Honeywell
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September 12, 2011

To: Diane Carlton, NYSDEC, Region 7 (1 CD)
Holly Sammon, Onondaga County Public Library (1 bound)
Samuel Sage, Atlantic States Legal Foundation (1 bound)
Joseph J. Heath, Esq., Onondaga Nation (cover letter)
Cara Burton, Solvay Public Library (1 bound)

Re: Letter of Transmittal – Wastebeds 1-8 Site Repository Addition

The below document has been approved by the New York State Department of Environmental Conservation (NYSDEC) and is enclosed for your document holdings:

- Cover System Pilot Study Work Plan – Wastebeds 1 through 8 dated August 16, 2011

Sincerely,

John P. McAuliffe by CCC

John P. McAuliffe, P.E.
Program Director, Syracuse

Enc.

cc: Tracy A. Smith- Project Manager

New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau D, 12th Floor
625 Broadway, Albany, New York 12233-7013
Phone: (518) 402-9676 • **Fax:** (518) 402-9020
Website: www.dec.ny.gov

Joe Martens
Commissioner

August 30, 2011

Mr. John P. McAuliffe, P.E.
Honeywell International, Inc.
301 Plainfield Road
Suite 330
Syracuse, NY 13212

Re: Wastebeds 1-8 Cover System Pilot Study

Dear Mr. McAuliffe:

The New York State Department of Environmental Conservation has reviewed the "Cover System Pilot Study Work Plan Wastebeds 1 through 8" (work plan) submitted in your letter dated August 16, 2011. Based on our review, the work plan is approved. If you have any questions, please contact me at 518-402-9796.

Sincerely,

Tracy A. Smith

Tracy A. Smith
Project Manager

ecc: J. Gregg, NYSDEC
H. Kuhl
T. Joyal, Esq.
G. Laccetti, NYSDOH
F. Kirshner
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D. Hesler, NYSDEC
A. Lowry

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August 16, 2011

Mr. Tracy Smith
New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau D
625 Broadway 12th Floor
Albany, NY 12233-7013

Re: Wastebeds 1 – 8, Town of Geddes, Onondaga County, New York
Index # D-7-0002-02-08

Dear Mr. Smith:

Attached please find a copy of the *Cover System Pilot Study Work Plan, Wastebeds 1 through 8*. The work plan attached hereto was prepared by O'Brien & Gere.

Please contact Douglas Crawford of O'Brien & Gere at (315) 956-6100 or me should you have any questions regarding the information presented herein.

Sincerely,

John P. McAuliffe by CCC

John P. McAuliffe, P.E.
Program Director, Syracuse

Enc. (2 copies, 1 CD)

cc:	Mr. Robert Nunes	USEPA (1 copy, 2 CDs)
	Mr. Harry Warner	NYSDEC Region 7 (1 copy, 1 CD)
	Mr. Steven Bates	NYSDOH (1 copy, 1 CD)
	Mr. Geoffrey Laccetti	NYSDOH (ec or ec ltr only)
	Margaret A. Sheen, Esq.	NYSDEC, Region 7 (ltr only)
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	Brian D. Israel, Esq.	Arnold & Porter (ec or CD)
	Mr. David Coburn	O.C. Office of the Environment (1 copy, 1 CD)
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Thane Joyal, Esq.	Onondaga Nation (ec or CD)
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Ms. Heidi Kuhl	Onondaga Nation (1 copy)
Mr. Curtis Waterman	Onondaga Nation (ec or CD)
Ms. Alma Lowry	Onondaga Nation (ec ltr only)
Mr. Michael Spera	AECOM (1 copy, 1 CD)
Mr. David Scheuing	AECOM (1 copy, 1 CD)
Mr. William Hague	Honeywell (ec or CD)
Mr. Alfred J. Labuz	Honeywell (ltr only)
Mr. Steve Miller	Parsons (CD/ltr only)
Mr. Douglas M. Crawford	O'Brien & Gere (1 copy)
Mr. Christopher C. Calkins	O'Brien & Gere (ec or ec ltr only)

Cover System Pilot Study Work Plan
Wastebeds 1 through 8

Honeywell

August 2011

O'BRIEN & GERE

INTRODUCTION

The Solvay Wastebeds 1-8 Site is a complex of settling basins located adjacent to Onondaga Lake, located in the Town of Geddes, New York (**Figure 1**). The basins are composed of Solvay waste, an alkaline material consisting largely of calcium and magnesium salts which has been shown to be deficient in nutrients, specifically phosphorus (Hewlett 1956, Michalenko 1991, Eallonardo 2010). Data from Solvay waste sites world-wide (**Table 1**) show that soils developed from Solvay waste are atypical, but not completely inhibitory to vegetation growth and in some cases support vegetation with high conservation value and robust growth when managed properly. Additionally, it has been shown that acute abiotic stresses associated with Solvay waste pH and salinity typically diminish below inhibitory levels within nine years. Vegetation on the Wastebeds 1-8 Site is generally sparse and remains in an early successional state relative to the age of the Wastebeds (Michalenko 1991). As a result of the limited vegetation development, the substrate cover and stabilization, and evapotranspiration (ET) provided by the vegetation are also limited.

OBJECTIVES

The objectives of this pilot study are to develop information on cover systems, based on vegetation management, to enhance ET, and increase substrate cover and stabilization. This information will be used to evaluate the efficacy of an amendment and re-vegetation approach to establish a suitable vegetative treatment/cover system for the Site-wide FS (*i.e*, as an alternative to a traditional engineered cap). The FS evaluation will include consideration of the long-term viability of the vegetation, the ET capabilities of the vegetation, the impact of the root system/vegetative growth on stabilization of surface Solvay waste and percent ground cover established by the vegetation, and the ability of the approach to meet the remedial action objectives of the FS.

