreader, or a typical hand pushed lawn fertilizer spreader. The PAM is applied to the soil surface and does not require additional pre- or post-treatment activities be performed.
5. Application of PAM can be undertaken in fall, late-fall, or early-spring conditions.
6. Monitoring of hydrology and vegetation performance will be conducted to document success.

Specifications for Bentonite

1. Underperforming areas of the Forested Wetland as mapped in Figure 01, totaling approximately **1.5 acres**, will receive an application of Bentonite clay in dry granular form to the soil surface subsequent to the application of PAM (see specification for time period below).
2. Based on an application rate of **100 lbs/acre**, the City would secure **150 lbs** of Bentonite clay in dry granular form from an appropriate manufacturer or distributor.
3. An estimated cost for the Bentonite application at $10/lb is $1500.00, for treatment of the entire 1.5 acres.
7. The Bentonite must be broadcast with ***a clean and absolutely dry*** hand operated fertilizer spreader such as a small hand operated cyclone spreader, or a typical hand pushed lawn fertilizer spreader. The bentonite is applied to the soil surface and does not require additional pre- or post-treatment activities be performed.
4. Application of Bentonite must be applied several weeks after the PAM application and **after at least two precipitation events or after snowmelt has occurred**. Treatment can be undertaken in fall, late-fall, or early-spring conditions.
5. Monitoring of hydrology and vegetation performance will be used to document success.

PAM and Bentonite Environmental Impacts

Both the specified PAM and Bentonite formulations are inert materials selected because they have no known toxicities for terrestrial or wetland invertebrates or vegetation (see attached toxicity test report for Soil Net TRIPAM which tested for effects on aquatic organisms). To minimize any risk to organisms particularly KBB, the selected materials and timing of treatment prior to the growing season will limit the risk of exposure for KBB and any surface dwelling terrestrial or wetland organisms. Once applied, PAM and Bentonite will begin to mobilize downward into the soil column when exposed to moisture. That process will be accelerated with rainfall and snow melt with the highest probability for success occurring during the late fall, late winter/early spring periods. Once distributed in the soil, PAM forms a sticky gel-like material that coats the sand grains and, as described previously, functions to significantly improve the sands ability to retain water, nutrients, and organic matter which develops via improved vegetation establishment.

Concern for Potential Impacts to KBB Populations

Seed from plantings of dry sand prairie on adjoining uplands along the perimeter of the forested wetlands in Areas A and C appears to have washed downslope, during rainfall events subsequent to seeding. As a result, several dry prairie species, such as Canada tick trefoil (*Desmodium canadensis*), sand bergamot (*Monarda punctata*), little bluestem (*Andropogon scoparius*), and first year seedlings of lupine (*Lupinus perennis*), are found growing among the wetland species of the developing Forested Wetland community, which supports cardinal flower (*Lobelia cardinalis*), giant blue lobelia (*L. siphilitica*), grass-leaved goldenrod (*Solidago graminifolia*), red maple saplings and silky dogwood shrubs, and many other forested wetland species. Because the dry-site species cannot tolerate root zone saturation, they will decline over time from this zone as the wetland hydrology and the forested wetland community continues to develop. This shift will accelerate as root growth reaches the slightly deeper water table, particularly with red maple.

During the discussions regarding soil amendments, APBPC raised the concern that lupine plants are occupying the restored wetland areas and provide habitat opportunities for Karner blue butterflies.

As a result, APBPC has requested a census of the lupine population, in addition to a discussion of how the proposed PAM soil amendments would affect the habitat for KBB and what risks the PAM amendment might pose to KBB individuals, which are occupying other restored habitats onsite (although not currently in the area of the proposed treatment), and what the treatment effects might have on the overall population over time. To address these concerns, a census of the lupine population in the forested wetland areas was conducted to assess the extent of the lupine population in the areas proposed for the PAM amendment, and to characterize the present lupine growth and KBB habitat opportunities in these areas.

Lupine Census and Analysis

Methods—measurements were conducted in the areas proposed to receive the PAM amendment, to quantify the presence of lupine and to characterize growth and habitat quality. The census distinguished between mature plants, which were defined as those that appeared to have completed two full growing seasons (based on evidence of flowering and seed production, or presence of semi-woody stems), and lupine seedlings (basal rosettes with no flowering evidence). The measurements occurred in two areas (Area A and Area B—Figure 02), using 60 randomly distributed 1-meter square quadrats. The number of mature and seedling plants in each quadrat were enumerated. Table 3 summarizes the stem counts per quadrat, total stem counts, and frequency of occurrence. Using the total stem count numbers we calculated the stem number or stocking density of plants per acre in both Area A and Area B, as well as density per square meter. Because lupine seedling mortality in exposed windswept and unstable sandy soils is typically relatively high, we also calculated stocking densities using frequency of occurrence values (the occurrence of one or more lupine plants in a quadrat equates to a count of 1). The resulting numbers were compared to the KBB habitat quality metric provided by the APBPC in its April 2009 memo, which uses the number of lupines plants per acre to define poor (≤1801), fair (1802-2401), good (2402-3603), and very good (>3603) quality KBB habitat.

Results—all censused lupine plants in Areas A and B were first year seedlings. Only two mature plants were observed within the study area, but these were not captured within the random quadrats. An analysis of the data in Area A, based on the actual stem count, results in an estimated stem count of 1,278 stems/acre. When adjusted using frequency of occurrence, the stem count in Area A is 852 stems/acre, or 0.211 stems/m^2. In both cases, the habitat quality ranking classification is poor for supporting KBB. The same analysis of the data in Area B, based on the actual stem count, results in an estimated stem count of 6,068 stems/acre. When adjusted using frequency of occurrence, the stem count in Area B is 1,471 stems/acre, or 0.363 stems/m^2. The higher count represents a habitat quality ranking classification of very good; the lower, a classification of poor. With anticipated high winter mortality of lupine seedlings, we caution that these resulting numbers are likely high.

Discussion—it is our opinion that the presence of lupine seedlings and other dry prairie species in the forested wetland habitats is due in large part to seed washing downslope during erosion events from planted and seeded populations in the more heavily populated dry prairie zones, which occur at topographically elevated locations immediately above Areas A and B. This was certainly a strong possibility in the area of the nursery where runoff was problematic for a period of time.

Conditions favorable for the continued growth of these dry site species in the forested wetland community will diminish as the tree canopy develops to achieve the required >50% canopy cover and a heavier wetland graminoid and herbaceous cover develops as intended and required in Areas A and B. This process would be accelerated by the addition of PAM, and would likely be apparent within

the period of a growing season as wetting up of the soils would reduce the vigor of the upland species currently present. This accelerated timeline is desirable to achieve the required forested wetland cover and to avoid creating a short-lived lupine population. During that time, KBB utilizing the area would have access to developing populations of lupine in adjacent more favorable upland locations, where plants are establishing vigorously and will continue to contribute to improved habitat quality over time, while plants growing in settings developing the forested wetland canopy and understory will continue to diminish.

Testing and product analysis has been conducted on the product SoilNet TRIPAM per attached documents: toxicity test for aquatic species (Wisconsin State Laboratory of Hygiene), NSF International Product and Service testing in drinking water, development of technical standard for water application of polymers (State of Wisconsin Department of Natural Resources), and certificate of analysis (Wisconsin Unified Certification Program). Test results on two aquatic organisms demonstrated that organisms remained alive at many of the higher concentrations of the product, although at these concentrations became immobilized in the viscous gel. As this PAM product is designed to be applied to the soil surface in dry granular form and to quickly dissolve and penetrate downward into the soil rooting zone once precipitation has occurred, it will have minimal residence time on the soil surface.

More importantly, timing of application will occur prior to active growth of vegetation in the spring, further minimizing direct contact with emerging and growing plants, including lupine. This process coupled with the relatively low quantities proposed to be applied, suggest the use of PAM is perhaps the lowest impact method for helping to achieve the wetland performance requirements in Areas A and B. This is certainly the case compared to purchasing and spreading a hydric soil layer, or by re-grading the area to achieve a lower topographic position with a higher water table. Both of these latter techniques would eliminate the lupine plants, as well as wetland plant species that have successfully established.

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Table 1. **Consecutive Days of Saturation and Inundation for Achieving Hydrology Standards for the 16 Telog Units**

Telog Number	2013 Dates Water Levels At or Above 12" of Soil Surface	Consecutive days April 1-October 15, 2013
1	6/28 – 7/14	17**
2	4/1 – 10/15	198**
3	6/10 – 6/15	6
4	5/18 – 10/15	151**
5	6/6 – 7/20	45**
6	6/6 – 7/19	44**
7	4/1 – 10/15	198**
8	4/1 – 10/15	198**
9	4/1 – 10/15	198**
10	4/1 – 10/15	198**
11	6/10 – 6/14	5
12	6/6 – 7/18	43**
13	4/1 – 10/15	198**
14	6/28	1
15	4/1 – 8/23	145**
16	4/1 – 10/15	198**

Table 2. Consecutive Days of Saturation and Inundation for Achieving Hydrology Standards for the Six Soil Moisture Meter Units

Soil Moisture Meter Number	2013 Dates Water Levels At or Above 12" of Soil Surface **	Consecutive Days April 10-October 15, 2013
1	4/10 – 10/15	189***
2	5/21 – 6/5	16***
3	4/10 – 10/15	189***
4	4/12 – 10/15	187***
5	6/11 – 6/18	8
6	6/11 – 6/16	6

** Saturation data based on either the 6 inch or 12 inch depth soil smart sensor.
*** Primary hydrology standard of 14 consecutive days or greater has been achieved.

Table 3. Lupine stems measured in random quadrats in areas w/ pure sand (Sampler: John Price, October 2, 2013)

Area A Quadrats	Seedlings	Mature Plants
1	-	-
2	-	-
3	-	-
4	-	-
5	-	-
6	-	-
7	-	-
8	2	-
9	-	-
10	-	-
11	1	-
12	-	-
13	-	-
14	2	-
15	-	-
16	-	-
17	-	-
18	-	-
19	1	-
20	2	-
21	-	-
22	-	-
23	-	-
24	2	-
25	-	-
26	1	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	1	-
38	-	-
Total stems	**12**	**0**
Frequency of occurrence	**8**	**0**
Stems/acre	**852**	**0**
Stem density/m2	**0.211**	**0**

Area B Quadrats	Seedlings	Mature Plants
1	-	-
2	4	-
3	-	-
4	4	-
5	5	-
6	9	-
7	-	-
8	-	-
9	-	-
10	1	-
11	-	-
12	-	-
13	5	-
14	-	-
15	3	-
16	2	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
Total stems	**33**	**0**
Frequency of occurrence	**8**	**0**
Stems/acre	**1471**	**0**
Stem density/m2	**0.363**	**0**

Methods: Random 1m2 quadrat hoops were tossed in the target wetland restoration areas A and B (see Figure 02 quadrat location map). A lupine stem count was conducted for each quadrat. Stems were distinguished as "mature plants" or "seedlings". "Mature plants" are defined as those with evidence of flowering/seeding, (or) those with a semi-woody stem, (or) those that appeared to have completed at least two (2) whole growing seasons. "Seedlings" are defined as any lupine not meeting those requirements. Mature plants were assumed to be the type of plants on which KBB would likely be present. Based on these criteria, there were no plants captured in the quadrats which met the requirements for "mature plant." During the census, two individuals right next to each other were observed that would qualify as mature, however they did not fall within a quadrat. Photos were taken of these, as well as of each of the quadrats censused and reference photos of mature lupine in the uplands.

Calculations: **Avg. lupine count /quadrat: 45 stems/60 quadrats = .75 stems/quadrat**

1 m2 = 10.764 ft2

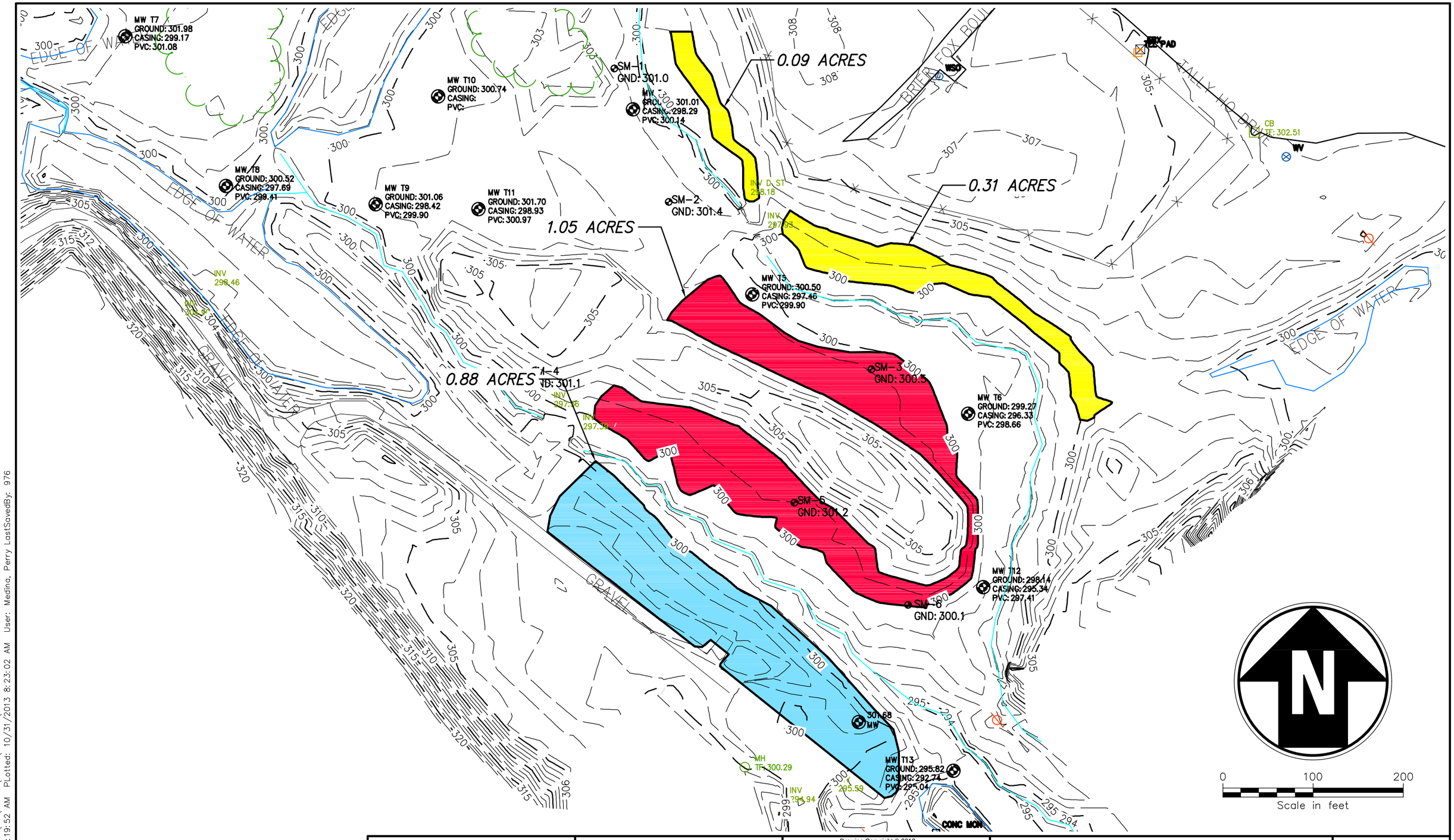
Area A = 38 m2 = 409.03 ft2

Area B = 22 m2 = 236.81 ft2

Area A = 43560/409.03 = 106.5 (12) = 1,278 stems/ac (using total stem count): Poor Habitat Rating

Area A = 8/12(1278) = 852 stems/ac (adjusted for frequency of occurrence): Poor Habitat Rating

Area A = 852/43560(10.764) = 0.211 stems/m2
Area B = 43560/236.81 = 183.9 (33) = 6,068 stems/ac: Very Good Habitat Rating
Area B = 8/33(6,068) = 1471 stems/ac (adjusted for frequency of occurrence): Poor Habitat Rating
Area B = 1471/43560(10.764) = 0.363 stems/m2



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PAM AMENDMENT AREAS

RAPP ROAD LANDFILL
RESTORATION PLAN

PROJECT NO. 25013

DATE: 10/31/13

FIGURE 01

MW T7
GROUND: 301.98
CASING: 299.17
PVC: 301.08

MW T10
GROUND: 300.74
CASING:
PVC:

MW T8
GROUND: 300.52
CASING: 297.69
PVC: 299.41

MW T9
GROUND: 301.06
CASING: 298.42
PVC: 299.90

MW T11
GROUND: 301.70
CASING: 298.93
PVC: 300.97

SM-1
GND: 301.0

MW T12
GROUND: 301.01
CASING: 298.29
PVC: 300.14

SM-2
GND: 301.4

INV D. ST
298.18

INV
297.

MW T5
GROUND: 300.50
CASING: 297.46
PVC: 299.90

SM-3
GND: 300.5

SM-4
GND: 301.1

INV
297.56

INV
297.38

MW T6
GROUND: 299.27
CASING: 296.33
PVC: 298.66

SM-5
GND: 301.2

MW T12
GROUND: 298.14
CASING: 295.34
PVC: 297.41

SM-6
GND: 300.1

301.68
MW

INV
298.46

BRIER FOX BOULEVARD

TALLY HO DRIVE

TEL PWD

WSO

CB
IE: 302.51

WV

EDGE OF WATER

GRAVEL

LEGEND

AREA A

AREA B

0 100 200

Scale in feet

S:090636:112513

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LUPINE CENSUS

RAPP ROAD LANDFILL
RESTORATION PLAN

PROJECT NO. 25013

DATE: 10/28/13

FIGURE 02

2014 Work Plan - Albany Rapp Rd. Landfill

File: V:\PROJECTS\ANY\K3\25013\CADD\FIGURES\25013-LUPINE-CENSUS-FIGURE.DWG
Saved: 10/28/2013 10:37:20 AM PLotted: 10/28/2013 10:39:23 AM User: Medina, Perry LastSavedBy: 976

Attachments: product analysis conducted on SoilNet TRIPAM formulation.

1. Wisconsin State Laboratory of Hygiene—toxicity test for aquatic species
2. NSF International Product and Service testing in drinking water
3. State of Wisconsin Department of Natural Resources—development of technical standard for water application of polymers
4. Wisconsin Unified Certification Program—certificate of analysis
5. Soil Net LLC brochure

WISCONSIN STATE LABORATORY OF HYGIENE

Environmental Health Division
2601 Agriculture Drive
P.O. Box 7996
Madison, WI 53707-7996
Phone: (608) 224-6202 • (800) 442-4618
FAX: (608) 224-6213

University of Wisconsin

December 2, 2004

Dr. Aicardo Roa

Re: Soil Net–TRIPAM Toxicity Tests

Aicardo,

We performed toxicity tests on your product known as Soil Net-TRIPAM using two aquatic species, *Ceriodaphnia dubia* and fathead minnows. A toxicity test is designed to cause sufficient mortality in order that an LC50 can be calculated from the data. An LC50 is the lethal concentration (LC) killing 50% of a test population. It is calculated with statistical software using the concentrations and organism mortality occurring in five dilutions of a sample.

We were unable to calculate an LC50 for this product because more than 50% of the organisms survived at the highest concentration tested (4g/L). Because of the extreme viscosity of this product, we were unable to test concentrations higher than this. Therefore, we calculated an EC50 for this product. An EC50 is the effective concentration (EC) preventing movement in 50% of the test population. At many of the higher concentrations of this product the organisms were alive, but could not move at all and would eventually die due to starvation.

To prepare the highest concentration we mixed 4g/L of Soil Net-TRIPAM with 1L of lab water in a glass beaker and mixed on a stir plate for 1 hour. Six serial dilutions were made from this mixture to give a total of 7 test concentrations (4, 2, 1, 0.5, 0.25, 0.125, 0.06 g/L). A laboratory control contained no product and one liter of lab water. Prior to adding organisms, we poured off aliquots of the appropriate volumes to create replicate test chambers (4 replicates/treatment/species) according to our standard test protocol. The daphnia and fathead minnows were checked daily. Standard procedure is to transfer each organism to new solution after each 24 h exposure, however, the viscosity of the product made this impractical. Therefore, the test was performed as a static non-renewal toxicity test, with the tests ending at 48 h for the daphnia and 96 h for the fish. These durations are standard for acute tests.

The EC50 for *Ceriodaphnia dubia* was 1230 mg/L (ppm) with a 95% confidence interval of 1080 to 1410 mg/L (ppm). The EC50 for fathead minnows was 1370 mg/L (ppm) with a 95% confidence interval of 1280 to 1460 mg/L (ppm).

If you have any questions about any of these results or the procedures we used, please don't hesitate to call.

Sincerely,

Amy Mager
Environmental Toxicologist
WI State Laboratory of Hygiene
Madison, WI 53718
(608) 224-6230
sgeis@mail.slh.wisc.edu

The Public Health and Safety Organization

NSF Product and Service Listings

These NSF Official Listings are current as of **Friday, November 22, 2013** at 12:15 a.m. Eastern Time. Please contact NSF International to confirm the status of any Listing, report errors, or make suggestions.

Alert: NSF is concerned about fraudulent downloading and manipulation of website text. Always confirm this information by clicking on the below link for the most accurate information:
http://info.nsf.org/Certified/PwsChemicals/Listings.asp?CompanyName=Soil+Net+LLC&

NSF/ANSI 60
Drinking Water Treatment Chemicals - Health Effects

Soil Net LLC
560 Enterprise Avenue
Belleville, WI 53508
United States
608-221-8129

Facility : # 1 USA

Polyacrylamide[PC]

Trade Designation	*Product Function*	*Max Use*
EM-800	Coagulation & Flocculation	3mg/L
Liquid Tripam	Coagulation & Flocculation	3mg/L
S-1000	Coagulation & Flocculation	1mg/L
S-200	Coagulation & Flocculation	1mg/L
SW-300	Coagulation & Flocculation	1mg/L
TRIPAM	Coagulation & Flocculation	1mg/L

[PC] Polyacrylamide Products Certified by NSF International comply with 40 CFR 141.111 requirements for percent monomer and dose.