The working hypothesis of this study is that two interacting factors limit vegetation development and subsequent provisioning of ecological services on the Site:

1. Co-limitation by low nitrogen (N), phosphorus (P), and potassium (K) availability
2. The inability of species adapted to infertile conditions to colonize the Site

There are a variety of plant communities that naturally occur on soils offering similar growing conditions as Solvay waste. Marl fens occur on wet calcium carbonate that is alkaline and highly phosphorus deficient. Rich fens may occur on organic or mineral substrates but plants are still subject to alkaline, nutrient deficient growing conditions primarily due to discharge of alkaline groundwater and, periodically, the local presence of marl in surface soil horizons. Alvar grasslands have wide ranging soil moisture conditions but the soils are typically thin, alkaline and infertile. A reasonable explanation as to why, if plants from these communities are adapted to growing conditions provided by Solvay waste, but are not growing in abundance on the waste beds, is that they cannot get there on their own. For example, when species from these communities were planted on an un-vegetated site on Settling Basin 14 they flourished suggesting that fen and alvar plants can grow on Solvay waste but that they need assistance in getting to the site, thereby suggesting that fen and alvar plants could not disperse to the waste beds naturally (Eallonardo 2010). However, because the referenced study primarily used plants, as opposed to seeds, this study left open the question that seed germination and establishment may be the limiting factor to natural species proliferation, not dispersal. Hence, the study proposed herein aims to provide further support for bullet item (2) above, by introducing species to the Site by seed. While the most pertinent/direct test on this hypothesis, from a theoretical perspective, would be to introduce seed alone, the study proposed herein plans to introduce seed as part of mulch mixes that provide additional

soil stabilization benefits to maximize the potential success of the applications, and allow for data collection to also evaluate ET characteristics of the responses.

METHODOLOGY

Two basic vegetation management strategies (*i.e.*, fertilizer addition and species introduction) will be used within an experimental framework to evaluate the hypothesis.

Vegetation Management Strategy for Undeveloped Areas

The pilot study for undeveloped areas will comprise the following activities:

1. Establish four experimental blocks, within each of which, varied treatments will be applied to seven individual plots
2. Evaluate the vegetation treatment responses in terms of percent ground cover and ET rate of herbaceous species, saplings and seedlings (*i.e.*, the ground layer)

Vegetation Management Strategy for Overflow Parking Areas

The pilot study for overflow parking areas will comprise the following activities:

1. Establish two experimental 25ft by 40ft plots, within each of which, varied treatments will be applied over selected manufactured grass/root protection layers
2. Evaluate the vegetation treatment response in terms of ground cover and ET rate of herbaceous species
3. Evaluate, through application of vehicular traffic over the test plots, the performance of the manufactured grass protection technologies implemented in each plot

It is anticipated that application of treatments and preliminary vegetative response monitoring will be performed during the 2011 growing season, and ET data collection will be performed during the 2012 and 2013 growing seasons.

Pilot Study Design for Undeveloped Areas

The pilot study for undeveloped areas will take place at the northwestern end of the Wastebeds 1-8 Site (**Figure 1**). Four experimental blocks will be established at the approximate locations shown on **Figure 2**. Approximate block locations were selected based on accessibility, and on the targeted evaluation of areas with contrasted aspect and slope. In the field, final block locations will be selected as those that provide the greatest relative homogeneity of vegetative and soil conditions within each block. For example, a block will be located such that the percent and general type of vegetative cover across the entirety of the block is similar, avoiding, to the extent possible, large variations of existing vegetative size and/or species as well as substrate conditions. This will allow for a more direct comparison of data, in terms of vegetative response to the varied treatments applied across each block.

Blocks 1 and 2 are proposed to be situated at similar elevations, relatively close to one another due to constraints imposed by current Site accessibility. Though these blocks are close to each other they still serve as independent, statistical replicates within the focus area of the study (*i.e.*, the northwestern end of Wastebeds 1-8). Blocks 2 and 3 are located on relatively steeply sloped berms with contrasted aspect which will allow for treatment evaluation on these areas with substantially different amounts of solar

radiation. Block 4 is currently sparsely vegetated with a south-facing aspect (*i.e.*, high loading of solar radiation), suggesting that this block will be a "worst-case" test on the treatments.

Within each block, the following seven treatments will be applied in separate 20ft by 20ft plots (**Figure 3**):

1. Control
2. Hydromulch + seed
3. Hydromulch + seed + NPK (10-2-10) fertilizer at approximately 436 pounds per acre
4. Hydromulch + seed + NPK (10-2-10) fertilizer at approximately 1,307 pounds per acre
5. Organic matter + seed
6. Organic matter + seed + NPK (10-2-10) fertilizer at approximately 436 pounds per acre
7. Organic matter + seed + NPK (10-2-10) fertilizer at approximately 1,307 pounds per acre

The treatments will be randomly assigned to each plot and applied in early June 2011 (weather conditions permitting). A minimum of a five foot buffer will be maintained between treatment plots. In each plot, except the control, the native species seed mix (**Table 2**) will be applied at a rate of approximately 70 pounds per acre. Actual locations of, and spacing within the blocks will be determined in the field, and will be selected based on providing optimal conditions to evaluate the hypothesis.

The hydromulch to be used in this pilot study will be Flexterra® Flexible Growth Medium, which consists of wood fiber mulch with tackifier and biodegradeable interlocking matrix. Flexterra® will be applied in accordance with the manufacturer's recommendations of 3,050 pounds per acre on flat areas (*i.e.*, Blocks 2 and 3), and 3,500 pounds per acre on slopes ranging from 3H:1V to 2H:1V (*i.e.*, Block 1). The resulting application thickness for Flexterra® Flexible Growth Medium will be approximately 1 inch.

The organic matter to be used in this pilot study will be EcoBlanket™, which consists of an organic compost/mulch blend. Ecoblanket™ will be applied in accordance with the manufacturer's recommendations of two-inch depth, though this depth may vary should the manufacturer's approved installer (Ground Effects, Memphis, NY) recommend otherwise based on Site conditions.

Flexterra® and Ecoblanket™ are designed to provide erosion control functions similar to standard rolled erosion blankets but offer significant cost savings as they may be applied (along with seed and fertilizer) by automated processes (*i.e.,* Flexterra® will be applied by hydroseeding, Ecoblanket™ will be applied by a pneumatic process similar to hydroseeding) and do not require extensive clearing and grubbing prior to application.

The seed mix, and rationale for the selected species within the mix selected for the Undeveloped Area pilot study application is provided in **Table 2**.