Facility : # 2 USA

Poly (Diallyldimethylammonium Chloride)(pDADMAC)

Trade Designation	*Product Function*	*Max Use*

SL-4800	Coagulation & Flocculation	50mg/L

Polyamines[PY]

Trade Designation	*Product Function*	*Max Use*
SL-2700	Coagulation & Flocculation	20mg/L
SL-3000	Coagulation & Flocculation	20mg/L

[PY] Polyamines Certified by NSF International comply with 40 CFR 141.111 requirements for percent monomer and dose.

Number of matching Manufacturers is 1

Number of matching Products is 9

Processing time was 1 seconds

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

WISCONSIN
DEPT. OF NATURAL RESOURCES

Jim Doyle, Governor
Scott Hassett, Secretary

101 S. Webster St.
Box 7921
Madison, Wisconsin 53707-7921
Telephone 608-266-2621
FAX 608-267-3579
TTY Access via relay - 711

January 11, 2005

Dr. Aicardo Roa-Espinosa
Soil Net LLC
1628 Waunona Way
Madison, WI 53713

Subject: Use Restrictions for Soil Net LLC Polymer Products for Water Application

Dear Dr. Roa-Espinosa:

By copy of this letter I am transmitting the use restrictions for Soil Net-35, Soil Net-TRIPAM, and EM 1000 (OL 1000). To receive these use restrictions you submitted toxicological data, which was reviewed in accordance with Chapter 1.7 of the Whole Effluent Toxicity Program Guidance Document (11/02). The use restrictions represent the concentration below which acute toxicity impacts are not likely to occur.

As you are aware, the Department, along with a team of technical experts, developed a technical standard to address water application of polymers for sediment control in conjunction with sediment control structures. To be in compliance with Interim Technical Standard No.1051, Sediment Control: Water Application of Polymers, the application rate of the products shall not exceed the values below:

Product Name	**Use Restriction (mg/l)**	**Application Rate (lbs/ac-ft)**
Soil Net-35	105.5	142
Soil Net-TRIPAM	123	166
EM 1000 (OL 1000)	0.033 ml/L (@1.25 grams/ml density = 41.25 mg/l)	56

These application rates will keep the concentrations below the use restrictions. If you have any questions concerning these values, please feel free to contact me at (608) 261-6420.

Sincerely,

Mary Anne Lowndes

Mary Anne Lowndes, Urban Stormwater Engineer
Bureau of Watershed Management

cc: Pete Kemp - DOT

Soil Net
Soil and Water Engineering
Polymer Solutions

1628 ***Waunona Way Madison WI 53713***
Telephone ***608-221-8129, E****-mail* ***soilnetllc@soilnetllc.com,***
Telefax ***608-222-7658***

Dust Control
Erosion Control

October 15, 2013

CERTIFICATE OF ANALYSIS

O/L 183447L2

Customer	**Applied Ecological**
Customer Porduct Name	**Soil Net TRIPAM**
Lot Number	**UA3885K2**

Test	UNITS	SPECIFICATION	RESULT	QCTES
Total soli Content	wt%	87 min	**92.9**	100A
Residual Acrylamide	ppm	499 max	**23**	200A

UL Viscosity	cps	10 max	**6.7**	400A
Insolubles	wt%	3.5 max	**0.27**	151A
Solution Appearence		Slightly Hazy solution		

APROVED BY:

Aicardo Rao-Espinosa Ph.D

WISCONSIN UNIFIED CERTIFICATION PROGRAM
Soil Net LLC is Certified as:
Hispanic-Owned Disadvantaged Business Enterprise

Soil Net LLC is a company developed by Aicardo Roa PhD. It is dedicated to engineering environmentally beneficial polymer based products that are easy and inexpensive to apply. These products have been thoroughly tested for use in erosion control, water clarification, and dust abatement, resulting from construction, agriculture, mining and both military and civilian traffic.

- **30 years experience in Soil Science Engineering and Solid Separation.**
- **Products exceed FDA and EPA standards**
- **Highest quality products available on the market**
- **On site consulting and customized manufacturing**
- **Product efficacy tested and verified through University of Wisconsin Biological Systems Engineering Department.**
- **Products currently being used in North and South America, Asia and Europe.**
- **All products manufactured in the USA**
- **Research and Development constantly updating and improving existing line of products**

S:090636:112513

FOR MORE INFORMATION PLEASE FEEL FREE TO CONTACT US:

Soil Net Polymer Solutions

1628 Waunona Way
Madison, WI 53713

(608) 221-8129 (608) 358-7588
(608) 222-7658 fax
Email: Soilnetllc@aol.com
www.soilnetllc.com

Soil Net LLC
Polymer Solution

- Erosion Control
- Water Clarification
- Industrial Solids Separation
- Dust Control
- Custom Applications

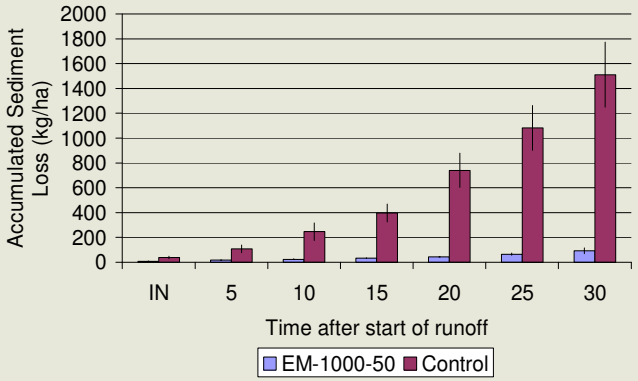
Soil Net LLC

is a company dedicated to engineering environmentally beneficial polymer-based products that are easy and inexpensive to apply. These products have been thoroughly tested for use in erosion control, water clarification, and dust abatement, resulting from construction, agriculture, mining and both military and civilian traffic.

Erosion Control

Soil Net products reduce soil loss and comply with environmental standards in all construction areas. These products have been engineered to lower application costs.

B



Products:

Soil Net-35

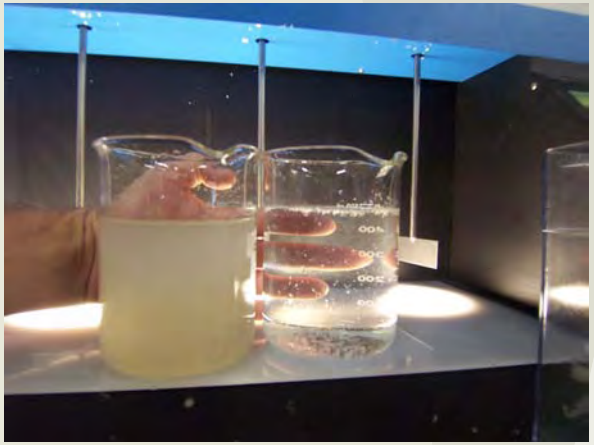
Soil Net TRIPAM

Soil Net EM 1000-50

Solid Separation and Industrial Effluent Clarification

We have had resounding success in the following industries:

- **Sugar refining**
- **Industrial effluent clarification and solid separation**
- **Water treatment clarification and filtration**
- **Ethanol and biodiesel solid separation and purification (total removal of DDG's).**
- **Starch industry effluent clarification (as pictured below).**
- **Manure separation, allowing environmentally friendly disposal of wastewater**
- **Dredging projects, to meet DNR standards by removing solids and pumping filtered water back into waterways.**



Without Soil Net Dust Control With Soil Net Dust Control

Protect your employees, machinery, and neighbors from the proven dangers of dust inhalation.

Use Soil Net LLC products to comply with air quality regulations.

Pre-emptive dust control product: Will leave sand loose, but increase dust particle weight in order to keep dust from becoming airborne.

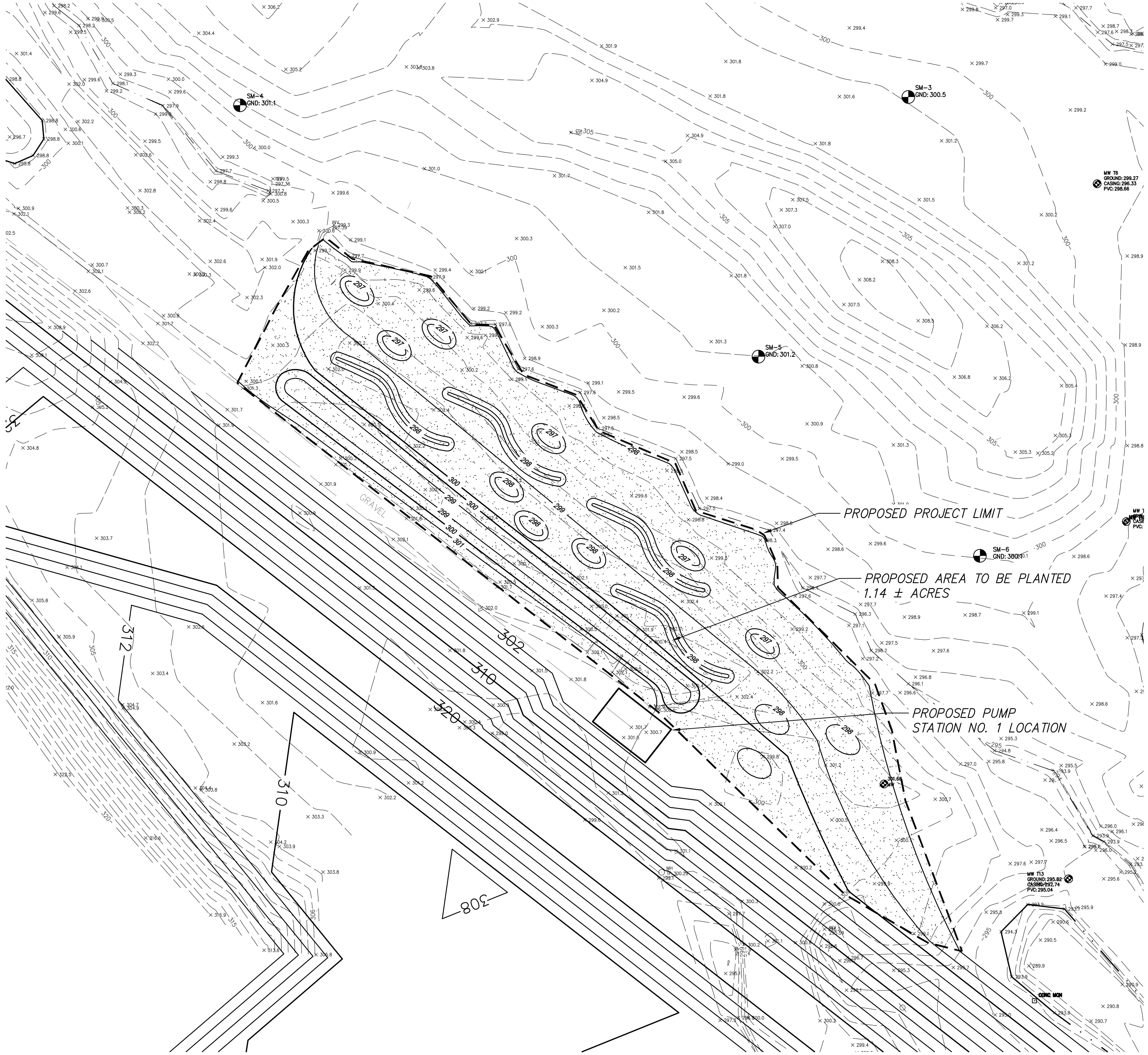
Surface sealant: Creates a seal over any soil or sand that can act as an alternative to paving or manmade coverings (i.e. tarps, straw mat or metal plating

Our products are ***not*** petroleum-based and are environmentally safe. They are specially engineered to combine with erosion control products and prevent fertilizer leeching and run-off while increasing nutrient retention.

Soil Net LLC

Pump Station Microtopography

During 2013, the pump station area of the Phase II restoration was re-graded in accordance with the plans provided in the 2013 Work Plan. This work was conducted to lower the elevation of this area to achieve better hydrology in support of wetland vegetation. Upon completion of grading, the area was planted and seeded with wetland species. This area continues to have a gentle slope from the pump station to the relocated stream, and, as a result, runoff from the surrounding areas, including the road to the pump station, has caused minor erosion and gullying. In order to control this condition and to support the retention of water in this area as a supplement to the PAM application, the incorporation of small depressions and swales is proposed. These small depressions will help to capture stormwater runoff and promote infiltration. The opportunity for creating microtopography came after the recognition of the impact on vegetation in this area from deer activity. Most of the trees and shrubs were significantly damaged by a concentration of deer in this area that browsed on the vegetation and rubbed their antlers on the young trees. As a result, it is anticipated that the 2013 plantings and seeding will have to be replaced in 2014. Therefore, prior to replanting, the small amount of grading work can occur to accommodate stormwater retention per the attached plan.



D PUMP STATION RE-GRADING
1"= 30' +/-

NOTES:
1. ALL DISTURBED AREAS SHALL BE SEEDED AND MULCHED.
2. SEED MIX SHALL BE THE SAME AS WHAT WAS PREVIOUSLY PROVIDED FOR THIS AREA AND AT THE SAME RATE.

0 20 60
Scale in feet

No.	Submittal / Revision	App'd	By	Date
1	ISSUED FOR BID	MEH	NJS	08/13/10
2	PUMP STATION GRADING; WETLAND MOUND DET	NJS	NJS	10/2012
3	VERNAL POND AND WETLAND MODIFICATIONS	NJS	NJS	11/2012
4	VERNAL POND AND WETLAND MODIFICATIONS	NJS	NJS	11/2712
5	**PUMP STATION HUMMOCK GRADING**	**NJS**	**NJS**	**11/31/13**

N

DEPT OF GENERAL SERVICES

ALBANY, NEW YORK

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Email: info@appliedeco.com

Designed: NJS | Drawn: TDR | Checked: NJS

ALBANY RAPP ROAD LANDFILL RESTORATION

PUMP STATION RE-GRADING

Issue Date: 8/13/10 | Project No.: 21661 | Scale: AS NOTED

FIG 4

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

Introduction

Phase II & Phase III 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). The Ecological Consultant acting on behalf of the City of Albany will conduct management of the following high priority species that pose the greatest risk to the long term success of the restoration plan. Other species, as listed in the IPM Plan, found within the restoration area may be controlled on a case by case basis.

General Task/ Specific Task (Year)	2014												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 (*Phragmites australis*)								x	x	x			All Phases	94	31 13 14
b. Oriental Bittersweet (*Celastrus orbiculatus*)	x	x	x	x	x	x	x	x	x	x	x	x	All Phases	77-80	31 13 14
c. Sweet Clover (*Melilotus spp.*)					x	x	x	x	x	x			All Phases	95-96	31 13 13
d Canada Thistle (*Cirsium arvense)*						x	x	x	x				All Phases	85-87	31 13 13
d. Purple Loosestrife (*Lythrum salicaria*)						x	x	x	x				All Phases	88-89	31 13 13
e. Garlic Mustard (*Alliaria petiolata*)	x	x	x	x	x	x	x	x	x	x	x	x	All Phases	72-74	31 13 14
f. Knapweed (*Centaurea maculosa*)	x	x	x	x	x	x	x	x	x	x	x	x	All Phases	80-83	31 13 14
g. Woody control	x	x	x				x	x	x	x	x	x	All Phases	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.

1. Proper PPE shall be worn at all times and consist of listed and approved PPE found on the herbicide label.
2. Only NYS licensed Applicators and Technicians shall apply chemical on site.
3. All product labels and MSDS shall be kept on site during applications.

4. Appropriate spill kits shall be kept on site during applications. All spills shall be reported immediately to the proper authorities.
5. No mixing of chemicals shall take place in or near wetlands or surface waters of the State.

Execution

A. <u>Woody Invasives</u>

Formal control measures for woody invasives in the Phase II and III areas were completed in March 2011. Management consisting of spot treatments began in the Fall of 2011 and until the desired level of control is reached. Species targeted include Oriental Bittersweet (*Celastrus orbiculatus*), European Buckthorn (*Rhamnus cathartica*), Autumn Olive (*Elaeagnus umbellata*), and multiple species of Honeysuckle (*Lonicera spp.*). Crabapple (*Malus spp.*) and Aspen seedlings were noted across the Phase II restoration, though not in high density. Their presence will be monitored, and control implemented accordingly if the population demonstrates the potential to thrive.

With the completion of Phase III thinning activities, additional woody species control will be required to maintain a pine barrens community in these newly cleared areas. Seedbank presence of cherries (*Prunus spp.*), Red Maple (*Acer rubrum*), and Poplars (*Populus spp.*) is likely to cause proliferation of these species following canopy removal. A foliar spray program consisting of 1-2% glyphosate was begun in 2013 to eliminate woody regrowth from cut stumps. This will continue in 2014 to prevent reestablishment of these and any other undesirable woody vegetation, until such time as a fire regime can effectively replace chemical control. Efforts to control woody invasives on the south side of the Landfill along the thruway were begun in 2013 and will continue into 2014, along with targeted thinning of canopy trees, in particular non-native trees. All cut tree species known to resprout should be stump treated to prevent resprouting.

Methods for control of woody invasives involve basal bark herbicide application, cut stem/stump application, and in some instances hand pulling. Both herbicide methods utilize Triclopyr at rates of 20-30% based on targeted species and mixed with bark oil to facilitate penetration of the cork cambium and ensure sufficient uptake of the chemical. Glyphosate may also be used at a rate of 50% - 100% as a standard solution with water. Chemicals used in this manner are mixed with a blue tracer dye to flag or mark treated stumps and ensure proper coverage. All methods of removal will be through the use of manual tools (i.e. pruners, loppers, handsaws).

1. **Oriental Bittersweet**

This strangling vine grows vigorously throughout forested areas, climbing over and smothering vegetation beneath. The extent of infestation is severe in many locations within the restoration making Oriental Bittersweet (*Celastrus orbiculatus*) a large part of woody invasives control. The vast majority of large vines (1" dia. or >) in Phase II and III areas were cut in 2012. While small stems persist in nearly all portions of the project area, the most significant populations remain in W-4, W-5, W-2 and W-1. In addition, large populations remain relatively untouched on the southern edge of the GAL.. The enhancement in Phase III has caused more light to reach the ground both in the cleared areas and along the wetland edges causing a large influx of bittersweet seedlings. Thinning of large trees in the wetlands will also open canopy cover resulting in the same effect. These areas will form the main focus of control efforts in 2014, with a secondary focus of eliminating Oriental Bittersweet in other sectors. Seedlings also appeared in high density in the Phase II

restoration. Wetland populations will be controlled and upland populations will be monitored to determine if they can thrive in a barrens community.

Control will be implemented as follows: Twining vines that extend onto surrounding vegetation will be cut with hand pruners at the base and treated with herbicide as part of dormant season control with other woody invasives as described previously. Young vines that occupy the herbaceous layer of vegetation will be hand pulled or foliar treated with herbicide as part of herbaceous species control efforts during the growing season (May – October).

2. Woody Saplings

Species such as Black cherry (*Prunus serotina*), Poplar species (Populus *tremuloides*, P.*deltoides*, and P. *grandidentata*), Oakes species (*Quarcus rubra*, Q. *alba*, Q. *coccinea* ect.) Black locust (*Robinia pseudoacacia*) have been observed sprouting in Phase II and Phase III enhancement areas. These species will need to be controlled and thinned as to prevent dense stand development and establish the correct shrub layer composition and open space complex as needed for a barrens ecosystem. Foliar application of 1-2% glyphosate or 3% triclopyr will be used to treat saplings during the growing season. Basal bark and cut stem/stump applications will be used during the dormant season and when applicable.

B. <u>Herbaceous Invasives</u>

Monitoring and control of non-native invasives will continue in the Phase II restoration area during 2014. Now completing its third full growing season following 2011 construction, both native perennials have begun to assert competitive dominance over annual species. As many agricultural weeds are naturally culled in this process, it will become more apparent which non-native invasives will thrive in the restoration. Garlic Mustard (*Alliaria petiolata*), Canada Thistle (*Cirsium arvense*), Spotted Knapweed (*Centaurea maculosa*), Common Reed Grass (*Phragmites australis*), Sweet Clover (*Melilotus albus & M. officianalis*), and Purple Loosestrife (*Lythrum salicaria*) have been identified as species of greatest concern due to their prevalence across the project area. Secondary species include Japanese Knotweed (*Fallopia japonica*), Black Bindweed (*Fallopia convulvulus*), Russian Thistle (*Salsola kali*) and Smooth Brome (*Bromus inermis*) among others.

Much of the control efforts conducted in 2014 will occur in Phase III enhancement areas following clearing activities. Similar to the Phase II restoration, these areas will require intense monitoring and control of vegetative growth, due to significant alterations in canopy structure, light penetration, and soil/litter dynamics. Control will focus on known invasives such as those listed above along with a new population of Japanese Hops (*Humulus japonica)*, while other non-native herbaceous plants will be monitored for their effects on the restoration.