Pilot Study Design for Overflow Parking Areas

The pilot study for overflow parking areas will take place on the western portion of Wastebed 3, within the area of the Site that is currently gravel-covered ground surface and used as overflow parking during the NY State Fair, as illustrated on **Figure 2**. The two experimental plots locations were selected based on accessibility, existing site conditions, and the anticipated traffic patterns of the overflow parking area during peak use. Final block locations will be selected in the field, as those that provide 'worst-case' growing conditions (*i.e.*, little or no vegetative growth, high soil density, gravel cover present, and high traffic pattern during peak use) within each plot.

The following treatments will be applied in the approximately 25ft by 40ft (1,000 ft^2) plots:

Plot A

1. Condition soil using a skid steer surface soil conditioner attachment
2. Apply 10-2-10 fertilizer at 10 pounds per 1,000 ft^2 and pelletized sulfur at 50 pounds per 1,000 ft^2
3. Mix soil, using agricultural-type disc cultivator, to minimum depth of 1 ft
4. Grade surface
5. Install Presto GeoSystems GeoBlock® 5150 Porous Pavement System
6. Install topsoil (silt loam, pH 4.5 to 6.5, minimum organic matter concentration 3%) to fill GeoBlocks
7. Apply seed mix (**Table 3**) at rate of approximately 1.4 pounds per 1,000 ft^2 with 70 pounds per 1,000 ft^2 of Hydro-Blanket and 10 pounds per 1,000 ft^2 of 10-2-10 fertilizer
8. Track in seed
9. Water as needed (apply 0.5 inches of water if this amount is not received during any 7 day window from June to the end of August)

Plot B

1. Condition soil using a skid steer surface soil conditioner attachment
2. Apply of 10-2-10 fertilizer at 10 pounds per 1,000 ft^2 and pelletized sulfur at 50 pounds per 1,000 ft^2
3. Mix soil, using agricultural-type disc cultivator, to minimum depth of 1
4. Grade surface
5. Install Tenax® Grass Protection (GP) Mesh
6. Apply seed mix (**Table 3**) at rate of approximately 1.4 pounds per 1,000 ft^2 with 70 pounds per 1,000 ft^2 of Hydro-Blanket and 15 pounds per 1,000 ft^2 of 10-2-10 fertilizer
7. Track in seed
8. Water as needed (apply 0.5 inches of water if this amount is not received during any 7 day window from June to the end of August)

The seed mix, and rationale for the selected species within the mix selected for the Overflow Parking Area pilot study application is provided in **Table 3**. Copies of the manufacturer's product specification documents for the Presto GeoSystems GeoBlocks® 5150 Porous Pavement System and the Tenax® GP Mesh are included as Exhibits A and B, respectively.

The treatments will be applied in early June 2011 (weather conditions permitting). Actual locations of the plots will be determined in the field, and will be selected based on providing optimal conditions to evaluate the selected geosynthetic materials and vegetation-related hypothesis.

Data Collection

Within each undeveloped area treatment plot, four permanent subplots approximately 11 ft^2 (1 m^2) in size will be systematically located (**Figure 3**) and established prior to application. In each subplot, the existing/pre-treatment percent cover of vascular plants will be estimated using a modified Daubenmire (1959) cover class system. Percent cover of non-vascular species (*e.g.*, mosses) will be evaluated but not identified to species. Additionally, cover estimates will be performed for exposed substrate, rocks, and

coarse woody debris greater than 1 inch in diameter. Herbaceous plants and woody plants less than 4.5 ft tall (*i.e.*, seedlings and saplings) that are rooted or hanging into each plot will be included in the cover estimate. These cover estimates will be repeated in early September 2011. Similarly, for the parking area overflow plots, the percent cover of vascular plants will be estimated using a modified Daubenmire (1959) cover class system, and cover estimates will be performed for exposed substrate, rocks, and coarse woody debris greater than 1 inch in diameter.

Four soil samples (0-20 cm depth) will be collected from each plot prior to application of treatments. The soil samples will be composited, by plot, placed in plastic bags, and analyzed for pH (EPA 9040B), electrical conductivity (EPA 120.1), total N (EPA 351.1 or 440.0), and extractible phosphorus (EPA 365.1). Soil nutrient data will be used as a covariate to provide statistical control over the analysis of treatment responses (*i.e.*, to help explain changes in vegetation that are not clearly attributed to the treatments).

ET will be estimated from each plot following the procedures documented in Allen *et al.* (1998). This approach uses the Penman Monteith (PM) model as a basis to estimate ET from a variety of plant community types. Though the PM model assumes consistent canopy coverage and well-watered growing conditions, it has been found to be robust to these assumptions and to perform well in natural settings (Souch *et al.* 1998, Hughes *et al.* 2001, Sun and Song 2008). Furthermore, Allen *et al.* (1998) provides guidance to account for such "non-standard" conditions. This approach requires values (either measured or assumed) for the variables itemized in **Table 4**. Except for albedo, the remaining abiotic and biotic data will be measured on an approximately bi-weekly basis from June through August 2012 and 2013, and used to calculate ET (in mm/hr). These ET estimates will be scaled up to the growing season using crop coefficients as described in Allen *et al.* (1998).

The biotic variables itemized in **Table 4** will be measured on the same day across all plots in a block to eliminate the potential for daily weather conditions to confound comparisons of the treatments. Stomatal resistance measurements will be limited to between 10 a.m. and 1 p.m. to evaluate plant physiological activity when it is expected to be most consistent. Additionally, clear, sunny days will be selected in order to facilitate consistent measurements of stomatal resistance.

In-place soil moisture content will be field measured using a TRIME TDR soil moisture meter or similar. Measurements will be taken from the upper 16 cm of soil. These measurements will be collected concurrent with the ET data, on a bi-weekly basis. Soil moisture measurements will provide an indicator as to the ET performance of the vegetation, and provide a data variable to the overall Site water budget. In addition to soil moisture measurements, qualitative observations of surface water runoff will be made for a minimum of three rain events during the pilot study schedule. These observations will be recorded, and used to evaluate whether an increase in vegetative cover significantly impacts surface water runoff on areas of the Site affected by the pilot study.