Methods for invasive herbaceous species control involve hand pulling, mowing, and foliar application of herbicides with backpack applicators. Glyphosate used at a rate of 1-3% is typical for most foliar applications but other herbicides may be used as outlined in the Integrated Pest and Invasive Species Management Plan. All work is to be performed during the growing season (May – October) in the manner described, however, special consideration is given to the following based on methods to be used and timing:

1. Garlic Mustard

While plants remain active year round, control of Garlic Mustard (*Alliaria petiolata*) typically occurs in spring (April – May) as second-year plants bolt and flower, but first-year rosettes may be treated any time of year weather conditions allow. This timing is generally used to reduce impact to surrounding vegetation. Given the predominance of spring ephemerals amongst garlic mustard in the wetlands directly east of the landfill, it is recommended that treatment for this area be attempted in fall and winter, anytime the outside temperature reaches 45 degrees, following senescence of vegetation that would otherwise conceal basal leaves of first year plants. All other areas shall remain open for treatment in the spring. Methods involve foliar application of 2-3% aquatic Glyphosate (Rodeo) and standard use Roundup WeatherMax with backpack applicators. Hand pulling can also be utilized in sensitive areas or once seed development is sufficient to warrant removal of the seed head. All cut vegetative material will be bagged and removed from site. Control efforts will be ongoing as disturbance from construction activities may continue to support reestablishment.

2. Spotted Knapweed

Spotted Knapweed (*Centaurea maculosa*) emerged in high density in the Phase II restoration in 2012, in both uplands and wetlands. Significant effort was made to eliminate basal rosettes before flowering and seed maturation, and the same strategy will carry over into 2014. Control will focus on upland and mesic populations, as the wetland populations are not anticipated to thrive long-term. Given their proximity and inter-connectedness, a similar level of recruitment to that observed in Phase II is likely to occur in areas cleared for Phase III. There, we will employ the same proactive approach of monitoring and control before flowering occurs in order to limit invasion.

Herbicide application of 2% Glyphosate (Roundup WeatherMax) with backpack applicators is an effective control method for Knapweed. Small individual plants can be hand pulled especially in the sandy soils found throughout the site. Gloves should be worn during this process as the oils in Knapweed are known to be carcinogenic. Treatment will correspond with summer herbaceous species control across the site from May through October.

3. Phragmites

Areas treated in 2009-2012 include the Albany Landfill/GAL, areas adjacent to Fox Run Estates trailer park, and the APB vernal pond FWW A-11 (see map attached). Reduction in stand area and density has been significant but consistent management is still required to prevent re-establishment. The APB vernal pond has shown dramatic improvement with only a handful of stems found this season. Monitoring will continue in 2014, with a goal of confirming 100% elimination. The phragmites (*Phragmites australis*) stands west of Fox Run Estates have also largely been eliminated as a result of construction activities in Phase II. Resprouts in the sedge meadow and south of W-8 will continue to be monitored and treated. Scattered stems are now emerging in various locations across Phase II. These plants were likely small rhizome fragments left over from Phase II construction that are only just now strong enough to push up through the wetland vegetation. Proactive control of these plants will prevent reestablishment of phragmites stands in Phase II before they become more difficult to treat. Management priorities will now shift to controlling populations on the GAL while continuing to maintain newly

cleared areas such as the APB vernal pond and Phase II restoration. Phragmites stands accessible by tractor will be mowed during the spring and early summer to remove dead standing stems from the previous season and to reduce vigor of the current season's growth. Mowing in these areas must be discontinued by July 15 in order to have time to develop sufficient regrowth and leaf surface area for effective treatment to occur (see mowing restriction detail for Phragmites on the Invasive Plant Management map, Sheet 5 of 7). Monitoring will be conducted in the spring and management activities adjusted accordingly.

Applications are typically conducted twice a year with the first application starting in mid-summer and a follow up treatment in the fall prior to the first killing frost (Avg. Sept 30th in Albany County, NY). The herbicides to be used in Phragmites control are aquatic Glyphosate (trade names: Rodeo and/or Aqua Neat) and Imazamox (trade name Clearcast). Rodeo when used alone is applied at a rate of 3%. Rodeo and Clearcast are used together at a rate of 1% each. Treatment will require a high pressure spray gun to achieve maximum cover on thick vegetation while an ATV powered boom applicator will be used for low growth and re-sprouts. As stands diminish in size and stature, spot treatment with backpack applicators is the preferred method. Phragmites in the vernal pond area of the Preserve will continue to be hand-wicked under the direct supervision of APBPC staff.

4. <u>Canada Thistle</u>

The extent of Canada thistle (*Cirsium arvense*) infestation was previously masked by the presence of Phragmites throughout the project area. The continued removal of Phragmites has revealed that Canada thistle is prevalent on the GAL and many of the borders surrounding the Phase II restoration. The biggest concern is not its presence on the landfill, whose populations will eventually be buried under sand, but rather the vast amount of seed these nearby populations will deposit on adjacent restored or planted areas (GAL test plots and Phase II restoration). Timed mowing at the flowering stage in late June early July will be used to prevent populations from going to seed on the landfill until it is covered with sand and planted. Thistle stands located on the GAL will be mowed to remove seed heads in late June, and no later than July 1st, to be most effective at reducing seed rain into the restoration area (see mowing detail on the Canada Thistle map, Sheet 1 of 7).

Populations in the Phase II/III areas will need to be treated twice annually to eliminate the existing plants while protecting surrounding vegetation. The first treatment is conducted in June/July during the period of late bud development or early flowering to eliminate seed production and force the plant to use up root reserves. This is done with either mowing or a precise backpack foliar application of 2% Glyphosate (trade names: Rodeo and/or Aqua Neat). The second treatment is conducted in the late summer at least 4 weeks following full bloom. At this stage the plant sends up a second flush of growth to produce sugars for the root system before winter. At this time a backpack foliar application of 2/3 pint per acre aminopyralid (Stinger, Lontrel) or 2% Glyphosate (trade names: Rodeo and/or Aqua Neat) is readily transported throughout the root system and is very effective in controlling this species. Monitoring will be conducted annually and management adjusted accordingly.

5. Purple Loosestrife

Purple Loosestrife (*Lythrum salicaria*) emerged in post-construction Phase II stream corridors and associated forested wetlands in higher numbers than had been observed on surrounding marginal wetlands in previous years. Similar recruitment has been observed in Phase III wetlands. This increase is likely due to the ground disturbance and canopy release caused by construction activities, combined with an existing seedbank presence. Control of the new population began in 2012, and will continue in 2014. Loosestrife has also been treated in the APB vernal pond. Strict monitoring of this population will be maintained in order to prevent further spread.

Purple Loosestrife is most effectively controlled after flower bud development begins in July, but before seed maturation occurs, thus limiting spread. If plants are discovered to have begun seed set, the flowering structure is removed before spraying. Chemical applications are foliar, made with a backpack applicator at a rate of 2% triclopyr (Garlon3A). Hand-pulling stems is an effective control, but due to the brittle nature of Loosestrife root systems, this method is only applicable in the muckiest soils.

6. Sweet Clover

Species of sweet clover (*Melilotus alba, M. officinalis*) have emerged in high densities across much of the wetland and upland portions of the Phase II & Phase III restoration. The sweet clovers are biennial range crops with a high fruiting capacity and seed-bank viability lasting decades. As such, control efforts will be focused on preventing seed production by elimination of mature plants. Effective control has been achieved with foliar backpack applications of 2% glyphosate. Treatment is possible any time throughout the growing season (May-October). First year plants will bolt and develop a leafy habit but rarely flower. These can be cut below the lowest node in September which prevents nutrient storage and results in winter mortality. At a point when use of prescribed fire becomes feasible onsite, repeated well-timed burning can be effective at reducing sweet clover seed reserves and preventing the addition of new sweet clover seed (Heitlinger 1975; Kline 1984). Research and the application of this practice suggests that the best results come from a back-to-back burn sequence, with a dormant season burn (March or early April) one year to stimulate new seedling germination, followed the next year by a spring burn in May to eliminate second year mature plants. Because this repeated practice can also reduce the frequency of native forbs, dormant season burns should continue to be an important part of long-term management, supplemented as needed with short-term alternate treatments for troublesome species, such as sweet clover (Kline 1984).

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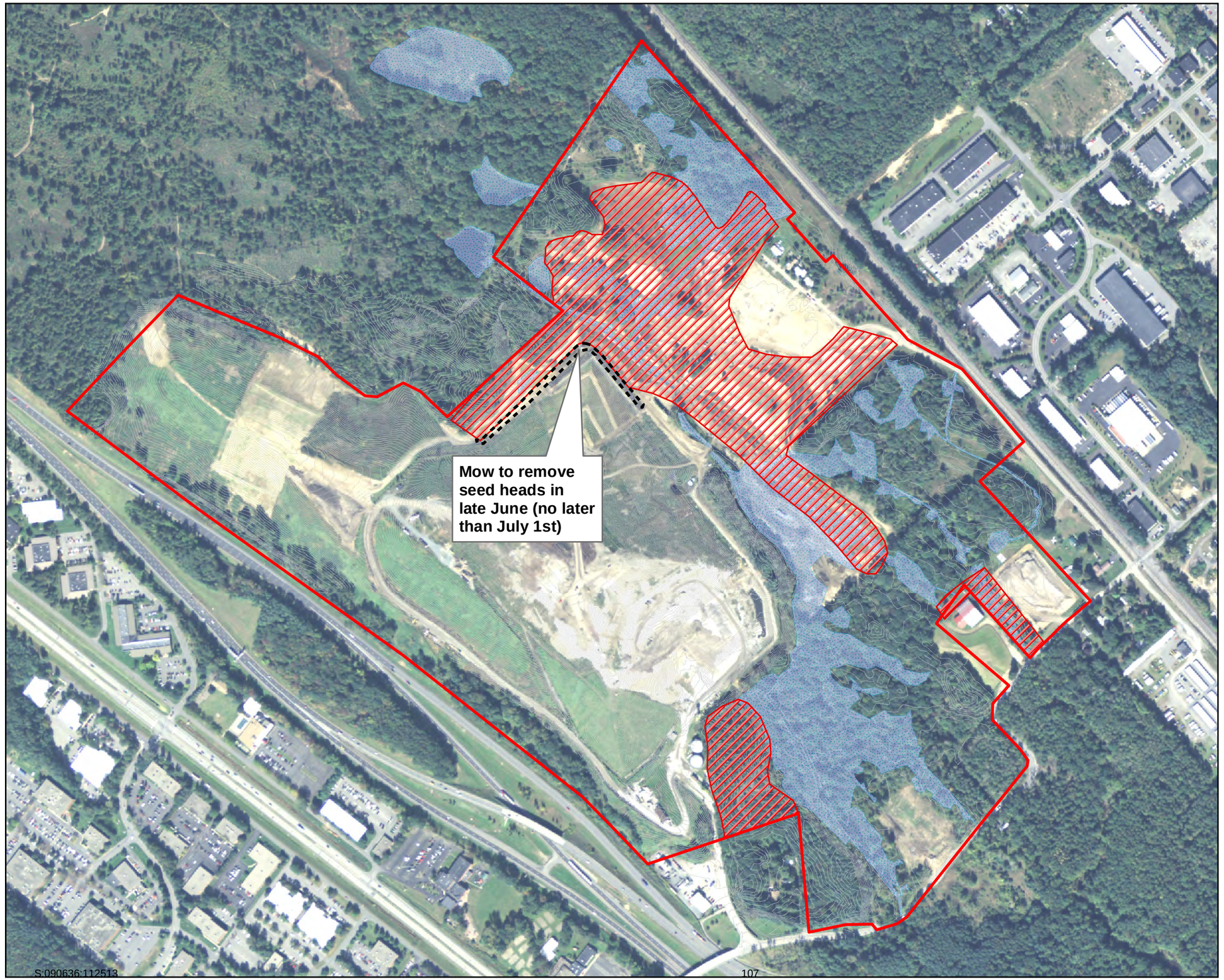
Heitlinger, M.E. 1975. Burning a protected tallgrass prairie to suppress sweet clover, *Melilotus alba* Desr. Pages 123-132 in M.K. Wali, editor. Prairie: A multiple view. University of North Dakota Press.

Kline, Virginia M. 1984. Response of Sweet Clover (*Melilotus alba* Desr.) and Associated Prairie Vegetation to Seven Experimental Burning and Mowing Treatments. Proceedings of the Ninth North American Prairie Conference, 1984 Moorhead, MN.



Invasive Plant Mangement

Albany Rapp Road Landfill
Albany, NY

City of Albany
One Conners Blvd.
Albany, New York

Legend

- Project Boundary
- Wetland
- Contours

Targeted Invasive Plant Species

- Canada Thistle
- Garlic Mustard
- Knapweed
- Oriental Bittersweet
- Phragmites (no mow)
- Phragmites (mow until July 15th only)
- Purple Loosestrife
- Sweet Clover

Aerial: 2011 NAIP

N

0 250 500 1,000 Feet

1 inch = 500 feet when printed on 11x17

Coordinate System:
NY State Plane East

AES Project #: 09-0636

Invasive_Species_Update_20131022dwa.mxd

Applied Ecological Services, Inc.

120 W. Main St.
West Dundee, Illinois 60018
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Email: info@appliedeco.com
www.appliedeco.com

Last modified:
Oct 29, 2013
Mapped by: mlb
dwa

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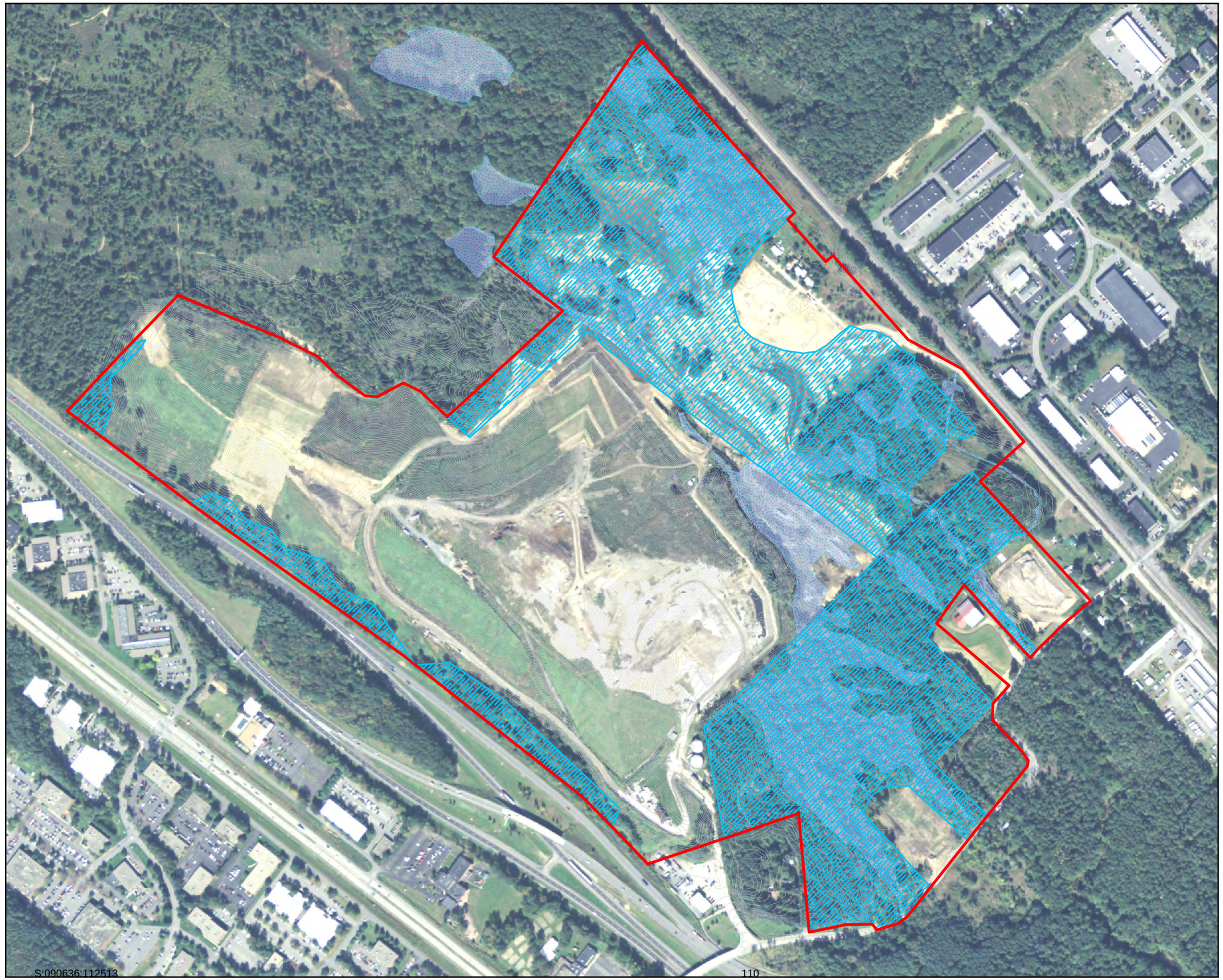

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City of Albany
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Albany, NY

City of Albany
One Conners Blvd.
Albany, New York

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- Sweet Clover

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Limited mower access due to steep slopes.

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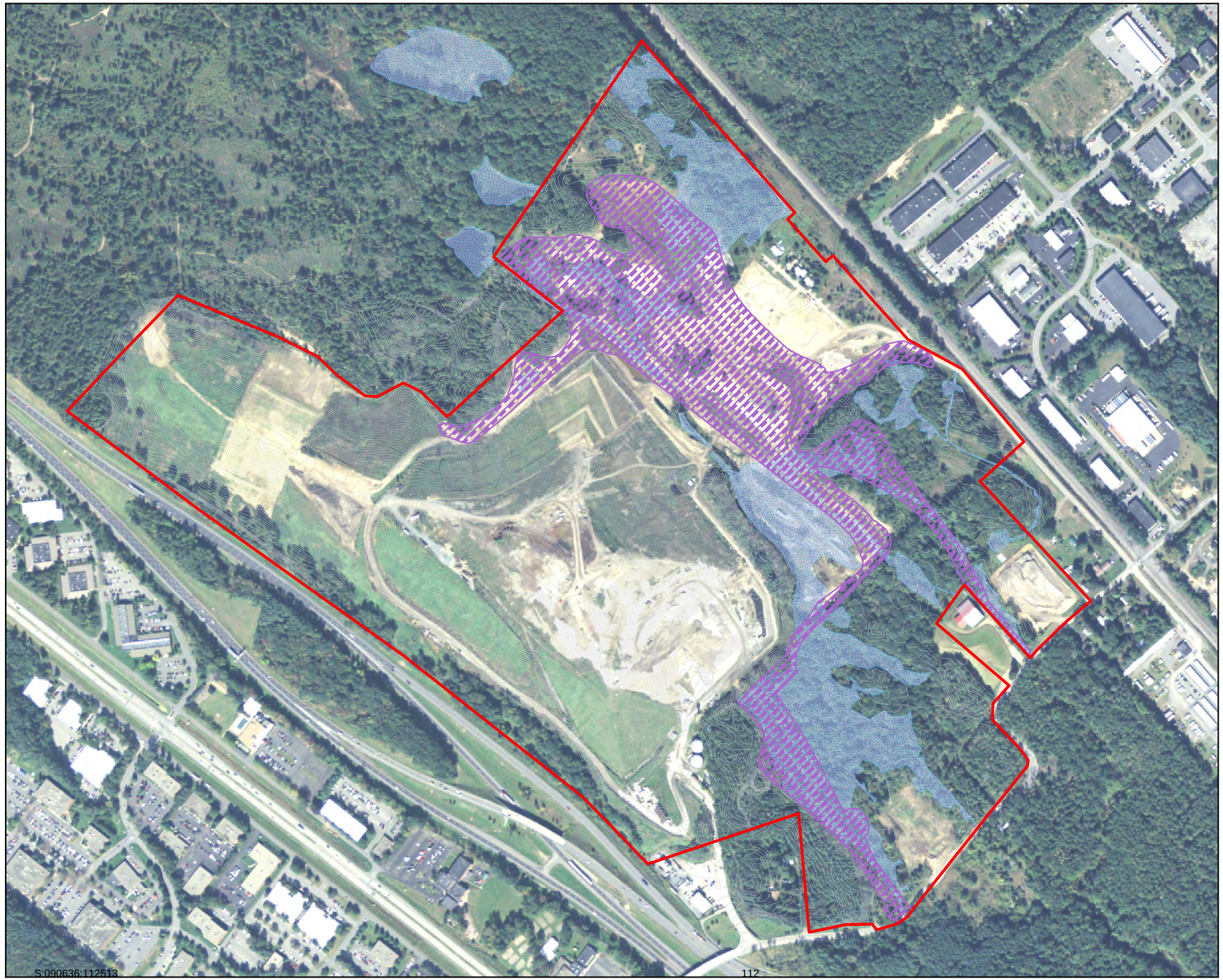

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City of Albany
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Albany, New York

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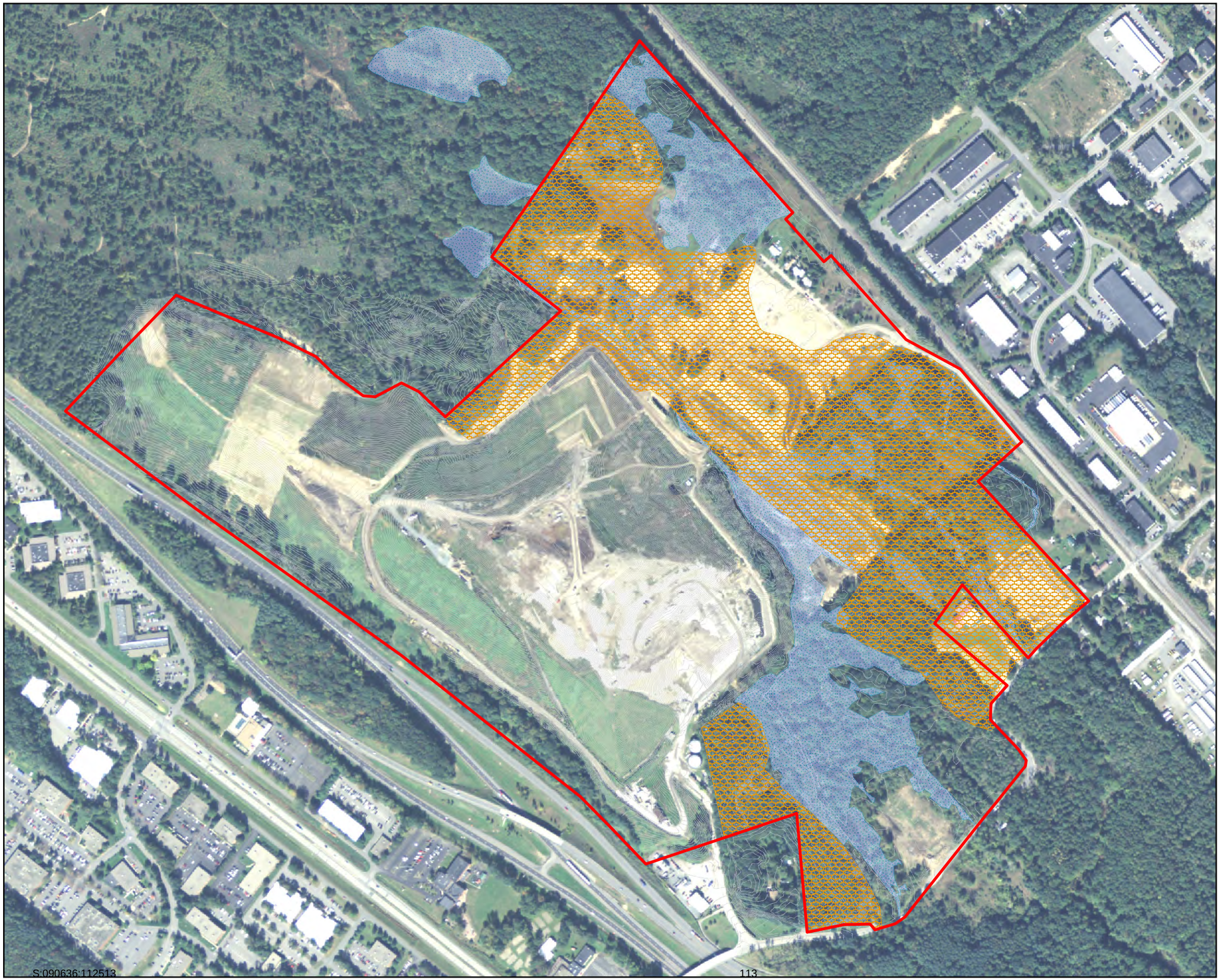

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2014 Phase III Enhancement Plan
Albany Rapp Road Landfill
Ecosystem Mitigation, Restoration & Enhancement Plan
City of Albany, New York

I. Introduction

The Albany Rapp Road Landfill Restoration project includes roughly 88 acres of existing barrens and forested wetlands cover, the ecological health and functioning of which had become highly degraded as a result of historic and recent human land use. In the past, natural and anthropogenic "wildfires" were once a regularly occurring component of the disturbance regimes which created and maintained the characteristic early successional communities of the Albany Pine Bush, such as Pitch Pine/Scrub Oak Barrens (PPSOB) and Dry Prairie/Sand Flats (DPSF). In effect, fire served to regulate the stem densities and composition of woody species, as well as to limit the amount of organic matter contained in the alluvial sands that comprise the barrens soils. Suppression of the barrens fire regime has resulted in the development of a closed canopy forest and the widespread establishment of aggressive native and non-native invasive species. Artificial drainage of the site's wetlands for past agriculture and development has also allowed many of the same aggressive native and non-native species to encroach upon wetland settings as well.

Implementation of the Phase III Enhancement Plan was begun in 2012 with the goal of restoring upland areas to the PPSOB and DPSF communities that once occupied the site and to establish the early successional habitat critical for the continued conservation of the federally listed Karner Blue Butterfly (*Lycaeides melissa samuelis*). This restoration effort has been and will continue to be accomplished through a variety of prescriptions that include clearcutting, grubbing, soil stripping, soil placement, selective thinning, transplanting, manual/mechanical/and chemical control of invasive species, and native species enhancement through seeding and containerized planting. Implementation of the Phase III Enhancement Plan will contribute to achieving the overall goal of the Albany Rapp Road Landfill restoration project to create the early successional habitats necessary to restore ecological connectivity to Albany Pine Bush Preserve lands east and west of the project site. The original Phase III Enhancement Plan can be found in the 2012 Phase III Work Plan.

A. 2013 Status Report

- **Upland Units**

  Units U3, U4, U6, and U8 were previously cleared and are in use for stockpiling sand that will be used on the final landfill cap restoration. Once this sand is removed, restoration will commence within these areas. Work within remaining upland units began in the fall of 2012 with tree thinning and removals completed by the spring of 2013. Stumping and grubbing was also completed for most of the upland units and a temporary cover crop installed. Units U5, U7, and U2 where finished over the summer and will be stabilized with cover crops by the fall of 2013.

  The recently cleared and/or thinned upland units were left fallow for the 2013 growing season and managed for invasive species and/or excessive woody re-growth. Following a field evaluation at the end of August, it was determined that the non-stockpile Phase III upland management units are ready for native seeding in 2014. Native seed will be drilled into existing sod to minimize disturbance to any native species that are repopulating from

the soil seed bank. Some units underwent more aggressive thinning than others (i.e. aspen and locust stands) and will require supplemental plantings of trees and shrubs to establish the correct species and structural component.

Phase II wetland mitigation included the construction of a northern stream channel through the former trailer park which connected wetlands in the northwest of the project to a historic stream bed in W2. Reconnection of this stream has increased water flow through W2 and contributed to a "wetting up" of the former hydric soils that remain within the riparian corridor. Work during Phase II to improve hydrology in W1 has had a similar affect although to a lesser extent. As a result, border areas within upland units that are adjacent to W1 and W2 are showing increased soil moisture following Phase III clearing work than in previous years. These select border areas between upland units and wetland units will be seeded with a mesic seed mix that will act as an important ecotone between the two habitat types.

- **Wetland Units**
  The Phase III wetland management units will undergo thinning of aspens as part of the drill & fill chemical control work to be conducted in the winter of 2013. The modest increase in light penetration through the canopy will help to promote a more diverse forb layer within these forested wetlands. As a result, the wetland management units will also be ready for enhancement seeding in 2014.

  Some wetland units (W5 & W8) have an open habitat type and will be seeded to a wet meadow mix. The lack of woody species will allow these areas to be seeded with a native seed drill in the spring of 2014.

B. 2014 Work Plan

Native seeding and restoration in Phase III for approximately 36 acres of upland and 32 acres of wetland is expected to be completed in the spring of 2014. However, seeding dates may be extended for management units that require additional preparation and management. The context map for final native seeding of these areas is provided as Figure 01 – Phase III Enhancement Seeding. All seed mixes for Upland and Wetland units are described below and in Table 1 – Phase III Seed Mixes.

- **PPSOB Mix** – Designed to provide a full suite of PPSOB species to areas that have undergone heavy disturbance and/or grading.

- **PPSOB Enhancement Mix** – Designed to establish key KBB breeding and nectar species in areas with established compositions of PPSOB plants.

- **Mesic Meadow Mix** – Designed to establish mesic nectar species in upland areas that are too moist for xeric barrens species persistence.

- **Forested Wetland Enhancement Mix** – Designed to enhance species diversity in forested wetland areas with an established composition of shade tolerant wetland plants.

- **Wet Meadow Enhancement Mix** – Designed to enhance species diversity in wet meadow and sedge meadow areas with an established composition of shade intolerant wetland plants.

- **Aquatic Mix** – Designed to establish emergent flora, enhance aquatic habitat, and improve water quality in the existing pond located in U9.

Methods

- Seed mixes will be supplied from project stock and mixed prior to installation. Some species are available commercially and must be purchased. These species are listed and amounts given in Table 1 – Phase III Seed Mixes.
- Upland, Mesic, and Wet Meadow areas will be installed with a rangeland type grain drill or no till planter such as by Truax or equivalent. The native seed drill must include a "fluff box" designed for awned and/or light fluffy seed.
- Seeding will begin after April 1st and must be completed by May 31st. Seeding may occur prior to April 1st if site conditions allow.
- Prior to the start of work, native seed drill must be checked and adjusted to the site conditions to ensure adequate penetration of disk openers and proper furrow depth for planting.
- Mowing in preparation for seeding will be required as directed to remove woody vegetation that may interfere with proper seed drill operation. This includes W5, parts of U12, U10 utility ROW, and any other areas that have heavy woody regrowth.
- Native seed will be installed in two passes. Each pass will be perpendicular to each other where possible to ensure thorough coverage.
- Seed Drill will be calibrated to ½ the rate per acre intended for each seed mix used. This will be checked for proper calibration prior to the start of work each day and whenever there is a change to a new seed mix.
- On steep slopes, native seed should be drilled with the contour and perpendicular to the direction of the slope.
- Raise seed drill and/or disengage drive wheel at the end of rows, when transporting or traveling. Native seed will continue to fall from seed tubes if drive wheel is engaged and turning.
- Native seed should not be left in the seed drill at the end of the day unless seed boxes are protected from moisture and high temperatures. Moisture will cause seed to stick and jam equipment, mold, rot, and/or germinate. Equipment left in direct sun can heat up seed boxes and kill live seed. When possible, seed boxes should be run until empty at the end of the day and refilled the next work day.
- Optimal tractor speed is between 4-6 miles/hr but may be adjusted based on field performance. Tractor speed should at no time exceed 8 mph.
- A cover crop of Annual Ryegrass (*Lolium multiflorum*) will be added at a rate of 60lbs/ac to upland and mesic areas that have sparse vegetation or need additional stabilization. It is important that sufficient vegetation is present when natives germinate to act as a nurse crop while the slow growing native perennials develop. Cover crop can be added to the grain box of the seed drill and installed at the same time as native seed.
- Native seed for each zone will be overlapped by 8 feet or one width of the tractor to blend transitions between vegetation types.

- **Forested wetland**
  Forested wetland units have significant woody debris as well as many live trees and shrubs that make access with machinery and mechanical seeding difficult and ineffective. Therefore, hand seeding of these areas in the late winter over existing snow cover is the best option. Dormant native seed is broadcast throughout the forested wetlands onto fresh, fluffy snow or prior to a snowfall event to prevent birds from eating the seed. The darker color of the seeds catches the sun and melts them through the snow until they eventually reach the soil surface. The snow then acts as a cover keeping them in place while freeze & thaw cycles naturally work seeds into the soil along with seeds from existing vegetation that fell the previous growing season. The freshly seeded natives will then emerge in spring with the rest of the seed bank. The forested wetland units within the project do not typically experience large scale flooding or washing so the risk of seed displacement prior to germination is low.

C. **Schedule and Milestones**

✓ Transplant Thinning	Complete – Fall 2012
✓ Mechanical Thinning	Complete – Fall 2013
Chemical Thinning	October – December 2013
Native Seeding (Wetland Enhancement)	January – June 2014
Native Seeding (Upland Enhancement)	April – June 2014
Restoration (Sand Stockpiles)	2015+
Containerized Planting	2015+

II. Upland Enhancement - 58.7 Acres

Objectives:

- Remove all woody species not associated with Pitch Pine/Scrub Oak Barrens.
- Preference for tree protection will be given to Pitch Pine over all other species.
- Achieve a stand canopy density of 20-40% for PP/SOB and 0-20% for Dry Prairie/Sand Flat.
- Achieve a shrub layer density of 15-30% for PP/SOB and DP/SF.
- Ensure a barrens soil type of mineral soil that is low in nutrients and organic matter.
- Where possible, establish habitat suitable for the breeding and nectaring of federally listed Karner Blue Butterfly (*Lycaeides melissa samuelis*).
  - >2400 stems/ac Wild Blue Lupine (*Lupinus perennis*).
  - Spring nectar species richness: 2-3
  - Summer nectar species richness: 2-4
  - Nectar species density: >50%

U1 - Scale House Wood – 2.1 acres
Stand Composition:
This mixed age stand consisted of predominately Oak and Pitch Pine. Some Black Locust, White Pine, and smaller oaks had filled in the canopy/understory. This area underwent selective thinning to remove primarily BL and WP while protecting the larger Oaks and PP. Understory shrubs and oriental bittersweet were released following thinning activity and were controlled with foliar treatments during the 2013 growing season. However, key pine barrens shrubs were missing (scrub oak, blueberry,

serviceberry, etc.) and will need to be introduced. A few remnant native barrens species have emerged from the seed bank but diversity and density is still too low to carry viable populations. A full native seed mix and additional woody shrubs are needed.

Target: Pitch Pine Scrub Oak Barrens
Current Canopy: 20-40%
Shrub Layer: 20-40% - white pine, black cherry, bittersweet
Target Flora Present: Low Density, Low Diversity
Seeding: 2014 PPSOB Mix
Planting: 2015+ Shrubs at 15/ac

U2 - Simon's Wood – 7.2 acres
Stand Composition:
This parcel was dominated by large diameter Black Locust and Black Cherry. Some Tree of Heaven was also mixed in with an understory entirely of honeysuckle. Few if any salvageable trees were present. Topsoil was stripped from the entire site to remove the organic layer and non-native seed bank. The eastern portion of the site historically was mined for soil. This former sand pit was also re-contoured to return it to a more natural grade. Woody resprouts from root fragments were controlled with foliar herbicide applications during the growing season. Virtually no other flora has emerged from the pure sand subsoil. Native flora and woody plants will be reintroduced.

Target: Pitch Pine Scrub Oak Barren
Current Canopy: 0-20%
Shrub Layer: 0-10%
Target Flora Present: Low Density, Low Diversity
Seeding: 2014 PPSOB Mix
Planting: 2015+ Trees @ 5/acre, Shrubs @ 15/acre

U3 - Ice Age Property – 5.0 acres
Stand Composition:
The majority of this parcel was cleared during Phase II for use as a sand stockpile area. Clearing did not occur all of the way to the wetland boundaries. Poplar, White Pine, and other undesirable trees will be treated during Drill & Fill work in 2013. Restoration of this area will not take place for a number of years.

Target: Pitch Pine/Scrub Oak Barrens
Current Canopy: 0-20% - unit edges
Shrub Layer: 0-20% - unit edges
Target Flora present: N/A
Seeding: 2015+ PPSOB Mix, Mesic Meadow Mix
Planting: 2015+ Trees @ 5/acre, Shrubs @ 15/acre

U4 - French Quarter – 4.4 acres
Stand Composition:
Poplar and Honeysuckle dominated this even aged parcel with a few Red Maples to be found on the edges. The area is low and floods occasionally. West of the power-line right of way is a scrub/shrub area that will be preserved as an important bird area. A French drain resides at the bend of Rapp Rd which floods the corner during extended rain events. Topsoil was stripped to remove the seed bank and the area was used as a sand stockpile location. In the future when the stockpile is removed for

placement on the landfill, some of the material may be left in place to preserve an upland condition. Additional contouring would redirect surface runoff away from the road to help mitigate the periodic flooding issue. A mesic seed mix may be needed near edges of this unit where it borders wetland areas.

Target: Sand Storage to Pitch Pine Scrub Oak Barrens
Current Canopy: 0%
Shrub Layer: 0%
Target Flora Present: N/A
Seeding: 2015+ PPSOB Mix, Mesic Meadow Mix
Planting: 2015+ Trees @ 5/acre, Shrubs @ 15/acre

U5 - Horse Farm Dune – 4.6 acres
Stand Composition:
This area includes a nice Pitch Pine/Oak covered dune overlooking some lower areas to the south. Two oak covered ridges extend into the surrounding wetland from here. Red Maple, Poplar, and Black Cherry have invaded the stand and removed through selective thinning. All areas were thinned and grubbed with the exception of the Oak ridges to the southwest. The saddle between the PPSO dune and the Oak ridge is mesic to wet mesic and will be planted to meadow rather than PPSOB. Few native plants have emerged from the seed bank following release and additional seeding/planting is required.

Target: Pitch Pine Scrub Oak Barrens, Mesic Meadow
Current Canopy: 20-40%
Shrub Layer: 0-20%
Target Flora Present: Low Density, Low Diversity
Seeding: 2014 PPSOB Mix, Mesic Meadow Mix
Planting: 2015+ Shrubs at 15/ac

U6 - Horse Farm – 3.7 acres
Stand Composition:
Trees and topsoil have been previously stripped. The site is currently being used for sand storage.

Target: Pitch Pine Scrub Oak Barrens
Current Canopy: 0-10% - unit edges
Shrub Layer: 0-10% - unit edges
Target Flora Present: N/A
Seeding: 2015+ PPSOB Mix
Planting: 2015+ Containerized trees/shrubs

U7 - Oak Knob – 3.4 acres
Stand Composition:
This stand contains a small mound of Oaks that sits in the middle of a low lying area dotted with vernal pools. The heterogeneity between mesic and wetland pockets makes the area difficult to typify. The stand varies widely between Red Oak, Red Maple, Elm, Ash, Cherry, Birch, and Musclewood. Spicebush and Witch Hazel are also scattered throughout. The new route for the primary stream channel now passes directly to the west of this stand and it is difficult to tell what impacts recent construction may have on the hydrology of this area. Well defined upland areas along the northern and southern boundaries were selectively thinned while protecting the lower area in the middle of this unit. A mesic meadow mix will be used in border areas that will not support a long term population of lupine.

Target: Pitch Pine Scrub Oak Barrens, Vernal Pockets
Current Canopy: 60-80%
Shrub Layer: 0-10%
Target Flora Present: Low Density, Low Diversity
Seeding: 2014 PPSOB Mix, Mesic Meadow Mix
Planting: 2015+ Shrubs @ 15/acre

U8 - Rapp Farm – 4.1 acres
Stand Composition:
The Rapp farm was previously cleared and stripped of topsoil. It is currently in use for sand storage. Some drill and fill herbicide treatments will be used to remove undesired woody vegetation from the edges of the parcel.

Target: Pitch Pine Scrub Oak Barrens
Current Canopy: 0-10% - unit edges
Shrub Layer: 0-10% - unit edges
Target Flora Present: N/A
Seeding: 2015+ PPSOB Mix
Planting: 2015+ Trees @ 5/acre, Shrubs @ 15/acre

U9 - Farm Pond – 5.4 acres
Stand Composition:
Large Oaks and White Pines dominate this upland hill set above an old dug pond. The canopy is high with an open understory. Large White Pines were carefully removed from in-between the old oaks. Some native graminoids have emerged on the western side of the unit but a complete native component will be needed to establish quality KBB habitat. Few native shrubs are present and some additional planting will also be required. Reconstructing the northern stream channel to its western drainage basin has produced some wetting up effects in the historic riparian corridor adjacent the stream in W2. A mesic native seed mix will be used in some parts of U9 adjacent the stream in W2.

Target: Pitch Pine Scrub Oak Barrens
Current Canopy: 20-50%
Shrub Layer: 0-10%
Target Flora Present: Low Density, Low Diversity
Seeding: 2014 PPSOB Mix, Mesic Meadow Mix, possible Pond seeding
Planting: 2015+ Shrubs @ 15/acre

U10 - Fox Ridge – 1.6 acres
Stand Composition:
This dune occupies the utility ROW that runs from Whitestone Road to the corner of the landfill expansion area. It contains several large oaks but was overgrown with younger oaks due to fire suppression. Now that thinning is complete, this unit will create an area of mature savannah at the beginning of an important linkage between the young PPSOB in Phase II and the remnant areas near the former Rapp Farm (U9, U11, and U13).

Target: Pitch Pine Scrub Oak Barrens
Current Canopy: 20-40%
Shrub Layer: 0-10% - shrubs in ROW
Target Flora Present: Low Density, Low Diversity

Seeding: 2014 PPSOB, Mesic Meadow Mix
Planting: 2015+ Shrubs @ 15/acre

U11 - Red Cedar Prairie – 2.6 acres
Stand Composition:
This remnant prairie needs very little attention beyond Rx fire treatment and thinning of some encroaching Oaks/Poplar/White Pine saplings near the edges. PPSOB is represented in the southern portion which turns to mesic meadow between the ditch and the northern dune. Enhancement will focus on PPSOB areas only. The saplings were removed in 2013 and native seeding of the upland is all that remains to turn this unit into flourishing PPSOB.

Target: Pitch Pine Scrub Oak Barrens to Mesic Meadow
Current Canopy: 0-10%
Shrub Layer: 10 - 20%
Target Flora Present: Key species present, needs lupine & nectar plants
Seeding: 2014 PPSOB Enhancement Mix, Mesic Meadow Mix
Planting: N/A

U12 - Tractor Path – 2.1 acres
Stand Composition:
Poplar comprised most of this stand with scattered Cherry and Red Pine. A few young Oaks and pitch pine were saved. This parcel will serve as a connection to the Phase II restoration areas. Little PPSOB species were observed establishing from the seed bank in 2013. Reconstructing the northern stream channel to its western drainage basin has produced some wetting up effects in the historic riparian corridor adjacent the stream in W2. These historic hydric soils have now flourished with native species left in the seed bank. A mesic meadow mix is most appropriate for this area.

Target: Pitch Pine Scrub Oak Barrens
Current Canopy: 0-10%
Shrub Layer: 0-40% - poplar saplings
Target Flora Present: Low Density, Low Diversity

Seeding: 2014 PPSOB Mix, Mesic Meadow Mix
Planting: 2015+ Trees @ 5/acre, Shrubs @ 15/acre

U13 - Whitestone Dune – 3.8 acres
Stand Composition:
The dune and roadside are a nice mix of Oaks, Pitch Pine, and scrub oaks. A power-line ROW follows the roadside and contributes an open scrub/shrub area. Some Poplar, White Pine, and Cherry have been thinned to open up the canopy. The western portion rolls off to a drainage ditch and turns to Red Maple and Poplar. Many quality PPSOB species are present and only a lupine/nectar mix need be added east of the drainage ditch. A mesic meadow seed mix is most appropriate for wetter areas that border the drainage ditch and W3.