Photographs of each plot will be taken from permanent photo points prior to application of treatments, and during vegetation cover sampling. Photographs will be taken from consistent vantage points that will be identified at the time of the plot establishment/layout. Photographs will be taken, in succession, over the course of peak traffic (*i.e.*, prior to and during the NY State Fair) on the overflow parking area plots to document geosynthetic material and selected vegetative species performance.

Data Analysis

Mean vegetative cover and ET will be calculated by block and treatment applied. Mean values for each variable will be subjected to an analysis of regression coefficients following procedures documented by Meredith and Stehman (1991) and Cottingham *et al.* (2005). This analysis will facilitate detection of

significant differences among treatments in the variables of interest, and it is well-suited to describing the results performed across a range of conditions (*i.e.*, dose-response studies). Follow-up analyses of the variables in **Table 3,** or responses of particular species and functional groups (described below), will be conducted as necessary.

A qualitative assessment of the performance (in terms of protection of vegetative root mass) and durability of the geosynthetic materials under peak traffic conditions (fall 2011, 2012, and 2013), and subsequent to undergoing a complete season of freeze-thaw cycle (spring 2012 and 2013) will be completed.

DISCUSSION

Rationale for Species Selection in Undeveloped Areas

Species were selected for this study based on two general considerations: ability to tolerate relatively infertile soil conditions, and ability to attain relatively high rates of growth and ecological function. Species with these characteristics are found in fen and alvar plant communities that are native to New York State as well as other stressful communities in the eastern United States (as indicated in **Table 2**).

The overall species list was assembled such that a variety of "functional groups" were included in the study (*i.e.*, warm and cool season grasses, forbs, sedges, legumes, and woody species). Functional groups are groupings of organisms based upon similarities in growth traits, responses to disturbances, or effects on ecosystem processes (Lavorel *et al.* 2002). Observing the response of functional groups (as opposed to individual species) to an experimental treatment facilitates the generation of conceptual knowledge about the underlying, abiotic drivers of ecosystem characteristics and about the types of plant species that perform well given a certain set of conditions. Thereby, the species list is designed to introduce species that should perform well on the Site; however, species are selected such that information may be gleaned from consistent good or bad performance of functional types.

Rationale for Species Selection in Overflow Parking Areas

Species were selected based on trampling tolerance, relatively low stature, fine texture, and inefficient water use (*i.e.*, high ET potential relative to plant stature). See **Table 3**. These criteria were best fit by the cool season grasses targeted in the species mix. Since the Overflow Parking Areas are not intended to be natural areas, strict adherence to native species selection was not pursued. However, the species selected were vetted against invasiveness databases provided by USDA PLANTS (www.plants.usda.gov) such that problematic species were not being selected.

Rationale for Treatment Selection and Focus on Ground Layer Vegetation in Undeveloped Areas

As previously noted, the Site soils consist primarily of Solvay waste and are known to be nutrient deficient (Hewlett 1956, Michalenko 1991). As such, fertilization should spur vegetative development. The treatment series listed in the Methodology section of this Work Plan will provide a dose-response understanding of the fertilizer treatments by using a range of fertilizer rates. This range of fertilizer treatments will assist with developing a recommended application rate for use in the Site-wide FS.

While the overstory vegetation on the Site contributes to substrate cover, stabilization and ET, data collection will focus on the ground layer during the first year of this study, due to the following:

- Ground layer vegetation is usually the first to respond to vegetation management activities (Yorks 2001) and will therefore be a quantifiable indicator of the treatment effectiveness from project initiation
- A focus on ground layer vegetation will capture the relative success of the selected seed mix

- 80% coverage by ground layer vegetation is the standard indicator of substrate stabilization as defined by the NYSDEC in the State Pollutant Discharge Elimination System (SPDES) General Permit for Construction Activities (GP-0-10-001)
- The complexity of ET estimation increases substantially when multiple vegetation layers are considered, and, due to the current overstory sparseness in the areas of interest on the Site, it is expected that the ground layer focus will capture a majority of the ET.

DELIVERABLES

A summary of data and documentation of the methodologies, significant findings, and conclusions of the pilot study will be prepared and incorporated as an appendix of the Site-wide FS for the Wastebeds 1-8 Site. The appendix will include the following:

1. Summaries of vegetative cover, ET, and soil moisture data and analyses
2. Chronological photograph log documenting vegetation development in each plot during the 2011-2013 growing seasons
3. Conclusions/recommendations on cover system approaches for the WB 1-8 Site-wide FS.

HEALTH AND SAFETY

Health and safety procedures will be performed in accordance with the *Wastebed 1 - 8 Health and Safety Plan* (HASP) (O'Brien & Gere 2004). A Job Safety Analysis (JSA) will be completed prior to the initiation of the tasks that are not included in or defined by the HASP. Copies of these documents will be maintained on-Site within the support zone and with each field crew performing the work.

SCHEDULE

A preliminary schedule for the investigation activities is provided as **Figure 4**; however, the actual schedule may vary based on weather conditions.

REFERENCES

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TABLE 1
Honeywell
Wastebeds 1-8 Site
Feasibility Study
Geddes, NY

Summary of Soil Conditions Associated with Solvay Waste and Similar Materials (Adapted from Eallonardo 2010)

Site	Substrate	Age (yrs)	pH	Exchangeable cations (cmol /kg)[a]				Total N (%)	Notes	Reference
				Calcium	Magnesium	Potassium	Sodium			
SSB14, Camillus, NY	Solvay waste	20	8.9					0.05	Pre-planting and fertilizing; barren.	Eallonardo 2010
		22-23	8.4	31	14.2-35.6	0.45	0.16	0.09-0.12	172 spp. in 2.1 ha site post planting and fertilizing, 85 of which were planted or seeded; 7 species classified as Threatened or Endangered in New York State (of 14 planted).	Eallonardo 2010
Jaworzno, Poland	Solvay waste	90	7.5-7.9						136 spp. colonized 2 ha study site; refuge for rare species.	Cohn *et al.* 2001
Witton lime beds, Northwich, UK	Lime waste	16	9.1	15.8	0.2	0.2	0.2		Colonized by rare calciphiles; 67 spp. in 117 m^2 quadrats; salt tolerant species colonizing 16 year old site.	Lee & Greenwood 1976
	Lime waste	40	8.6	10.8	1.4	0	0.1			
	Distiller waste	40	8.7	9.8	0.1	0.1	1			