Target: Pitch Pine Scrub Oak Barrens
Current Canopy: 30-50%
Shrub Layer: 0-40% - heavy shrub component along ROW
Target Flora Present: Key species present, needs lupine & nectar plants
Seeding: 2014 PPSOB Enhancement Mix, PPSOB Mix, Mesic Meadow Mix
Planting: N/A

U14 - Ni-Mo Hill – 1.5 acres
Stand Composition:
This is a closed canopy stand of medium sized oaks. Very few undesirable trees are present for thinning and the value of the area as a connective corridor is low. No thinning prescriptions are recommended for this area.

Target: Pitch Pine/Oak Forest
Current Canopy: 80-100%
Expected Canopy: 80-100%
Seeding: N/A
Planting: N/A
Plugging: N/A

U15 – Spadefoot Dune – 4.3 acres
Stand Composition:
The northern side of the dune is similar in composition to U14 with many large Oaks and Pitch Pine. Oaks and undesirable species on the dune were removed to release the remaining Pitch Pine present. This dune opens up on the southern side to quality sand flats and scrub oak barrens that extend to the large white oak at the edge of the Phase II vernal pond. The Spadefoot gray birch vernal pool and dense saplings throughout the area were thinned out in the fall of 2012. West of the access road and the southern landing area will need a full PPSOB mix to fully restore the appropriate community but the high quality upland area between the spade foot vernal pond and the PII created vernal pond only needs lupine and other nectar species.

Target: Pitch Pine Scrub Oak Barrens
Current Canopy: 0-40%
Shrub Layer: 0-40%
Target Flora Present: Some high quality areas, some low density/low diversity
Seeding: 2014 PPSOB Mix, PPSOB Enhancement Mix**,** Mesic Meadow Mix
Planting: N/A

U16 - Indian Point – 2.9 acres
Stand Composition:
This hill separates the P4 mitigation pond from the Phase II vernal pond and is a key piece in creating a corridor for Karner Blue through the Phase II restoration area. The stand is almost entirely oaks with a high closed canopy and open understory. Selective thinning has opened the canopy and released a dozen pitch pine that were almost entirely choked out on the western side of the unit. Some native flora was released after thinning but little to no nectar species are present.

Target: Pitch Pine Scrub Oak Barrens
Current Canopy: 20-40%
Shrub Layer: 0-20%
Target Flora Present: Low Density, Low Diversity
Seeding: 2014 PPSOB Mix
Planting: 2015+ Shrubs @ 15/acre

III. Wetland Enhancement - 29.6 Acres

Objectives:

- Utilize the Phase II log vane stream structures to flood ceramic drain tiles in W1 and restore hydrology to existing muck soils.
- Increase diversity of forbs and graminoid species in all wetland areas.
- Treat Quaking Aspen, Big Tooth Aspen, and Eastern Cottonwood (*Populus* spp) to:
    - Reduce colonization of uplands.
    - Thin overstory/understory to promote diversity of species and microclimates.
    - Open forested wetland areas to allow for dispersal of KBB.

Methods: Scheduled for 2013. See narrative regarding *Populus* species in section A.2 of Attachment G – Invasive Plant Management.

W1 - Ice Age Forest – 15.4 acres
Classification: Forested Wetland (Degraded Red Maple Swamp)
Composition: Medium sized Red Maples are distributed throughout the dark muck soils of this previously dewatered wetland. Drain tiles have allowed Poplars, Cottonwoods, and Honeysuckle to move into the area. The species diversity of the herbaceous layer has also declined as a result of the altered water table. Honeysuckle and other woody invasive species were removed in the winter of 2010-11 and will continue to be monitored for treatment. The installation of log vanes in the channelized streambed during Phase II is designed to rewet the area and restore the hydrology. Enhancement seeding throughout the parcel will also help to jumpstart the rejuvenation process. In addition, the treatment of Populus spp. will promote replacement from existing Red Maple saplings and create a mottled shade that will further enhance forb and graminoid diversity.

Target: Forested Wetland (Red Maple Swamp)
Methods: Drill and fill herbicide application
Current Canopy: 60-80%
Expected Canopy: 40-80%
Seeding: 2014 Forested Wetland Enhancement Mix

W2 – Northern Stream Corridor – 3.0 acres
Classification: Forested Wetland (Red Maple Swamp)
Composition: This long, narrow corridor contained the remnant of a historic seasonal stream and its associated wetland pockets that served as a tributary to Lake Rensselaer. Human development had severed the stream from its upstream watershed on the western side of the Fox Run trailer park. The change in hydrology has since allowed upland trees and forbs to encroach into the former wetlands. Many aspen and cherry now occupy the canopy and understory. Phase II wetland mitigation work reconnected the stream to the western wetlands and has restored the hydrology to the wetland system in W2. In some cases this increased hydrology has even extended into areas previously thought to be upland. The existence of hydric soil and re-emergence of wetland flora from the seed bank suggests these too were part of the original wetland complex. Chemical thinning of the invading upland trees and reintroduction of lost wetland species will bring this stream corridor back to its former glory.

Target: Forested Wetland (Red Maple Swamp)
Methods: Drill and fill herbicide application
Current Canopy: 40-80%

Expected Canopy: 40-60%
Seeding: 2014 Wetland Enhancement Mix

W3 - Farm Pond Corridor – 2.5 acres
Classification: Forested Wetland (Degraded Red Maple Swamp)
Composition: This Red Maple swamp was fed by storm water from the former Fox Run trailer park and the railroad bed across Whitestone Road. A shallow ditch directs water from this wetland off of the property to the east and eventually connects with the Farm Pond behind the Rapp Farm stockpile area (U9). Removal of the storm water system from Fox Run may alter this area but a small grade control structure in the ditch could offset the difference. The herbaceous layer is reasonably diverse and all woody invasive species were removed in 2010-11. Some aspen and cottonwood has moved into the area and will be treated as part of the enhancement process.

Target: Forested Wetland (Red Maple Swamp)
Methods: Drill and fill herbicide application
Current Canopy: 20-100%
Expected Canopy: 20-80%
Seeding: 2014 Forested Wetland Enhancement Mix

W4 - Fox Run Forest – 1.9 acres
Classification: Forested Wetland (Degraded Red Maple Swamp)
Composition: Mature Red Maple dominates this stand. Few if any poplars are present for removal. Woody Invasive species were removed in the winter of 2010-11.

Target: Forested Wetland (Red Maple Swamp)
Methods: Drill and fill herbicide application
Current Canopy: 80-100%

Expected Canopy: 80-100%
Seeding: 2014 Forested Wetland Enhancement Mix

W5 - Champion Oak Meadow – 2.3 acres
Classification: Degraded Wet Meadow
Composition: The majority of this parcel is without tree cover in the form of two weedy fields divided by a stand of Aspen. This corridor connects with the created sedge meadow in Phase II which is underrepresented in the Albany Pine Bush. Treatment of poplars will reconnect these two areas while interseeding this section with a nice mix will create one large and contiguous sedge meadow.

Target: Sedge Meadow/Wet Meadow
Methods: Drill and fill herbicide application
Current Canopy: 0-80%
Expected Canopy: 0-20%
Seeding: 2014 Wet Meadow Enhancement Mix

W6 - Azalea Swamp East – 2.1 acres
Classification: Forested Wetland (Red Maple Swamp)
Composition: A nice mix of Oaks and Red Maples are spread throughout this hummocky vernal pool area. A few poplars may be found along the edges but very little needs to be done in this area.

Target: Forested Wetland (Red Maple Swamp)
Methods: Drill and fill herbicide application
Current Canopy: 80-100%
Expected Canopy: 80-100%
Seeding: 2014 Forested Wetland Enhancement Mix

W7 - Azalea Swamp West – 1.4 acres
Classification: Forested Wetland (Red Maple/Gray Birch Swamp)
Composition: A decent sized Gray Birch swamp transitions into Red Maple. Poplars have spread profusely through the Gray Birch area. Treatment of these to open up the area again will help to reinvigorate the Birches. Birches will be cut and removed but stumps left in place untreated.

Target: Forested Wetland, Wet Meadow
Methods: Drill and fill herbicide application
Current Canopy: 80-100%
Expected Canopy: 40-60%
Seeding: 2014 Forested Wetland Enhancement Mix

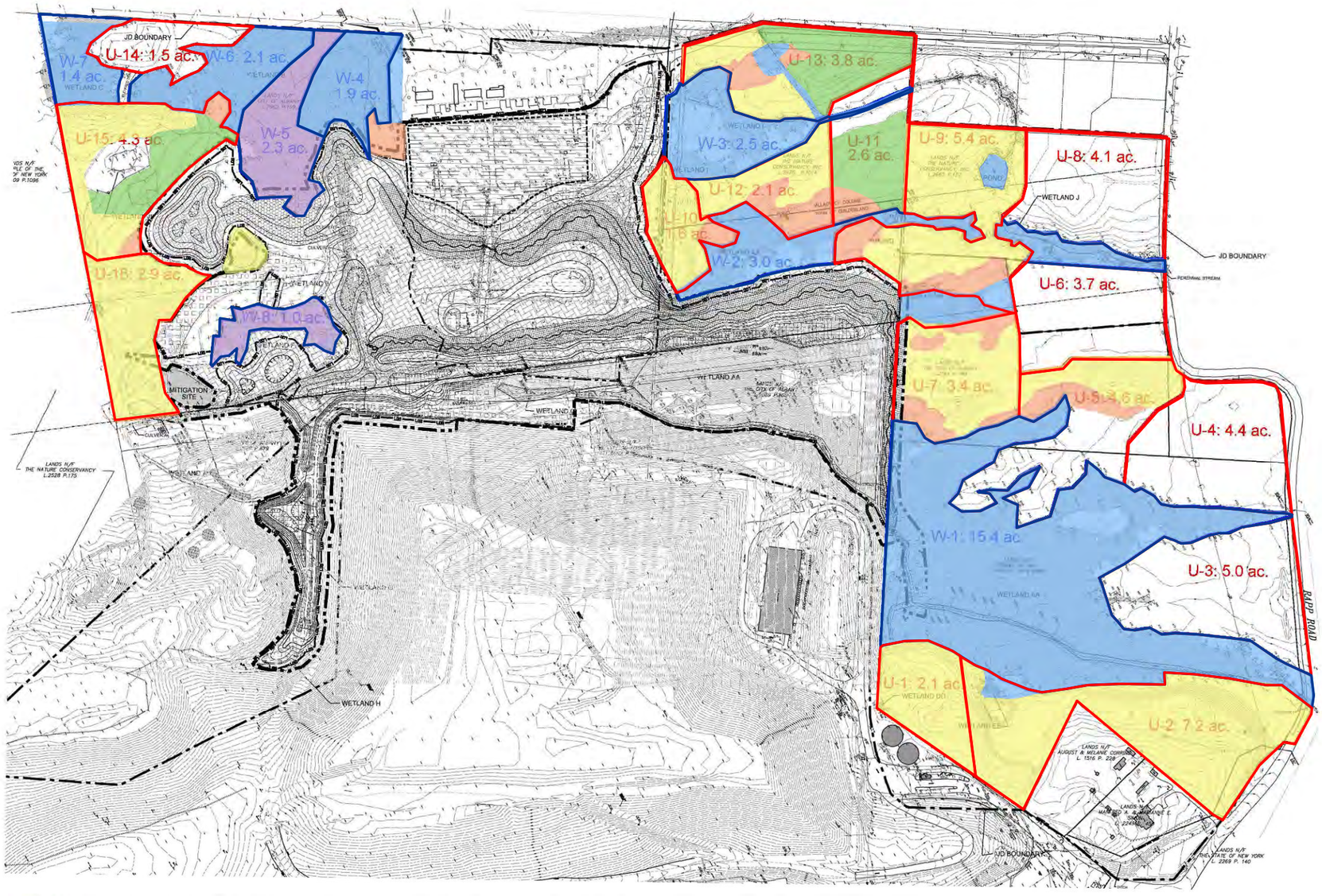
W8 – PC Wetland – 1.0 acres
Classification: Forested Wetland (Degraded Red Maple Swamp)
Composition: The area was protected during Phase II construction and was covered with Phragmites. Subsequent control efforts have eliminated several other invasives and seeding is all that is required.

Target: Forested Wetland (Red Maple Swamp)/Sedge Meadow
Methods: Invasives control/site prep
Current Canopy: 10-40%
Expected Canopy: 10-40%
Seeding: 2014 Wet Meadow Enhancement Mix

Phase III Enhancement Seeding

Albany Rapp Road Landfill
Albany, NY

City of Albany
One Conners Blvd.
Albany, New York



Phase III Project Areas
- Upland Units
- Wetland Units

Phase III Enhancement Seeding*

- Forested Wetland Enhancement Mix (28.08 Acres)
- Mesic Meadow Enhancement Mix (4.52 Acres)
- PPSOB Enhancement Mix (4.62 Acres)
- PPSOB Mix (26.37 Acres)
- Wet Meadow Enhancement Mix (3.36 Acres)

* Seeding areas are estimated and have not been surveyed with GPS.

N

0 200 400 800 Feet

1 inch = 400 feet when printed on 11x17

Coordinate System:
NY State Plane East

AES Project #: 09-0636

Seeding_Plan_20130830.mxd

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www.appliedeco.com

Last modified:
Aug 30, 2013
Mapped by: mlb

Table 1. PIII Enhancement Mixes

PPSOB (26.37 ac)				Ratio	37:63	Rate	12.0217	lbs/ac
Grasses, sedges, etc.	**Grasses**	**Matrix**	**Commercially Available**	**KBB Nectar**			**Seeding Rate**	
Botanical Name	**Common Name**				**oz**	**oz/ac**	**lbs/ac**	
Andropogon gerardi	Big bluestem grass	x			118.35	4.5000	0.2813	
Carex foenea	Dryspike sedge				0.11	0.0040	0.0003	
Carex pennsylvanica	Penn sedge				78.9	3.0000	0.1875	
Carex swanii	Swan's sedge				105.2	4.0000	0.2500	
Cyperus houghtonii	Houghton's sedge				26.3	1.0000	0.0625	
Cyperus schweinitzii	Schweinitz's sedge				13.15	0.5000	0.0313	
Danthonia spicata	Poverty-grass				19.725	0.7500	0.0469	
Leptoloma cognatum	False witch grass				9.205	0.3500	0.0219	
Panicum acuminatum	Western panic grass				118.35	4.5000	0.2813	
Panicum capillare	Witch grass				39.45	1.5000	0.0938	
Panicum linearifolium	Slender-leaved panic grass				210.4	8.0000	0.5000	
Schizachyrium scoparium	Little bluestem grass	x	x		1052	40.0000	2.5000	
Sorghastrum nutans	Indian grass	x			105.2	4.0000	0.2500	
					1896.34	**72.1042**	**4.5065**	
						37.49%	**of Mix**	
Forbs	**Forbs**							
Botanical Name	**Common Name**				**oz**	**oz/ac**	**lbs/ac**	
Ageratina altissima	White Snakeroot				92.05	3.5000	0.2188	
Anaphalis margaritacea	Pearly everlasting				0.63909	0.0243	0.0015	
Anemone cylindrica	Thimbleweed			1	9.5995	0.3650	0.0228	
Anemone virginiana	Thimbleweed			1	16.24551	0.6177	0.0386	
Apocynum androsaemifolium	Spreading dogbane			2	0.63909	0.0243	0.0015	
Aquilegia canadensis	Columbine				8.07936	0.3072	0.0192	
Arabis glabra	Tower mustard				13.15	0.5000	0.0313	
Asclepias syriaca	Common milkweed			2	131.5	5.0000	0.3125	

Asclepias tuberosa	Butterfly milkweed			2	26.63138	1.0126	0.0633	
Aster cordifolius	Blue wood aster				39.45	1.5000	0.0938	
Aster ericoides	Heath aster				65.75	2.5000	0.1563	
Aster laevis	Smooth blue aster	x	x		39.45	1.5000	0.0938	
Aster linearifolius	Flax-leaved aster	x			78.9	3.0000	0.1875	
Aster pilosus	Frost aster				13.15	0.5000	0.0313	
Aureolaria flava	Yellow false foxglove			2	7.101	0.2700	0.0169	
Campanula rotundifolia	Harebell			2	0.02893	0.0011	0.0001	
Ceanothus americanus	New Jersey tea	x		1,2	317.9118	12.0879	0.7555	
Clematis virginiana	Virgin's bower				11.19854	0.4258	0.0266	
Comandra umbellata	Bastard-toadflax			1	43.43971	1.6517	0.1032	
Desmodium canadense	Showy tick trefoil				6.575	0.2500	0.0156	
Desmodium nudiflorum	Naked flower tick trefoil				29.76108	1.1316	0.0707	
Diodia teres seteria	Poor joe				121.506	4.6200	0.2888	
Eupatorium sessilifolium	Upland boneset				33.664	1.2800	0.0800	
Helianthemum bicknellii	Bicknell's frostweed				6.71965	0.2555	0.0160	
Helianthemum canadense	Longbranch frostweed			1,2	12.77128	0.4856	0.0304	
Helianthus divaricatus	Woodland sunflower			2	91.47403	3.4781	0.2174	
Helianthus strumosus	Wood-sunflower			2	20.76385	0.7895	0.0493	
Houstonia caerulea	Azure bluets			1	0.39976	0.0152	0.0010	
Krigia virginica	Dwarf dandelion			1	0.31823	0.0121	0.0008	
Lespedeza capitata	Round-headed bush clover	x	x	2	263	10.0000	0.6250	
Lespedeza hirta	Hairy bush clover				5.11798	0.1946	0.0122	
Lupinus perennis	Wild lupine	x		1,2	949.5194	36.1034	2.2565	
Melampyrum lineare	Cow wheat				6.59341	0.2507	0.0157	
Monarda fistulosa	Wild bergamot	x		2	112.8112	4.2894	0.2681	
Monarda punctata	Dotted horsemint	x	x	2	92.05	3.5000	0.2188	
Oenothera biennis	Common evening primrose			2	13.15	0.5000	0.0313	
Penstemon digitalis	Beardtongue				52.6	2.0000	0.1250	
Penstemon hirsutus	Hairy beardtongue				7.89789	0.3003	0.0188	
Potentilla arguta	Prairie cinquefoil			1	0.263	0.0100	0.0006	
Potentilla canadensis	Canadian cinquefoil			1	2.55899	0.0973	0.0061	
Pseudognaphalium obtusifolium	Rabbit tobacco			2	51.82678	1.9706	0.1232	

Pycnanthemum tenuifolium	Narrow-leaved mountain mint			2	92.05	3.5000	0.2188	
Rosa carolina	Carolina rose				11.4405	0.4350	0.0272	
Rubus flagellaris	Dewberry			1	5.26	0.2000	0.0125	
Rudbeckia hirta	Black-eyed Susan	x		2	19.725	0.7500	0.0469	
Sisyrinchium montanum	Blue eyed grass				0.31823	0.0121	0.0008	
Solidago bicolor	Silverrod				7.99783	0.3041	0.0190	
Solidago hispida	Hairy goldenrod				1.01781	0.0387	0.0024	
Solidago juncea	Early goldenrod			2	105.2	4.0000	0.2500	
Solidago nemoralis	Old-field goldenrod				83.2921	3.1670	0.1979	
Solidago rugosa	Rough-stemmed goldenrod				19.61454	0.7458	0.0466	
Tephrosia virginiana	Goat's Rue	x		1	13.31569	0.5063	0.0316	
Thalictrum revolutum	Skunk Meadow rue				2.79832	0.1064	0.0067	
Trichostemum dichotomum	Blue curls				16.9372	0.6440	0.0403	
Tuecrium canadense	Germander				78.9	3.0000	0.1875	
Viola sagittata	Arrowleaf violet			1	0.31823	0.0121	0.0008	
					3162.391	**120.2430**	**7.5152**	
						62.51%	**of Mix**	
PPSOB Enhancement (4.62 ac)				**Ratio**	**5:95**	**Rate**	**5.1123**	**lbs/ac**
Grasses, sedges, etc.		**Matrix**	**Commercially Available**	**KBB Nectar**			**Seeding Rate**	
Botanical Name	**Common Name**				**oz**	**oz/ac**	**lbs/ac**	
Carex swannii	Swan's sedge				9.24	2	0.125	
Danthonia spicata	Poverty grass				3.465	0.75	0.046875	
Panicum linearifolium	Slender leaved panic grass				9.24	2	0.125	
					21.945	**4.7500**	**0.2969**	
						5.81%	**of Mix**	
Forbs								
Botanical Name	**Common Name**				**oz**	**oz/ac**	**lbs/ac**	
Anemone virginiana	Thimbleweed			1	2.853774	0.6177	0.0386	
Asclepias syriaca	Common milkweed			2	4.62	1.0000	0.0625	
Asclepias tuberosa	Butterfly weed	x		2	4.678212	1.0126	0.0633	

Aster linearifolius	Stiff aster				11.55	2.5000	0.1563	
Aureolaria flava	Yellow false foxglove			2	1.216446	0.2633	0.0165	
Ceanothus americanus	New jersey tea	x		1,2	55.8461	12.0879	0.7555	
Commandra umbellata	Bastard toadflax			1	7.438662	1.6101	0.1006	
Helianthemum canadense	Longbranch frostweed			1,2	2.187108	0.4734	0.0296	
Helianthus divaricatus	Woodland sunflower			2	15.015	3.2500	0.2031	
Helianthus strumosus	Woodland sunflower			2	3.555552	0.7696	0.0481	
Lespedeza capitata	Round-headed bush clover	x	x	2	23.1	5.0000	0.3125	
Lupinus perennis	Wild lupine	x		1,2	166.7977	36.1034	2.2565	
Melampyrum lineare	Cow wheat				1.404942	0.3041	0.0190	
Monarda fistulosa	Wild bergamot	x		2	18.9882	4.1100	0.2569	
Monarda punctata	Horse mint	x	x	2	11.55	2.5000	0.1563	
Potentilla arguta	Prairie cinquefoil			1	0.055902	0.0121	0.0008	
Pseudognaphalium obtusifolium	Rabbit tobacco			2	9.216438	1.9949	0.1247	
Solidago nemoralis	Old field goldenrod				15.34533	3.3215	0.2076	
Tephrosia virginiana	Goat's Rue			1	0.491568	0.1064	0.0067	
Trichostema dichotomum	Blue curls				2.900436	0.6278	0.0392	
					355.9576	**77.0471**	**4.8154**	
						94.19%	**of Mix**	
Mesic Meadow (4.52 ac)				**Ratio**	**35:65**	**Rate**	**8.3673**	**lbs/ac**
Grasses, sedges, etc.		**Matrix**	**Commercially Available**	**KBB Nectar**			**Seeding Rate**	
Botanical Name	**Common Name**				**oz**	**oz/ac**	**lbs/ac**	
Bromus kalmii	Wild chess				12.14976	2.688	0.168	
Elymus hystrix	Bottlebrush grass				49.60519	10.9746	0.685913	
Panicum clandestinum	Dear tongue				41.91984	9.2743	0.579644	
Schizachyrium scoparium	Little bluestem		x		67.8	15	0.9375	
Sorghastrum nutans	Indian grass				18.08	4	0.25	
					189.5548	**41.9369**	**2.6211**	
						31.33%	**of Mix**	

Forbs								
Botanical Name	**Common Name**				**oz**	**oz/ac**	**lbs/ac**	
Actaea pachypoda	White baneberry				0.999824	0.2212	0.013825	
Actea rubra	Red baneberry				0.949652	0.2101	0.013131	
Ageratina altissima	White snakeroot				45.2	10.0000	0.625	
Agrimonia parviflora	Agrimony				2.5199	0.5575	0.0348	
Aster lateriflorus	Calico aster				5.759836	1.2743	0.0796	
Aster pilosus	Frost aster				13.56	3.0000	0.1875	
Aster puniceus	Swamp aster				18.23956	4.0353	0.252206	
Cimicifuga racemosa	Black snakeroot				6.699996	1.4823	0.092644	
Eupatorium maculatum	Spotted Joe Pye weed				45.2	10.0000	0.625	
Geranium maculatum	Wild geranium			1	1.599628	0.3539	0.022119	
Lobelia inflata	Indian tobacco				3.839966	0.8496	0.0531	
Maianthemum racemosum	False solomon seal			1	5.57994	1.2345	0.077156	
Osmorrhiza claytonii	Sweet cicely				6.599652	1.4601	0.091256	
Penstemon digitalis	Beardtongue				54.24	12.0000	0.75	
Pycnanthemum tenuifolium	Mountain mint			2	15.06652	3.3333	0.208331	
Rudbeckia hirta	Black eyed susan			2	13.56	3.0000	0.1875	
Rudbeckia laciniata	Cutleaf coneflower				0.319564	0.0707	0.004419	
Solidago gigantea	Giant goldenrod				22.6	5.0000	0.3125	
Solidago graminifolia	Old field goldenrod			2	47.46	10.5000	0.65625	
Solidago juncea	Early goldenrod				22.6	5.0000	0.3125	
Solidago rugosa	Rough goldenrod				3.371016	0.7458	0.046613	
Spiraea tomentosa	Steeplebush			2	22.6	5.0000	0.3125	
Teucrium canadense	Germander				45.2	10.0000	0.625	
Tradescantia ohiensis	Spiderwort				12.79974	2.8318	0.176988	
Verbena hastata	Swamp verbena				30.284	6.7000	0.41875	
					415.565	**91.9392**	**5.7462**	
						68.67%	**of Mix**	

Wet Meadow (3.36 ac)				Ratio	60:40	Rate	14.2329	lbs/ac
Grasses, sedges, etc.		**Matrix**	**Commercially Available**	**KBB Nectar**			**Seeding Rate**	
Botanical Name	**Common Name**				**oz**	**oz/ac**	**lbs/ac**	
Carex annectens	Yellow fruit sedge				15.99998	4.7619	0.2976	
Carex comosa	Bottlebrush sedge				29.33347	8.7302	0.5456	
Carex crinita	Fringed sedge				11.83997	3.5238	0.2202	
Carex flava	Yellow spike				16.31986	4.8571	0.3036	
Carex hystericina	Porcupine sedge				67.2	20.0000	1.2500	
Carex lacustris	Lake sedge				11.19989	3.3333	0.2083	
Carex lupulina	Hop sedge				33.27979	9.9047	0.6190	
Carex scoparia	Broom sedge				67.2	20.0000	1.2500	
Carex vulpinoidea	Fox sedge				67.2	20.0000	1.2500	
Eleocharis obtusa	Spike rush				0.0672	0.0200	0.0013	
Elymus hystrix	Bottlebrush grass				28.31472	8.427	0.5267	
Glyceria canadensis	Rattlesnake grass				25.81992	7.6845	0.4803	
Glyceria grandis	American mannagrass				33.6	10.0000	0.6250	
Juncus dudleyi	Dudley's rush				0.533232	0.1587	0.0099	
Juncus effusus	Common rush				0.533232	0.1587	0.0099	
Juncus tenuis	Path rush				0.533232	0.1587	0.0099	
Leersia oryzoides	Rice cut grass				3.199728	0.9523	0.0595	
Scirpus atrovirens	Dark green bulrush				14.66674	4.3651	0.2728	
Scirpus cyperinus	wool grass				21.33331	6.3492	0.3968	
Scirpus pendulus	Nodding bulrush				21.33331	6.3492	0.3968	
Sphenopholis intermedia	Slender wedge grass				0.319872	0.0952	0.0060	
					469.8275	**139.8296**	**8.7394**	
						61.40%	**of Mix**	
Forbs								
Botanical Name	**Common Name**				**oz**	**oz/ac**	**lbs/ac**	
Epilobium coloratum	Cinnamon willow-herb				2.450784	0.7294	0.0456	
Eupatorium maculatum	Spotted Joe Pye weed				50.4	15.0000	0.9375	
Eupatorium perfoliatum	Boneset				60.48	18.0000	1.1250	

Lobelia siphilitica	Great blue lobelia				0.02856	0.0085	0.0005	
Lycopus americanus	American horehound				40.32	12.0000	0.7500	
Lysimachia ciliata	Fringed loosestrife				1.279824	0.3809	0.0238	
Penthorum sedoides	Ditch stonecrop				14.71982	4.3809	0.2738	
Solidago gigantea	Giant goldenrod				7.7868	2.3175	0.1448	
Solidago graminifolia	Old field goldenrod			2	13.44	4.0000	0.2500	
Solidago juncea	Early goldenrod				7.7868	2.3175	0.1448	
Spirea alba	White meadowsweet				20.79974	6.1904	0.3869	
Spirea tomentosa	Steeplebush			2	20.16	6	0.375	
Thalictrum pubescens	King of the meadow				8.639904	2.5714	0.160713	
Verbena hastata	Swamp verbena				40.32	12	0.75	
Verbena urticifolia	White verbena				6.72	2	0.125	
					295.3322	**87.8965**	**5.4935**	
						38.60%	**of Mix**	
Forested Wetland Enhancement (28.08 ac)				**Ratio**	**45:55**	**Rate**	**5.5683**	**lbs/ac**
Grasses, sedges, etc.	**Grasses = 8-12 lbs/acre**	**Matrix**	**Commercially Available**	**KBB Nectar**			**Seeding Rate**	
Botanical Name	Common Name				oz	oz/ac	lbs/ac	
Carex comosa	Bottlebrush sedge				23.78946	0.8466	0.0529	
Carex hystericina	Porcupine sedge				144.9595	5.1587	0.3224	
Carex scabrata	Eastern rough sedge				1.91923	0.0683	0.0043	
Carex scoparia	Broom sedge				140.5	5.0000	0.3125	
Carex squarrosa	Squarossa sedge				4.1588	0.1480	0.0093	
Carex stipata	Prickly sedge				18.87758	0.6718	0.0420	
Carex utriculata	Northeast territory sedge				4.73766	0.1686	0.0105	
Carex vulpinoidea	Fox sedge				206.7177	7.3565	0.4598	
Eleocharis obtusa	Spike rush				8.43	0.3000	0.0188	
Glyceria grandis	American mannagrass				237.119	8.4384	0.5274	
Juncus dudleyi	Dudley's rush				11.24	0.4000	0.0250	
Juncus effusus	Common rush				14.05	0.5000	0.0313	
Juncus tenuis	Path rush				2.02601	0.0721	0.0045	

Scirpus atrovirens	Dark green bulrush				162.98	5.8000	0.3625	
Scirpus cyperinus	Wool grass				56.2	2.0000	0.1250	
Scirpus pendulus	Nodding bulrush				49.06541	1.7461	0.1091	
					1086.77	**38.6751**	**2.417194**	
						43.41%	**of Mix**	
Forbs	**Forbs = 2-4 lbs/acre**							
Botanical Name	**Common Name**				**oz**	**oz/ac**	**lbs/ac**	
Ageratina altissima	White snakeroot				163.9691	5.8352	0.3647	
Arisaema triphyllum	Jack-in-the-pulpit				7.49989	0.2669	0.0167	
Boehmeria cylindrica	False nettle				43.51847	1.5487	0.0968	
Epilobium coloratum	Cinnamon willow-herb				28.1	1.0000	0.0625	
Eupatorium maculatum	Spotted Joe Pye weed				281	10.0000	0.6250	
Eupatroium perfoliatum	Boneset				281	10.0000	0.6250	
Galium palustris	Marsh bedstraw				0.63787	0.0227	0.0014	
Lycopus americanus	American horehound				16.63801	0.5921	0.0370	
Polygonum virginianum	Jumpseed				0.95821	0.0341	0.0021	
Solidago gigantea	Giant goldenrod				140.5	5.0000	0.3125	
Solidago graminifolia	Old field goldenrod			2	140.5	5.0000	0.3125	
Verbena hastata	Swamp verbena				265.7136	9.4560	0.5910	
Verbena urticifolia	White verbena				46.71906	1.6626	0.1039	
					1416.754	**41.1049**	**3.1511**	
						56.59%	**of Mix**	

Attachment I. Soil & Hydrologic Monitoring
Albany Rapp Road Landfill
Ecosystem Mitigation, Restoration & Enhancement Plan
City of Albany, New York

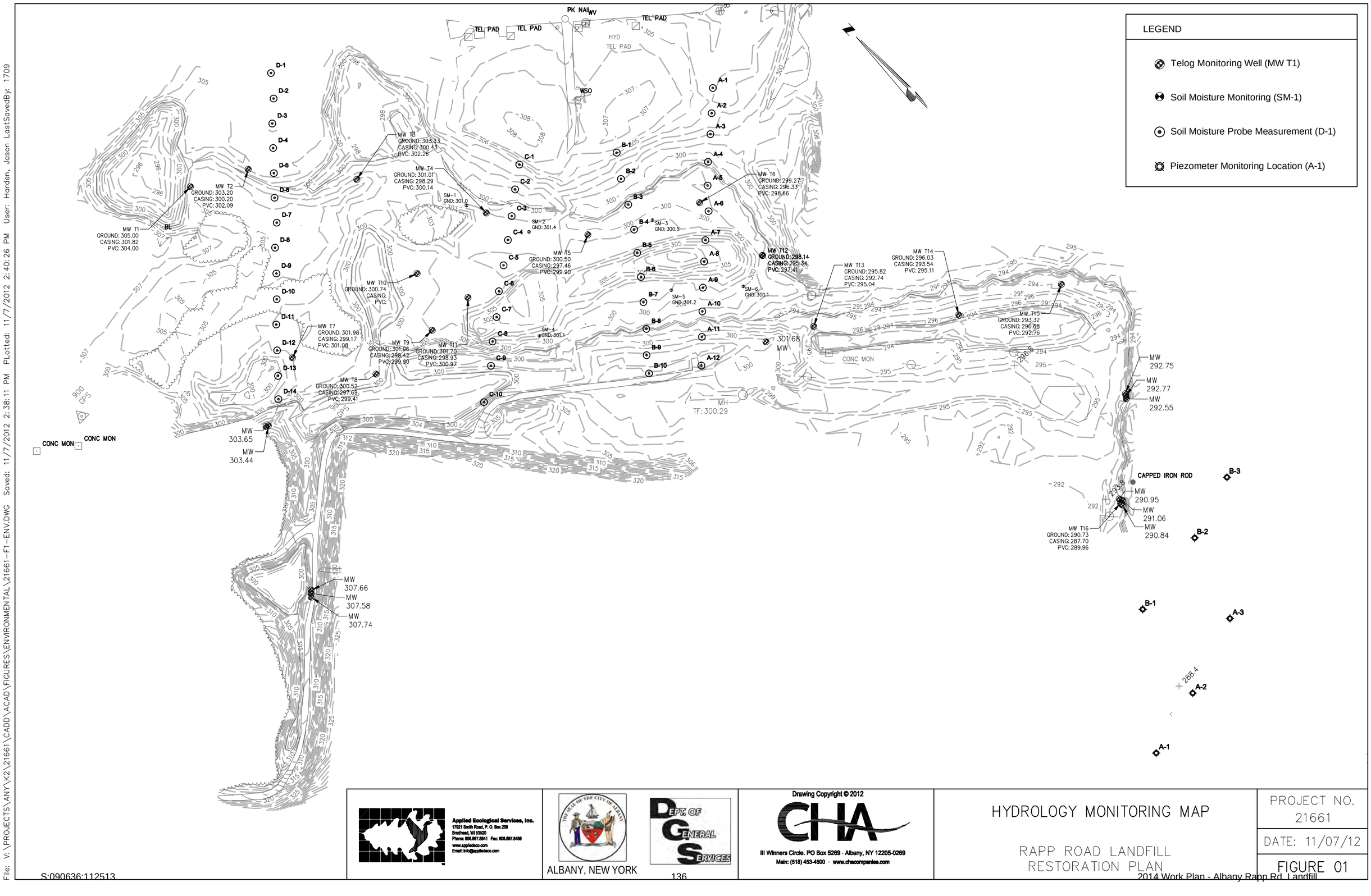
Soil sampling and laboratory analyses will be done on the Phase I and Phase II restoration areas and on the enhancement locations on an as-needed basis. Information collected will include background soil property data, pH analysis, texture, bulk density, moisture content, and other parameters that assist planning and management of the restored land.

The approved hydrologic monitoring plan is located in the "Monitoring Plan and Performance Criteria" found in Appendix 3 of the permitted restoration plan. Hydrologic monitoring of the Phase II restoration area will restart in March of 2014 and continue into mid October to coincide with the wetland vegetation growing period for the Albany, New York area. Standard procedure for shallow Telog sensors is to leave the units in the well case if extreme dry or cold conditions are not expected. All Telogs sensors in the Phase II restoration area were left in place and in March these units will be checked and calibrated as needed prior to beginning data collection for the 2014 season.

The Decagon EC-5 soil moisture sensors are subject to damage from freezing at their deployment depths of six and twelve inches below the ground surface. Therefore, these soil moisture units were removed from the six soil moisture sampling locations in November of 2013. The Decagon EC-5 soil moisture sensors will be re-installed at the 2013 locations in March of 2014 to monitor during 2014. At the end of monitoring in October or November, the soil moisture sensors will be removed and stored for re-deployment during the 2015 monitoring season.

In addition, other consultants designated by the City will measure the water level in six previously installed piezometers (A1-A3 and B1-B3) on the "Ice Age" Property at least quarterly starting in March of 2014.

Locations for six soil moisture wells and sixteen Telog wells were surveyed in 2012. Sampling locations for 2014 are shown on the accompanying hydrologic monitoring map (Figure 1).



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HYDROLOGY MONITORING MAP

RAPP ROAD LANDFILL
RESTORATION PLAN

PROJECT NO. 21661

DATE: 11/07/12

FIGURE 01

S:090636:112513

2014 Work Plan - Albany Rapp Rd. Landfill

Attachment J. Ecological Monitoring Plan
Albany Rapp Road Landfill
Ecosystem Mitigation, Restoration & Enhancement Plan
City of Albany, New York

Introduction

Ecological monitoring of vegetation and wildlife will continue in spring 2014, encompassing the Phase I test plots; Phase II constructed wetlands, streams, and uplands; and Phase III enhancement areas. The monitoring protocols and methods that will be applied to both vegetation and faunal surveys are contained in Appendix 3 of the Monitoring Plan & Performance Criteria of the Albany Rapp Road Landfill Ecosystem Mitigation, Restoration & Enhancement Plan. Vegetation and faunal surveys conducted in 2006, 2009, 2010, and 2011 have established baseline and during-construction (faunal only) conditions. Data collected during the 2012 and 2013 vegetation and faunal surveys represent the first and second years of post-construction results. These data will be combined with future data to assess restoration success and mitigation performance according to performance standards defined in the Appendix 3 Monitoring Plan & Performance Criteria.

The following faunal survey methods and scheduling used for the 2013 post-construction surveys will continue to be applied for specific Threatened & Endangered (T&E) Species. Attached map figures in this section include the Post Construction Faunal Monitoring Plan and the Phase II/III Vegetation Monitoring Map set as presented in the 2013 Compliance Report.

T&E Survey Methods

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 (see information provided in the Natural Resources Inventory Calendar with Survey Dates and Protocols at the end of this section).

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.

Butterfly Surveys

Modified transect counts using the Pollard Walk Method (1977) will be used to detect butterflies. Each survey transect will be located within areas where the presence of wild lupine or nectar plants are present and traverse a range of habitat deemed most representative of butterfly habitat.

Surveys will be conducted during optimal time and weather conditions listed below:

- Between 10 am and 5 pm
- Temperatures above 65º F
    - When temperatures are between 65-70ºF, surveys should only be conducted under mostly sunny skies (< 50% cloud cover) with calm to light wind
- Do not conduct surveys under drizzly or rainy conditions or delay survey after heavy rain until the vegetation and butterflies have had a chance to dry out.

Observers will slowly walk in a zigzag pattern along each transect stopping frequently to scan the area for movement. Vegetation will be gently prodded using a butterfly net or meter stick. All butterflies will be recorded.

If a potentially listed species is detected outside the established transect, observers will leave the transect and properly identify the species. If identification confirms a T&E or special concern (SC) species, observers will search the area for other individuals before returning to the established transect.

Time spent on each transect will be recorded to the minute. Time spent on transects during Karner blue butterfly (*Lycaeides melissa samuelis*) (KBB) surveys will be recorded to the second. Time spent outside the transect will be subtracted from transect time.

Butterflies

Species identification will be made visually, using binoculars when needed. If it is required to capture a butterfly with a net for proper identification, care should be taken to release the insect unharmed. Individuals will be recorded only once. The sex of a butterfly should be recorded during the walk if it is obvious to the observer. Karner blue butterfly nectar species should be noted when observed during Karner blue butterfly surveys.

Things to bring to the field:

Data form and pencil	GPS unit	Map
Clipboard	Hand lens	Field guides
Butterfly net	Camera	Wind & temperature meter
Specimen envelopes	Binoculars	
Storage for specimen containers (backpack, vest, etc.)		

(See survey form and reference USFWS monitoring protocols for Karner blue butterfly below)

SURVEY DATA FORM

Site Name: Albany Landfill _____ Transect ID No._____
Date: _____ Observer(s): _____
Start Time: _____ End Time: _____
Weather:
Start Temp.: _____ End Temp.: _____ %Cloud cover: _____
Start Wind: _____ End Wind: _____

Time	Species	Sex*	Notes

* if can be determined

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.

Bird Surveys

Breeding birds will be sampled as a measure of wildlife habitat quality. Bird surveys were conducted during the baseline year (2007) and again in 2009 and each year since. These surveys will continue through the monitoring and maintenance period for the restored communities. Richness (number of species of birds), breeding bird density (number of breeding pairs by species) and spatial and habitat-use affinities (mapped locations of bird use relative to habitat types) are the avian variables that will be measured. Sampling will be conducted during the period late May through late June during the breeding season. An additional sampling of bird species will occur in spring and fall/winter for detecting migratory species.

Representative study locations have been identified throughout the Property based on the complexity, patchiness, and types of avian habitat present. The study points are spaced sufficiently to ensure independence of data from other study points. Study points are illustrated on the Post Construction Faunal Monitoring Plan.

Avian surveys will use modified methods[1] designed for quantification of richness and relative abundance of bird species. At each study point birds will be surveyed daily at dawn through mid-morning over four consecutive days during summer breeding under suitable meteorological conditions. Arrival at each study point will be followed by one-to-two minutes of acclimation while data sheets are being labeled as to time, date, surveyor, study point number, and survey identification. During timed surveys (using stopwatch) the bird species heard or observed each minute will be recorded and locations mapped. Surveys will be continued until no additional species are recorded at each study point, often requiring 15-20 minutes of total survey time. Only after at least four consecutive minutes with no new-recorded species are surveys complete at each point and the survey is terminated. The modification of the Reynolds et al. (Ibid.) method is similar to the Goff's proposal for surveying plants. Additional listings of birds observed or heard in the property but not at study points will be noted while moving between study points. Identification and nomenclature for birds follows Robbins[2] and the American Ornithological Union[3].

A raw field data sheet will be entered into a database to create a list of birds as well as summary and analysis. The study will determine the breeding status of species identified during the surveys. Avian breeding status on the site will follow the criteria adopted by the New York State Department of Environmental Conservation (NYSDEC) Breeding Bird Atlas Behavioral Codes[4] . The behavior categories and breeding listed in the table below will be used in the study.

(See data form below)

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[1] Reynolds, R. T., J. M. Scott and R. A. Nussbaum. 1980. A variable circular-plot method for estimating bird numbers. Condor 82:309-313.