TABLE 1
Honeywell
Wastebeds 1-8 Site
Feasibility Study
Geddes, NY

Summary of Soil Conditions Associated with Solvay Waste and Similar Materials (Adapted from Eallonardo 2010)

Site	Substrate	Age (yrs)	pH	Exchangeable cations (cmol /kg)[a]				Total N (%)	Notes	Reference
				Calcium	Magnesium	Potassium	Sodium			
Darcy Level, Bolton, UK	Lebalnc waste	80	8-9						42 spp. on 1.6 ha site; 17 of 36 sown species established; aggressive species failed; species that established filled an empty niche.	Ash *et al.* 1994
Wastebeds 1-8, Geddes, NY	Solvay waste	5	10	11.9		0.3	2.5		Barren.	Hewlett 1956
		9	8.2						Old field and *Populus* and *Salix* spp. present (mostly below 2 m height); vegetation cover up to *ca.* 50%.	
		11	7.9	4.0		0.04	0.5			
		13	7.9							
		18	8	2.1		0.02	0.2		Presence of uncommon orchid *Platanthera huronensis* (Nutt.) Lindl. noted.	
		24	8	2.3		0.02	0.1		100% cover; uncommon orchid *Spiranthes cernua* (L.) Rich. present.	
		53	7.7							
		55	7.6	2.3		0.03	0.3			

TABLE 1
Honeywell
Wastebeds 1-8 Site
Feasibility Study
Geddes, NY

Summary of Soil Conditions Associated with Solvay Waste and Similar Materials (Adapted from Eallonardo 2010)

Site	Substrate	Age (yrs)	pH	Exchangeable cations (cmol /kg)[a]				Total N (%)	Notes	Reference
				Calcium	Magnesium	Potassium	Sodium			
		0	11.9	233.1	20.4	0.7	20.6	0.3	Barren	Michalenko 1991
		9	8.2	49.5	8.4	0.9	0.6	0.2	Little change in overall community composition over time, though consistent increase in overall abundance suggested; community dominated by non-native old field species and no rare species reported	
		15	8.2	54.3	8	0.4	0.7	0.2		
		39	7.8	45.3	5.7	0.3	1.2	0.2		
		48	7.4	50.1	4.7	0.4	1	0.3		
		57	7.3	54.2	7.2	1.2	0.7	0.9		
		83	7.4	49.6	5.3	0.8	1.1	0.6		
Cool, humid area region	Typical clay loam surface soil		5-5.5	9	3	1	0.02			Brady & Weil 2002

[a]For cation extraction, Lee & Greenwood (1976) used 0.1N ammonium acetate while the present study and Michalenko (1991) used 1N ammonium acetate. Data presented by Hewlett (1956) were based on a 1:1 soil:water extraction.

TABLE 2
Honeywell
Wastebeds 1-8 Site
Feasibility Study
Geddes, NY

Seed Mix for Cover System Pilot Study in Undeveloped Areas[1]

Species	Common name	Percent of mix	Salinity/alkali tolerance (1 to 10 scale)[2]	Rationale for Inclusion
Panicum virgatum	switchgrass	15.0	7	Cosmopolitan across habitat types (C), Native to Great Lakes alvar grasslands (A)
Elymus canadensis	Canada wild rye	11.5	7	Quick establishment (Q), C
Avena sativa[3]	oats	10.0	4	Cover crop
Agrostis perennans	autumn bentgrass	6.0	6	C
Andropogon gerardii	big bluestem	6.0	6	C, A
Sorghastrum nutans	Indiangrass	6.0	7	Native to NYS fens (F), A, C
Calamagrostis canadensis	bluejoint grass	6.0	6	C
Festuca rubra	red fescue	5.0	8	Q, C
Elymus virginicus	Virginia wild rye	4.0	6	Q, C
Chamaecrista fasciculata	partridge pea	4.0	6	Legume for soil improvement (L)
Agrostis scabra	ticklegrass	4.0	7	Q, C, A
Deschampsia cespitosa	tufted hairgrass	3.0	6	C, A
Sporobolus heterolepis	northern dropseed	3.0	7	A
Eupatorium perfoliatum	bonset	2.0	7	C, A
Bouteloua curtipendula	side oats grama	2.0	6	A

TABLE 2
Honeywell
Wastebeds 1-8 Site
Feasibility Study
Geddes, NY

Seed Mix for Cover System Pilot Study in Undeveloped Areas[1]

Species	Common name	Percent of mix	Salinity/alkali tolerance (1 to 10 scale)[2]	Rationale for Inclusion
Bouteloua gracilis	blue grama	2.0	6	Shortgrass prairie species—highly stress tolerant (S)
Asclepias incarnata	swamp milkweed	1.0	7	F
Asclepias tuberosa	butterfly milkweed	1.0	7	C, A
Carex pensylvanica	Pennsylvania sedge	1.0	6	A
Carex vulpinoidea	fox sedge	1.0	7	F, A
Helianthus maximilianii	Maximilian's sunflower	1.0	5	Q, C
Amorpha canescens	lead plant	0.5	5	C, L
Aronia melanocarpa	black chokeberry	0.5	5	C
Aster lateriflorus	calico aster	0.5	6	C
Betula alleghaniensis	yellow birch	0.5	4	C
Coreopsis lanceolata	lance leaved coreopsis	0.5	5	Tallgrass prairie species—moderately stress tolerant (T)
Dalea purpurea	purple prairie clover	0.5	6	L
Echinacea purpurea	purple coneflower	0.5	5	T
Monarda fistulosa	wild bergamot	0.5	5	T
Platanus occidentalis	American sycamore	0.5	4	Riparian species adapted to variable moisture (R)
Silphium laciniatum	compass plant	0.5	5	T

TABLE 2
Honeywell
Wastebeds 1-8 Site
Feasibility Study
Geddes, NY

Seed Mix for Cover System Pilot Study in Undeveloped Areas[1]

Species	Common name	Percent of mix	Salinity/alkali tolerance (1 to 10 scale)[2]	Rationale for Inclusion
Viburnum lentago	nannyberry	0.5	4	Successional species

[1]The species mix may vary based upon commercial availability of species.

[2] This scale is relative to all vascular plant species that are hardy in Central New York. Scores given based on information provided by Eallonardo (2010), Dickerson *et al*. (2007), and the USDA Plants Database (plants.usda.gov).

[3]This species is not native to the eastern U.S., however it is expected to only have a short term presence as a cover crop while the other species in the mix establish on Site.

TABLE 3
Honeywell
Wastebeds 1-8 Site
Feasibility Study
Geddes, NY

Seed Mix for Cover System Pilot Study in Overflow Parking Areas[1]

Species	Common name	Percent of mix	Rationale for Inclusion
*Agrostis alba**	redtop	30	Sod forming (S), Tolerant of varied moisture levels (T)
Festuca rubra	red fescue	30	S, T
*Agrostis stolonifera**	creeping bentgrass	25	S, T
Sporobolus asper	rough dropseed	10	T
Elymus villosus	silky wild rye	5	T

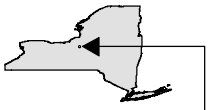
* Not native to the Northeastern United States, but widely naturalized and not considered an invasive species

TABLE 4
Honeywell
Wastebeds 1-8 Site
Feasibility Study
Geddes, NY

Variables to be Measured/Assumed and Used in the Penman Monteith Model Following Allen *et al.* (1998)

Type	Variable	Units	Measurement approach/Assumption
Biotic	Leaf area index (LAI)	m^2/m^2	Bi-weekly LAI 2000 measurement in sub-plots. Because the upper canopy is the relatively "active" portion of the plant canopy, Allen *et al.* (1998) suggests dividing in half field measurements of LAI, otherwise overestimates of ET may occur.
	Canopy height	m	Bi-weekly meter stick measurement in sub-plots.
	Stomatal resistance	s/m	Bi-weekly porometer (Decagon SC-1) measurement in sub-plots. Leaves will be selected to represent the dominant species in each sub-plot. Well-lit, mature, upper canopy leaves will be selected.
	Canopy albedo	Unitless	Assumed to be 0.23.
Abiotic	Net radiation	$MJ/m^2/hr$	Abiotic data will be collected from a weather station on Settling Basins 12-15. This weather station is preferred to others on the waste beds due to its ability to measure net radiation.
	Temperature	°C	
	Relative humidity	%	
	Wind speed	m/s	