[2] Robbins, C. S., B. Bruun, and H. S. Zim. 1966. Birds of North America. Golden Press, Western Publishing Company, Racine, WI. 340 pp.

[3] American Ornithologists' Union. 1983. Check-list of North American Birds. 7th edition. American Ornithologists' Union, Washington, D.C. (and associated supplements)

[4] New York State Department of Environmental Conservation (NYSDEC) Breeding Bird Atlas Behavioral Codes (http://www.dec.ny.gov/animals/7308.html)

Breeding Behavior Categories and Breeding Codes

Breeding Behavior	Breeding Code	Description
Possible Breeding (PO)	X	Species observed in possible nesting habitat, but no other indication of breeding noted; singing male(s) present (or breeding calls heard) in breeding season.
Probable Breeding (PR)	S	Singing male present (or breeding calls heard).
	P	Pair observed in suitable habitat in breeding season.
	T	Bird (or pair) apparently holding territory. In addition to territorial singing, chasing of other individuals of same species often marks a territory.
	D	Courtship and display, agitated behavior or anxiety calls from adults suggesting probable presence nearby of a nest or young; well-developed brood-patch or cloacal protuberance on trapped adult. Includes copulation.
	N	Visiting probable nest site. Nest building by wrens and woodpeckers. Wrens may build many nests. Woodpeckers, although they usually drill only one nest cavity, also drill holes just for roosting.
	B	Nest building or excavation of a nest hole.
Confirmed Breeding (CO)	DD	Distraction display or injury-feigning. Agitated behavior and/or anxiety calls are Probable-D.
	UN	Used nest found. Caution: These must be carefully identified if they are to be counted as evidence. Some nests (e.g. Baltimore Oriole) are persistent and very characteristic. Most are difficult to identify correctly.
	FE	Female with egg in the oviduct (by bird bander).
	FL	Recently fledged young (including downy young of precocious species – waterfowl, shorebirds). This code should be used with caution for species such as blackbirds and swallows, which may move some distance soon after fledging. Recently fledged passerines are still dependent on their parents and are fed by them.
	ON	Adults(s) entering or leaving nest site in circumstances indicating occupied nest. NOT generally used for open nesting birds. It should be used for hole nesters only when a bird enters a hole and remains inside, makes a change-over at a hole, or leaves a hole after having been inside for some time. If you simply see a bird fly into or out of a bush or tree, and do not find nest, the correct code would be Probable-N.
	FS	Adult carrying fecal sac.
	FY	Adult(s) with food for young. Some birds (gulls, terns, and raptors) continue to feed their young long after they are fledged, and even after they have moved considerable distances. Also, some birds (e.g. terns) may carry food over long distances to their young in a neighboring block. Be especially careful on the edge of a block. Care should be taken to avoid confusion with courtship feeding (Probable-D).
	NE	Identifiable nest and eggs, bird setting on nest or egg. Identifiable eggshells found beneath nest, or identifiable dead nestling(s). If you find a cowbird egg in a nest, it is NE for Cowbird, and NE for the identified nest's owner.
	NY	Nest with young. If you find a young cowbird with other young, it is NY for cowbird and NY for identified nest owner.

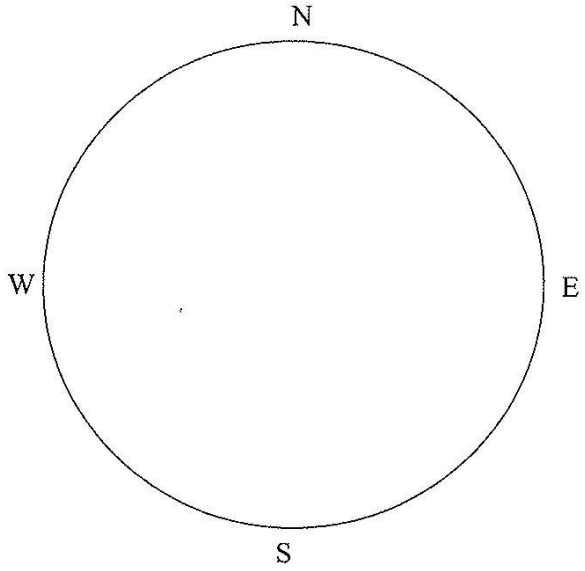
PASSERINE - Bird Point Count Data Sheet

Project Name _____ Sample Point ID # & Name _____

Date _____ Start Time _____ Stop Time _____ X coordinate, Y coordinate _____

Observer _____ Wind Spd. _____ Wind Dir. _____ Sky _____ Temp _____ Dominant (>50%) AES Habitat Type _____

Other Habitats _____



Wind	Sky	AES Habitat Type
0 = none	0 = <10% clouds	Developed
1 = 1-3mph	1 = partly cloudy	Cropland
2 = 4-7 mph	2 = mostly cloudy	Barren Land
3 = 8-12 mph	3 = overcast	Grassland
4 >12 mph	4 = rain	Upland Shrub-Scrub
	5 = fog	Upland Broadleaf Forest
Behavior		Upland Coniferous Forest
F = flying		Upland Mixed Forest
S = soaring		Wetland Forested
P = perching or on water		Wetland Shrub-Scrub
Fo = foraging		Wetland Emergent
MD = mating display		Open Water
O = other		

Notes:

Alpha Code	Behav. Code	Dir. from Point	Dist. from Point (m)	Flight Dir.	Ht. (ft or m)	0-3 min	3-5 min	5-10 min	10-15 min	15+ min	Notes

American woodcock surveys

Singing-ground surveys will be conducted according to *Protocol: Locating Woodcock Singing Ground Survey Routes* and Cooper, T.R., and K. Parker 2009[5] with the exception of a modified route. We have identified three listening point locations spaced far apart enough to cover the entire study area. These survey point locations are identified on the Post Construction Faunal Monitoring Plan as Nocturnal Bird Survey Locations. Two surveys will be conducted between April 25 and May 10 according to the preferred environmental conditions and seasonal and daily timing outlined in those documents. However, if woodcocks are detected earlier, surveys may be conducted prior to April 25. Observers will arrive to the site at or shortly after sunset. Observers will listen for two minutes at each point and will also record all birds heard as they walk and use the listening stops as reference points. Number of woodcocks heard peenting will be recorded and their approximate locations will be documented. Surveys will last no longer than 36 minutes. These surveys will only be used to document presence and approximate abundance. Population trends will not be evaluated.

(See data form below)

[5] Cooper, T. R., and K. Parker. 2009. American woodcock population status, 2009. U.S. Fish and Wildlife Service, Laurel, Maryland. 15 pp.

WOODCOCK SINGING GROUND SURVEY DATA SHEET

Location:_____

Observer:_____ Date:_____

Route No: _____ Route Name: _____

Official Sunset: _____ + 22 or 15 = Starting time: _____ End Time:_____

Circle at start:

Cloud Conditions: **Clear 25% Overcast 50% Overcast 75% Overcast >75% Overcast**

Precipitation: **None Mist Snow Light Rain Moderate Rain Heavy Rain Fog**

Temperature (F°): **<40 >40**

Fill in for each stop:

Wind: **C**alm **G**entle **L**ight **M**oderate **S**trong *Noise Disturbance*: **NO LO MOD HI**

Stop No:	Odometer	Wind	Noise Disturbance	# Males Peenting	Flights	Other:	Description of Courting Area
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
SUM							

(1) Make sure to conduct survey at proper time of day according to sky conditions
Starting Time: <75% overcast = 22 Minutes after sunset
>75% overcast = 15 Minutes after sunset
(2) Entire survey should be completed within 36 minutes
(3) Stops are at designated survey point locations; listen for exactly 2 minutes at each stop.
(4) Do not conduct survey if temperature is below 40° F (5° C), in strong wind, or in heavy precipitation.
--If possible, please designate type of clearing that is used by courting woodcock (i.e. Field, Clear-cut, Strip cut, Natural Opening, Log landing, etc.)
--Count only the number of <u>different</u> woodcock <u>heard</u> peenting at a stop.
--Record birds heard flying but not peenting in column for "Flights".
Optional: Record Owls, whip poor wills, and any other night signing birds in the "Other" column.

Whip-poor-will surveys

Surveys will be conducted according to the methodologies identified in *A Proposed Survey Methodology for Monitoring Nightjars (Caprimulgidae, Caprimulgus) in Eastern North America*[6] with the exception that we are not able to space survey points more than one mile apart to minimize the risk of double-counting individuals. Three survey point locations were located at distances sufficient to cover all areas of disturbance while trying to limit potential double-counting of individuals. Two surveys will be conducted between May 15 and June 30. However, if whip-poor-wills are detected earlier, surveys may be conducted prior to May 15. Surveys will commence during the period of maximum lunar illumination (≥ 50%) when the moon is not obscured by cloud cover (<25 %) or the horizon. Surveys will begin after the sun has set completely. There will be double-observer point counts consisting of three two-minute periods at each survey point location. At each point, two observers will independently record individual birds as detected in each interval, with a new line for each bird. The resulting data sheet will look something like this (taken directly but modified from above cited source):

(See data form below)

[6] Pamela D. Hunt. A proposed Survey Methodology for Monitoring Nightjars (Caprimulgidae, *Caprimulgus*) in Eastern North America. Audubon Society of New Hampshire.

WHIP-POOR-WILL SURVEY DATA SHEET

Location:_____

Observer:_____ Date:_____

Official Sunset: _____ Starting time: _____ End Time:_____

Circle at start:

Cloud Conditions: **Clear 25% Overcast 50% Overcast 75% Overcast >75% Overcast**

Precipitation: **None Mist Snow Light Rain Moderate Rain Heavy Rain Fog**

Temperature (F^o):

Fill in for each stop:

Wind: **C**alm **G**entle **L**ight **M**oderate **S**trong *Noise Disturbance*: **NO LO MOD HI**

		Time Period			Notes
Point	Species	1-2	3-4	5-6	
1					
2					
3					

Notes:_____
_____
_____

Reptile and Amphibian Surveys

Systematic Sampling:

Systematic sampling will continue to occur in areas that have been modified or restored. Refer to the Post Construction Faunal Monitoring Plan for the locations of the herp systematic trapping arrays.

In these areas, two systematic sampling techniques will be used to sample for herps:

1. Wooden cover boards were placed on the ground in various areas and will be checked throughout the survey periods (locations are not illustrated on the map). Cover boards consist of flat-edged rough cut lumber and scrap wood of varying dimensions.
2. Trapping arrays are composed of drift fencing (silt fencing), metal snake funnel traps and pitfall traps (5 gallon buckets) established in key areas upslope of aquatic habitats with the intent of capturing herps as they migrate to and from potential breeding, nesting or foraging areas. Timing of the trapping events will be conducted during two distinct timeframes. The first is early spring to target Ambystomatid salamanders (1 trapping week – triggered when ice begins to melt on pooled areas) and a little later in spring when frog calling/breeding activity has begun (1 trapping week). The second will be during late spring/early summer to target species such as the hognose snake (*Heterodon platithinos*) and eastern spadefoot toad (*Scaphiopus holbrookii*) (2 separate trapping weeks proposed – 1 during dry weather and 1 during major rainfall events >45 degrees Fahrenheit between March and August). Trapping arrays will be functional for 1 week (5 day) intervals with no more than 4 trapping weeks (20 days) proposed.

It is likely that other animals such as small mammals will be captured in the trapping arrays. The trapping arrays will be checked once daily before noon. All species captured will be identified, documented and released.

At each sampling station, time, air temperature, water temperature, weather, wind conditions, and investigator initials will be recorded. At the end of each trapping session, all traps will be closed or removed to prevent accidental trapping or death of animals.

Passive Searches

Passive surveys for reptiles and amphibians will occur on established transects. Observers will constantly scan the areas they are traversing for any visible reptiles and amphibians. Any potential cover object such as rocks, logs and debris will be turned over and searched. Visual and audio observations will be recorded. Stage of development will be noted. Individuals will only be recorded once.

Call surveys will be conducted for eastern spadefoot toads during and after major rainfall events >45 degrees Fahrenheit between March and August. These passive surveys will consist of listening for calling toads and looking for them in the vicinity of pooled areas. A spotlight or powerful flashlight may be used to look for eye reflections.
If proper identification cannot be made, a photograph of the species will be collected for future identification.

Things to bring to the field:

Data form and pencil	GPS unit	Map
Clipboard	Field guides	Camera
Binoculars		

Survey Data Form

Site Name: Albany Landfill _____ Transect ID No. _____

Date: _____ Observer(s): _____

Start Time: _____ End Time: _____

Weather:
Start Temp.: _____ End Temp.: _____ %Cloud cover: _____

Start Wind: _____ End Wind: _____

Time	Species	Sex*	Notes

* if can be determined

NATURAL RESOURCES INVENTORY CALENDAR WITH SURVEY DATES AND PROTOCOL

Rapp Road Landfill Eastern Expansion

FEB - JUNE

Rare Species	Recommended Survey Dates	Recommended Time of Day	Habitat	Special Considerations	Required Survey Protocol	Proposed Survey Techniques
Jefferson salamander *Ambystoma jeffersonianum*	Early spring (Feb-April)	Check traps 1x/day before noon. Early season night surveys for migration to woodland pools.	Vernal woodland pools, under cover objects & underground.	Very early season while snow is still on the ground but pooled areas are starting to melt.	NA	Systematic sampling and passive searches.
Blue-spotted salamander *Ambystoma laterale*	Early spring (Feb-April)	Check traps 1x/day before noon. Early season night surveys for migration to woodland pools.	Vernal woodland pools, under cover objects & underground.	Very early season while snow is still on the ground but pooled areas are starting to melt.	NA	Systematic sampling and passive searches.
Henry's Elfin *Callophrys henrici*	Most of May with a few stragglers into June	10 a.m to 5 p.m.	Pine-oak barrens	Redbud, blueberries, viburnum host plants	NA	Pollard-Yates. Butterfly net w/ wandering pattern
Frosted Elfin *Callophyrus irus*	mid April through early June	between 8 a.m. & 6 p.m. - Refer to May 2008 Protocol	Lupine, barrens	Contact DEC for current flight periods prior to surveying	May 2008 USFWS/DEC	USFWS/DEC search protocols
Karner Blue Butterfly *Lycaeides melissa samuelis*	May-Jun & Jul-Aug	between 8 a.m. & 6 p.m. - Refer to May 2008 Protocol	Lupine, barrens	Contact DEC for current flight periods prior to surveying	May 2008 USFWS/DEC	USFWS/DEC search protocols
Tawny Crescent *Phyciodes batesii batesii*	May-July	10 a.m to 5 p.m.	Moist meadows	wavy leaved aster, other asters hosts	NA	Pollard-Yates. Butterfly net w/ wandering pattern
Bird Dropping Moth Cerma cora	May-Jun	10 a.m to 5 p.m.	Pine-oak barrens	pin cherry host	NA	Pollard-Yates. Butterfly net w/ wandering pattern

FEB - JUNE continued						
Rare Species	**Recommended Survey Dates**	**Recommended Time of Day**	**Habitat**	**Special Considerations**	**Required Survey Protocol**	**Proposed Survey Techniques**
Forcipate emerald *Somatochlora forcipata*	late May to mid August	10 a.m to 5 p.m.	bogs and small forested streams	adults forage in forest openings & along roads, often flying rather low. Males patrol streams.	NA	Pollard-Yates. Butterfly net w/ wandering pattern
Ringed Boghaunter *Williamsonia lintneri*	Mid April-May	10 a.m to 5 p.m.	Fens, Rushes	near wetlands	NA	Pollard-Yates. Butterfly net w/ wandering pattern
Dusted Skipper *Atrytonopsis hianna*	May-Jun	10 a.m to 5 p.m.	Grassland, barrens	little bluestem and big bluestem hosts	NA	Pollard-Yates. Butterfly net w/ wandering pattern
Broad-lined Catopyrrha *Erastria coloraria*	there are two broods in mid or late May to early June and much of July; a few may be present earlier in spring or later in June	10 a.m to 5 p.m. also at night	barrens and other dry, brushy places	closely associated with New Jersey tea. Adults can be flushed from NJ tea plants or nearby in daytime. Also active at night and come to lights.	NA	Pollard-Yates. Butterfly net w/ wandering pattern. May be detected at nocturnal sheet/light setups.
Persius duskywing Er*ynnis persius persius*	April to June (1 flight season)	any time when it's light out enough to see	pine barrens, oak savanna, and other open, sunny locations (such as powerline rights of way), marshes	host plants: lupine and indigo	NA	Pollard-Yates. Butterfly net w/ wandering pattern
American woodcock Scolopax minor	Spring courtship ritual. Nesting: mid March into June.	On or shortly after sunset	shrublands and forests (land along riverbanks), as well as upland shrublands, early successional forests and forest thickets. second growth hardwoods	courtship flight distinct	Protocol: Locating Woodcock Singing Ground Survey routes and Cooper, T.R., and K. Parker 2009	Singing-ground surveys

FEB - JUNE continued						
Rare Species	**Recommended Survey Dates**	**Recommended Time of Day**	**Habitat**	**Special Considerations**	**Required Survey Protocol**	**Proposed Survey Techniques**
Red-shouldered hawk *Buteo linneatus*	breed once per year between April and July, with peak activity occurring between early April and mid June.	1/2 hour before sunrise to 09:00	forests, but favors mature, mixed deciduous-coniferous woodlands, especially bottomland hardwood, riparian areas, and flooded deciduous swamps.	Courtship displays occur on the breeding grounds, and involve soaring together in broad circles while calling, or soaring and diving toward one another. Males may also perform the "sky-dance" by soaring high in the air, and then making a series of steep dives, each followed by a wide spiral and rapid ascent	NA	BBS.
Willow flycatcher *Empidonax traillii*	Early spring	1/2 hour before sunrise to 09:00	Breeds in moist shrubby areas often with standing or running water.	NA	NA	BBS.
Ruffed grouse Bonasa umbellus	Early spring	1/2 hour before sunrise to 09:00	Aspen woodlands and early successional, mixed deciduous forests with small clearings.	Males establish territory and drum to attract females	NA	BBS.
Dusted Skipper Atrytonopsis hianna	May-Jun	10 am to 5 p.m.	Grassland, barrens	little bluestem and big bluestem hosts	NA	Pollard-Yates. Butterfly net w/ wandering pattern

FEB - JUNE continued						
Rare Species	**Recommended Survey Dates**	**Recommended Time of Day**	**Habitat**	**Special Considerations**	**Required Survey Protocol**	**Proposed Survey Techniques**
Broad-lined Catopyrrha Erastria coloraria	there are two broods in mid or late May to early June and much of July; a few may be present earlier in spring or later in June	10 a.m to 5 p.m. also at night	barrens and other dry, brushy places	closely associated with New Jersey tea. Adults can be flushed from NJ tea plants or nearby in daytime. Also active at night and come to lights.	NA	Pollard-Yates. Butterfly net w/ wandering pattern. May be detected at nocturnal sheet/light setups.
Persius duskywing Er*ynnis persius persius*	April to June (1 flight season)	any time when it's light out enough to see	pine barrens, oak savanna, and other open, sunny locations (such as powerline rights of way), marshes	host plants: lupine and indigo	NA	Pollard-Yates. Butterfly net w/ wandering pattern
Note: If a rare species is observed or captured, the specific location will be documented and detailed information pertaining to the vegetative community in which the species is observed or captured will be collected. In all cases, vegetative communities will be identified according to Ecological Communities of New York State, Edinger, 2002. Pertinent notes, such as interspersion of surrounding communities, and other species-specific habitat relationships or observations will be taken. Representative photographs will be taken of the specific location and its surrounding areas.						

JUNE/JULY/AUGUST						
Rare Species	**Recommended Survey Dates**	**Recommended Time of Day**	**Habitat**	**Special Considerations**	**Required Survey Protocol**	**Proposed Survey Techniques**
Karner Blue Butterfly *Lycaeides melissa samuelis*	May-Jun, Jul-Aug	between 8 a.m. & 6 p.m. - Refer to May 2008 Protocol	Lupine, barrens	Contact DEC for current flight periods prior to surveying	May 2008 USFWS/DEC	USFWS/DEC search protocols
Edwards' Hairstreak *Satyrium edwardsii*	June-July	10 a.m to 5 p.m.	Oak barrens	scrub oak host	NA	Pollard-Yates. Butterfly net w/ wandering pattern
A Noctuid Moth *Chytonix sensilis*	August	nocturnal	Pine-oak barrens	night search	NA	Nigth survey with sheet and lights set-up
Pine barrens zanclognatha *Zanclognatha martha*	July but mostly mid-to-late July	nocturnal	pitch pine scrub oak barrens	night search	NA	Nigth survey with sheet and lights set-up
A Noctuid Moth *Macrochilo bivittata*	July	night search	Wet meadows	night search	NA	Nigth survey with sheet and lights set-up
Regal frilillary *Speyeria idalia*	one flight period from mid-June to mid-August	10 a.m to 5 p.m.	open sunny locations, including meadows, marshes, and mountain pastures	Larval host plants are violets	NA	Pollard-Yates. Butterfly net w/ wandering pattern
Barrens dagger moth *Acronicta albarufa*	July to mid-August	nocturnal	Pine-oak barrens or forest	night search	NA	Nigth survey with sheet and lights set-up
Broad-lined Catopyrrha *Erastria coloraria*	there are two broods in mid or late May to early June and much of July; a few may be present earlier in spring or later in June	10 a.m to 5 p.m. also at night	barrens and other dry, brushy places	closely associated with New Jersey tea. Adults can be flushed from NJ tea plants or nearby in daytime. Also active at night and come to lights.	NA	Pollard-Yates. Butterfly net w/ wandering pattern. May be detected at nocturnal sheet/light setups.