ADAPTED FROM: SYRACUSE WEST, NY USGS QUADRANGLE



QUADRANGLE LOCATION

HONEYWELL
WASTEBEDS 1 - 8
GEDDES, NEW YORK

SITE LOCATION

N

0 1,000 2,000 4,000 6,000 8,000

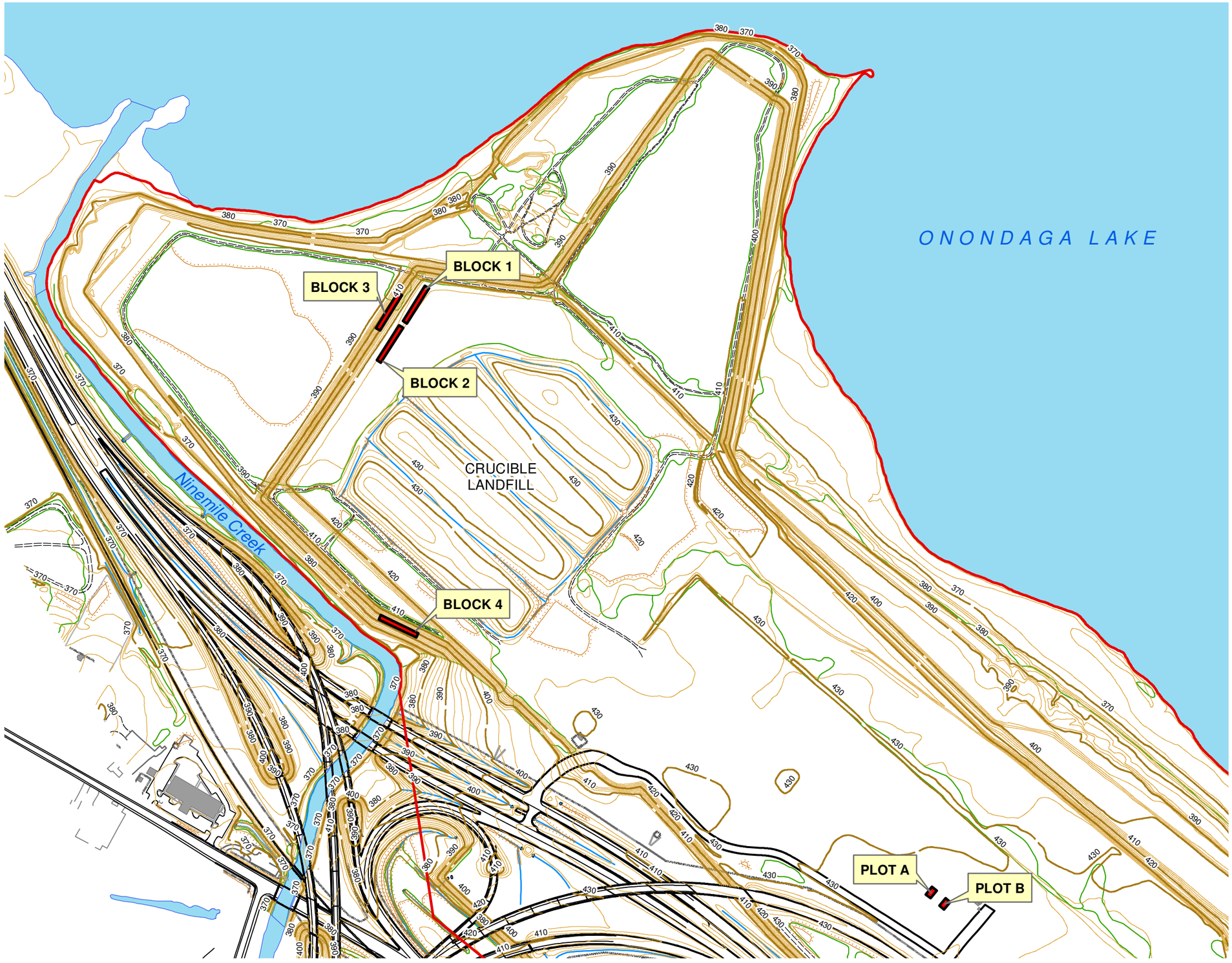
Feet

February 2011
1163.45176

1:24,000

O'BRIEN & GERE

FIGURE 2



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LEGEND

SITE

HONEYWELL
WASTEBED 1-8
FEASIBILITY STUDY
GEDDES, NEW YORK

COVER SYSTEM PILOT STUDY: APPROXIMATE LOCATION OF EXPERIMENTAL BLOCKS

EXPERIMENTAL BLOCK SIZE IS APPROXIMATE

0 150 300 600
Feet

MAY 2011
1163.45176

O'BRIEN & GERE

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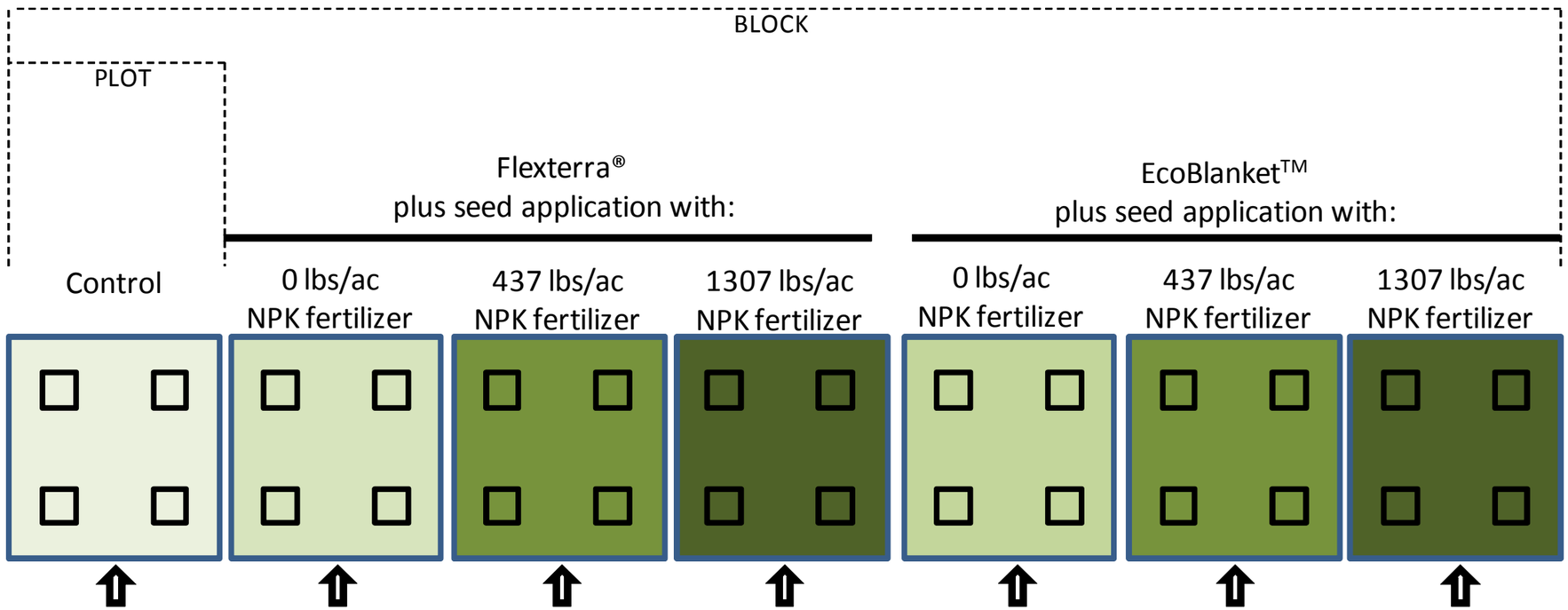
FIGURE 3



Legend/Notes:

Each treatment plot is 400 ft^2 (20x20 ft.)

= Vegetation monitoring sub-plot. 4 per plot; 11 ft^2 ea.

= Established photo monitoring points

HONEYWELL
WASTEBED 1-8
FEASIBILITY STUDY
GEDDES, NEW YORK

COVER SYSTEM PILOT STUDY BLOCK, PLOT, AND SUB-PLOT LAYOUT

JANUARY 2011
1163.45176

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PLOT DATE: 02/10/11 10:29:38 AM MillerMR