JUNE/JULY/AUGUST continued						
Rare Species	**Recommended Survey Dates**	**Recommended Time of Day**	**Habitat**	**Special Considerations**	**Required Survey Protocol**	**Proposed Survey Techniques**
Barrens itame, Itame sp. 1 nr. Inextricata	July	nocturnal	Pine-oak barrens	night search	NA	Nigth survey with sheet and lights set-up
Spatterdock darner *Rhionaeschna mutata*	Early June to early July	10 a.m to 5 p.m.	fishless ponds usually with water lilies	Adults hunt along forest edges, dirt roads and fields, often in vicinity of the wetlands where eggs are laid.	NA	Pollard-Yates. Butterfly net w/ wandering pattern
Subarctic darner *Aeshna subarctica*	mid-July to late September	10 a.m to 5 p.m.	muskeg ponds, bogs and northern swamps	fly low over wet areas and pools. Also open areas away from breeding habitat.	NA	Pollard-Yates. Butterfly net w/ wandering pattern
Seepage dancer *Argia bipunctulata*	early July to mid September	10 a.m to 5 p.m.	grassy seepages, small lakes, ponds and streams and pine barren bogs	NA	NA	Pollard-Yates. Butterfly net w/ wandering pattern
Mocha emerald *Somatochlora linearis*	Mid June thru early September	10 a.m to 5 p.m.	small shaded streams	adults hunt in fields and forest openings, usually flying at height of 6-10'. Most active morning and evening	NA	Pollard-Yates. Butterfly net w/ wandering pattern
Incurvate emerald *Somatochlora incurvata*	late June to early September	10 a.m to 5 p.m.	Sphagnum bogs	identifiable only in-hand	NA	Pollard-Yates. Butterfly net w/ wandering pattern
Common sanddragon Progomphus obscurus	mid June thru mid August	10 a.m to 5 p.m.	sandy-bottomed ponds, lakes and streams	the only clubtail in the northeast with dark basal wing markings.	NA	Pollard-Yates. Butterfly net w/ wandering pattern
Prairie Warbler Dendrocia discolor	Spring & summer	1/2 hour before sunrise to 09:00	Dunes, fields	stays near ground	Breeding Survey, Call survey	BBS.

JUNE/JULY/AUGUST continued						
Rare Species	**Recommended Survey Dates**	**Recommended Time of Day**	**Habitat**	**Special Considerations**	**Required Survey Protocol**	**Proposed Survey Techniques**
Sharp-shinned hawk *Accipiter striatus*	Year round	1/2 hour before sunrise to 09:00	Mature mixed for.	stays near ground	Breeding Survey, Call survey	BBS.
Cooper's hawk *Accipiter cooperii*	Year round	1/2 hour before sunrise to 09:00	Woods, shrubs	edges of woods	Breeding Survey, Call survey	BBS.
Wood Thrush *Hylocichla mustelina*	Spring & summer	1/2 hour before sunrise to 09:00	Mature decide. for.	in forest	Breeding Survey, Call survey	BBS.
Blue-winged warbler *Vermivora chrysoptera*	Spring & summer	1/2 hour before sunrise to 09:00	Shrubs, weeds	hybridizes with golden wing	Breeding Survey, Call survey	BBS.
Golden-winged warbler *Vermivora chrysoptera*	Spring & summer	1/2 hour before sunrise to 09:00	Shrubs, weeds	hybridizes with blue wing	Breeding Survey, Call survey	BBS.
Black-throated blue warbler *Dendroica caerulesens*	Spring & summer	1/2 hour before sunrise to 09:00	Conifers, shade	tries to stay out of direct sunlight	Breeding Survey, Call survey	BBS.
Yellow breasted chat *Ictera virens*	Spring & summer	1/2 hour before sunrise to 09:00	Brush, woods	scrub shrub inhabitant	Breeding Survey, Call survey	BBS.
Whip-poor-will Caprimulgus vociferous	Summer	After the sun has set completely	Mixed pine, deciduous woodland	active at night	Pamela D. Hunt. A proposed Survey Methodology for Monitoring Nightjars (Caprimulgidae, Caprimulgus) in Eastern North America. Audubon Society of New Hampshire	Modified point count surveys based on this source.

JUNE/JULY/AUGUST continued						
Rare Species	**Recommended Survey Dates**	**Recommended Time of Day**	**Habitat**	**Special Considerations**	**Required Survey Protocol**	**Proposed Survey Techniques**
Scarlet tanager *Piranga olivacea*	May to August	1/2 hour before sunrise to 09:00	mainly mature deciduous forests or mixed deciduous forests w/ hemlock & pine. Can also be found in younger deciduous forests, sometimes in heavily wooded suburban areas.	Males use a silent courtship display in which they fly to exposed branches below a female and extend their wings and neck to expose their scarlet back	NA	BBS.
Wood turtle Clemmys insculpta	summer	10 a.m to 5 p.m.	at home in water. woods, meadows, farmlands.	NA	NA	Systematic sampling and passive searches.
Snapping turtle *Chelydra serpentina*	summer	10 a.m to 5 p.m.	any permanent body of fresh water	NA	NA	Systematic sampling and passive searches.
Spotted turtle *Clemmys guttata*	March to October (breeding March to May)	10 a.m to 5 p.m.	marshy meadows, bogs, swamps, ponds, ditches, or other small bodies of still water. Daylight hours are spent eating and basking in the sun	In May females search for nesting areas: open site, such as a meadow, field, or the edge of a road	NA	Systematic sampling and passive searches.
Eastern hognose snake *Heterodon platyrhinos*	Spring, summer	10 a.m to 5 p.m.	Sandy areas	toads	NA	Systematic sampling and passive searches.

JUNE/JULY/AUGUST continued						
Rare Species	**Recommended Survey Dates**	**Recommended Time of Day**	**Habitat**	**Special Considerations**	**Required Survey Protocol**	**Proposed Survey Techniques**
Worm snake *Carphophis amoenus*	Spring, summer	10 a.m to 5 p.m.	Moist soils, rotting logs	underground, rotting logs	NA	Systematic sampling and passive searches.
Northern black racer *Coluber constrictor constrictor*	Spring, summer	10 a.m to 5 p.m.	dry sunny areas with access to cover; also damper sites	sunny days	NA	Systematic sampling and passive searches.
Black rat snake *Elaphe obsoleta*	Spring, summer	10 a.m to 5 p.m.	rocky timber hillsides to farmlands	sunny days	NA	Systematic sampling and passive searches.
Smooth greensnake Opheodrys vernalis	Spring, summer	10 a.m to 5 p.m.	largely terrestrial	sunny days	NA	Systematic sampling and passive searches.
Eastern spadefoot toad Scaphiophus holbrookii	March to August on days >45 degrees F with heavy rains	Day and night following appropriate weather conditions.	Sandy areas	best time to survey pouring rain	Call survey	Systematic sampling and passive searches.
Fowler's Toad Bufo woodhousei	Spring, summer	10 a.m to 5 p.m.	Moist soils, sandy	Diurnal	Call survey	Systematic sampling and passive searches.

SEPTEMBER/OCTOBER						
Rare Species	**Recommended Survey Dates**	**Recommended Time of Day**	**Habitat**	**Special Considerations**	**Required Survey Protocol**	**Proposed Survey Techniques**
Mottled Duskywing *Erynnis martialis*	Apr-Sep	10 a.m to 5 p.m.	Barrens	new jersey tea host	NA	Pollard-Yates. Butterfly net w/ wandering pattern
A Noctuid Moth *Chaetaglaea cerata*	Sep-Oct	Nocturnal	Pine-oak barrens	search at night	NA	Night survey with sheet and lights set-up
Inland Barrens Buckmoth *Hemileuca maia maia*	Sep-Dec	10 a.m to 5 p.m.	Oak barrens	scrub oak	NA	Pollard-Yates. Butterfly net w/ wandering pattern
Note: If a rare species is observed or captured, the specific location will be documented and detailed information pertaining to the vegetative community in which the species is observed or captured will be collected. In all cases, vegetative communities will be identified according to Ecological Communities of New York State, Edinger, 2002. Pertinent notes, such as interspersion of surrounding communities, and other species-specific habitat relationships or observations will be taken. Representative photographs will be taken of the specific location and its surrounding areas.						

LEGEND

● Breeding Bird Survey Location
● Nocturnal Bird Survey Location
✕ Herp Trapping Arrays
— Butterfly Transects

0 100 200
Scale in feet

No.	Submittal / Revision	App'd	By	Date

ALBANY, NEW YORK

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Designed: MRR | Drawn: KRV | Checked: XXX

RAPP ROAD LANDFILL RESTORATION PLAN

POST CONST. FAUNAL MONITORING PLAN

Issue Date: 03/26/13 | Project No.: 21661 | Scale: AS NOTED

GRAPHIC

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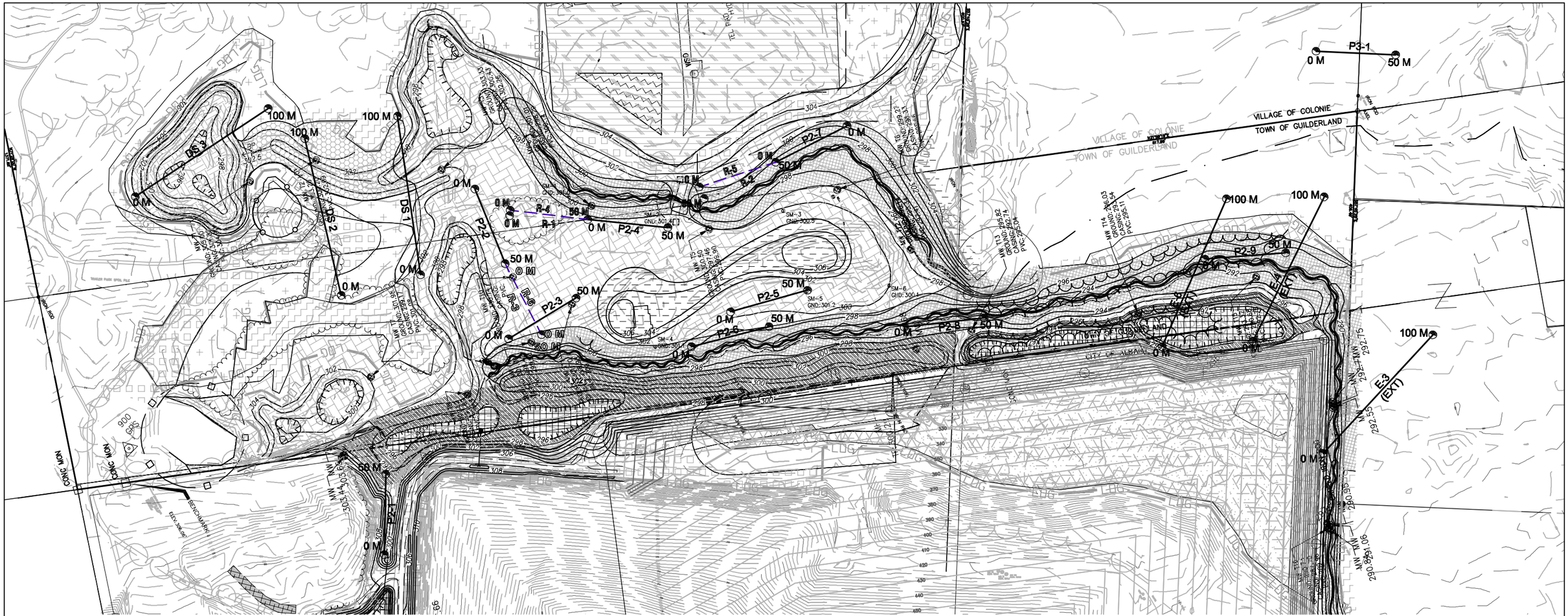

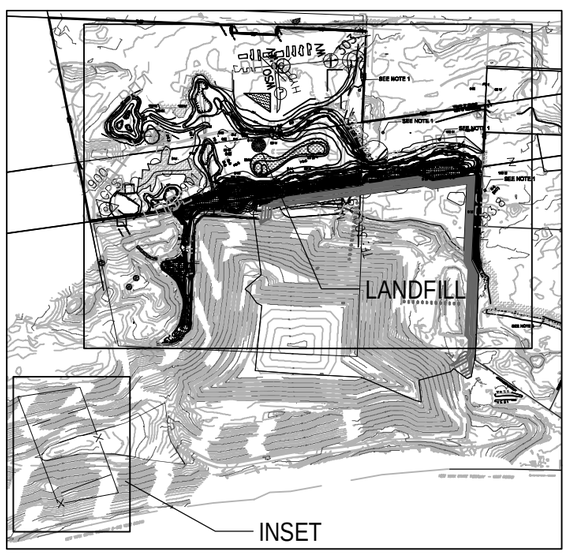

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LEGEND

- Existing 2' Contours
- Proposed 2' Contours
- Restored Stream
- Existing Stream

Upland Grassland Communities

- Dry Prairie/Sand Flat — 3.66 AC
- Dune — 1.30 AC

Upland Forest Communities

- Pitch Pine-Scrub Oak Barrens — 4.85 AC
- Nursery Area — 3.77

Wetland Communities

- Biofilter Wetland — 1.41 AC
- Pine Barrens Vernal Pond — 1.12 AC
- Sedge Meadow — 0.63 AC
- Forested Wetland (Red Maple Hardwood Swamp) — 13.71 AC
- Forested Wetland Enhancement (Red Maple Hardwood Swamp) — 3.05 AC
- Forested Riparian Wetland (Red Maple Hardwood Swamp) — 6.50 AC
- 0 M – – 50 M Random Transects
- 0 M — 50 M Vegetation Transects

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PII/PIII VEGETATION MONITORING MAP

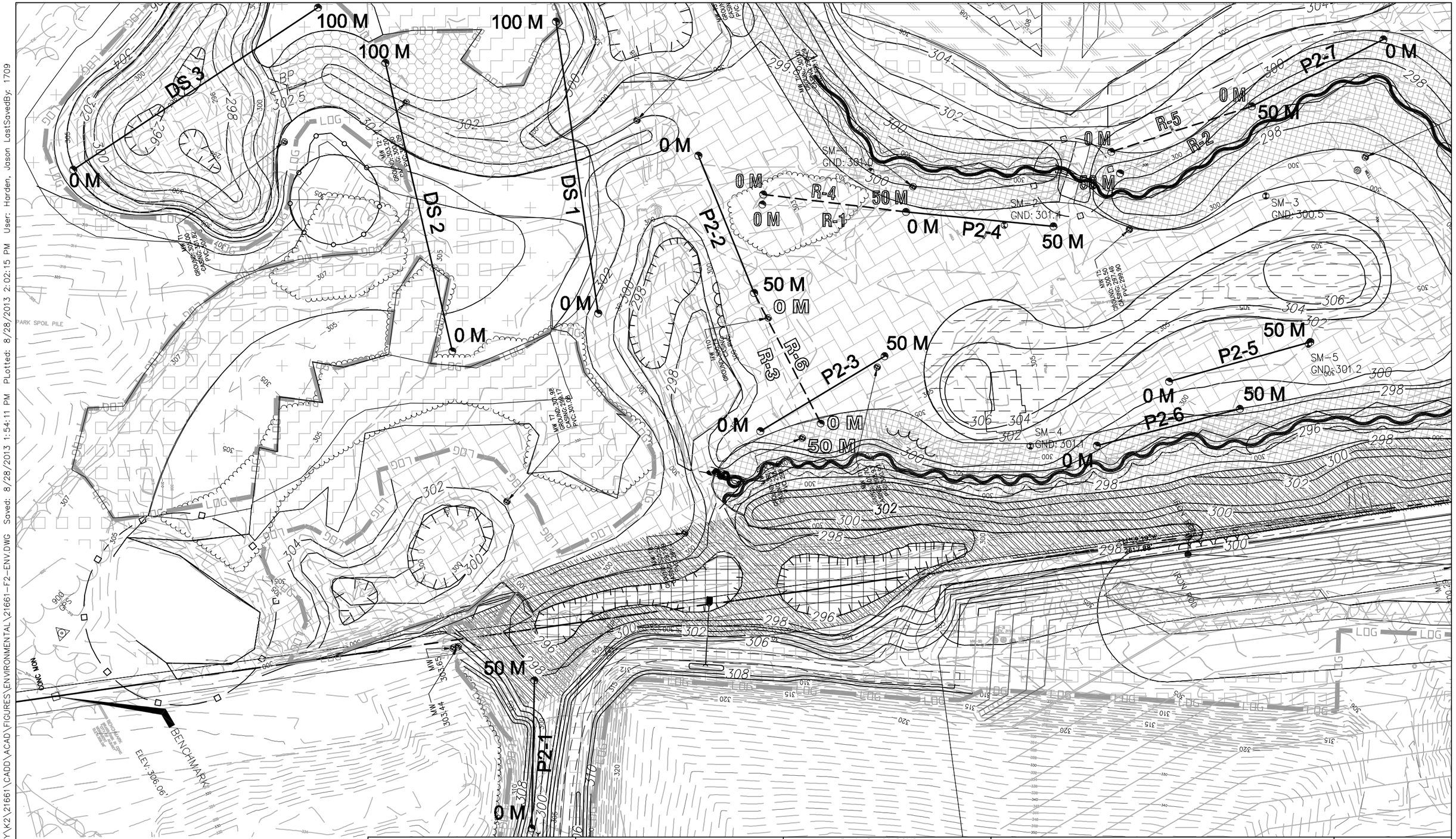
RAPP ROAD LANDFILL
RESTORATION PLAN

PROJECT NO. 21661

DATE: 08/26/13

FIGURE 01

2014 Work Plan - Albany Rapp Rd. Landfill



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PII/PIII VEGETATION MONITORING MAP ENLARGEMENT A

RAPP ROAD LANDFILL
RESTORATION PLAN

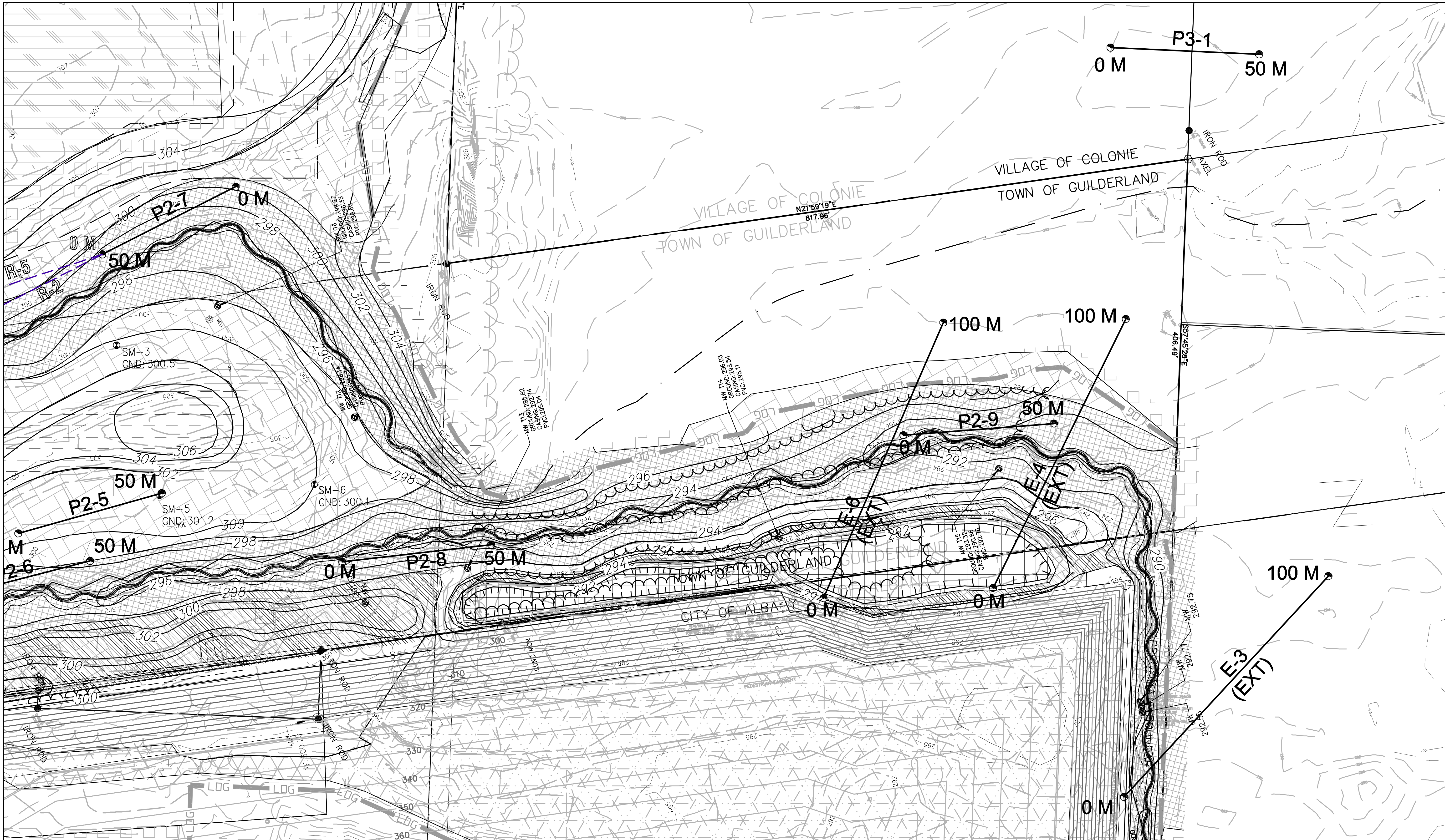
PROJECT NO. 21661

DATE: 08/26/13

FIGURE 01A

S:090636:112513

2014 Work Plan - Albany Rapp Rd. Landfill



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PII/PIII VEGETATION MONITORING MAP
ENLARGEMENT B

RAPP ROAD LANDFILL
RESTORATION PLAN

PROJECT NO.
21661

DATE: 08/26/13

FIGURE 01B