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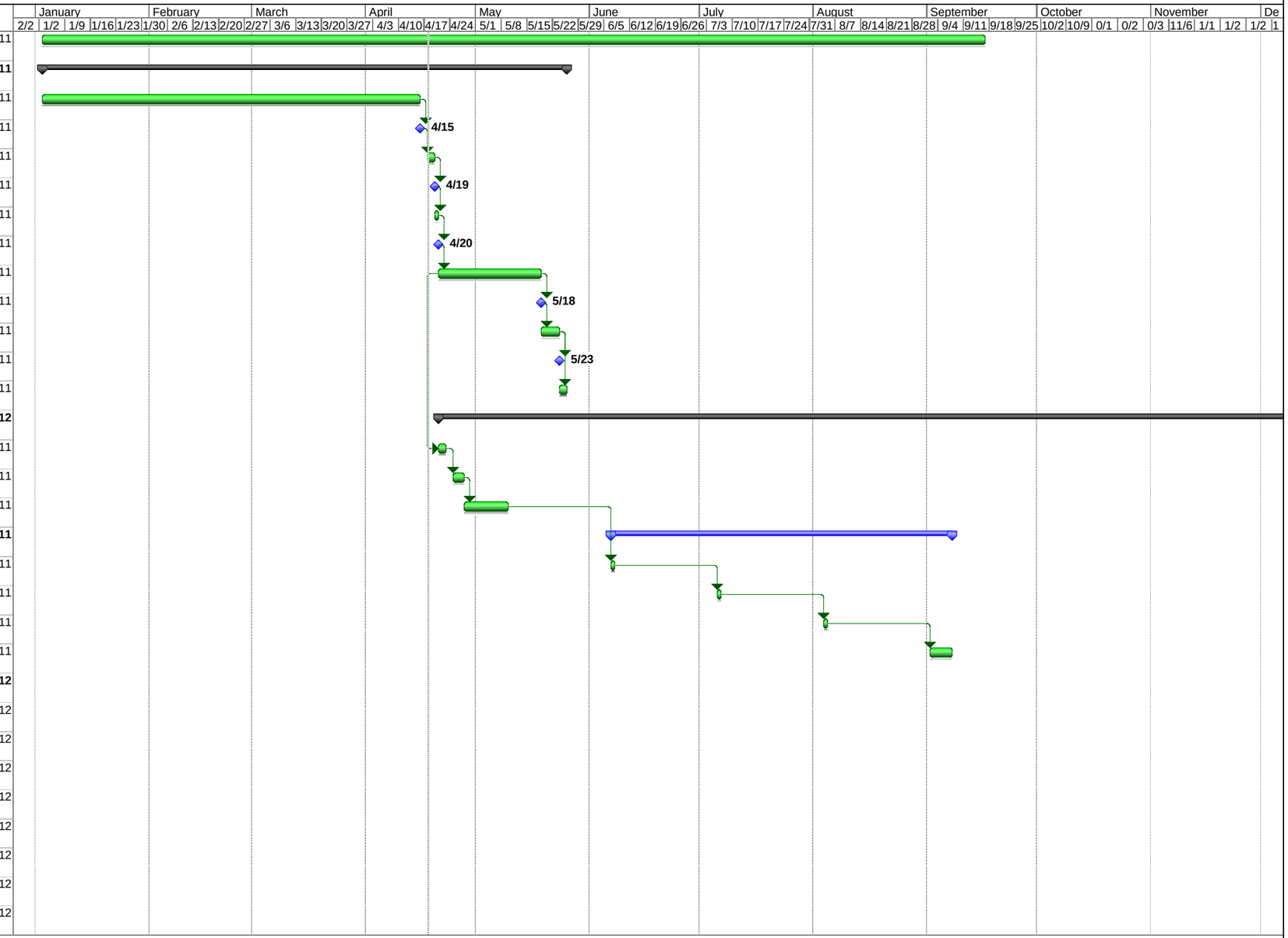
Cover System Pilot Study Schedule **Figure 4**

ID	Task Name	Duration	Start	Finish
1	**Cover System Pilot Study**	185 days	Mon 1/3/11	Fri 9/16/11
2	***Work Plan Preparation/Submittal***	**103 days**	**Mon 1/3/11**	**Wed 5/25/11**
3	Develop Draft Work Plan	75 days	Mon 1/3/11	Fri 4/15/11
4	Submit Draft Work Plan to Honeywell for Review	0 days	Fri 4/15/11	Fri 4/15/11
5	Honeywell Review of Draft Work Plan	2 days	Mon 4/18/11	Tue 4/19/11
6	Honeywell Comments due on Draft Work Plan	0 days	Tue 4/19/11	Tue 4/19/11
7	Incorporate Comments and Produce Draft Work Plan	1 day	Wed 4/20/11	Wed 4/20/11
8	Submit Draft Work Plan to NYSDEC for Review	0 days	Wed 4/20/11	Wed 4/20/11
9	NYSDEC Review of Draft Work Plan	20 days	Thu 4/21/11	Wed 5/18/11
10	Receive NYSDEC Comments on Draft Work Plan	0 days	Wed 5/18/11	Wed 5/18/11
11	Incorporate NYSDEC Comments into Work Plan	3 days	Thu 5/19/11	Mon 5/23/11
12	Resubmit Work Plan to NYSDEC	0 days	Mon 5/23/11	Mon 5/23/11
13	NYSDEC Final Review / Issue Approval of Work Plan	2 days	Tue 5/24/11	Wed 5/25/11
14	***Implementation of Cover System Pilot Study***	**344 days**	**Thu 4/21/11**	**Tue 8/14/12**
15	Scoping and Layout of Test Blocks/Plots	2 days	Thu 4/21/11	Fri 4/22/11
16	Documentation of Initial Conditions	3 days	Mon 4/25/11	Wed 4/27/11
17	Application of Treatments	8 days	Thu 4/28/11	Mon 5/9/11
18	Progressive Vegetation Monitoring/Documentation	**67 days**	**Tue 6/7/11**	**Wed 9/7/11**
19	Data Collection - Field Visit	1 day	Tue 6/7/11	Tue 6/7/11
20	Data Collection - Field Visit	1 day	Wed 7/6/11	Wed 7/6/11
21	Data Collection - Field Visit	1 day	Thu 8/4/11	Thu 8/4/11
22	Data Collection - Field Visit	4 days	Fri 9/2/11	Wed 9/7/11
23	*Evapotranspiration Evaluation/Data Collection*	**51 days**	**Tue 6/5/12**	**Tue 8/14/12**
24	Data Collection - Field Visit	1 day	Tue 6/5/12	Tue 6/5/12
25	Data Collection - Field Visit	1 day	Tue 6/19/12	Tue 6/19/12
26	Data Collection - Field Visit	1 day	Tue 7/3/12	Tue 7/3/12
27	Data Collection - Field Visit	1 day	Tue 7/17/12	Tue 7/17/12
28	Data Collection - Field Visit	1 day	Tue 7/31/12	Tue 7/31/12
29	Data Collection - Field Visit	1 day	Tue 8/14/12	Tue 8/14/12
30	Final Data Evaluation	30 days	Mon 9/3/12	Fri 10/12/12
31	Report Appendix Development	30 days	Mon 10/15/12	Fri 11/23/12



Project: Cov Sys Pilot Schedule-rev2.m
Date: Mon 4/18/11

Task Milestone Summary

Cover System Pilot Study Schedule **Figure 4**

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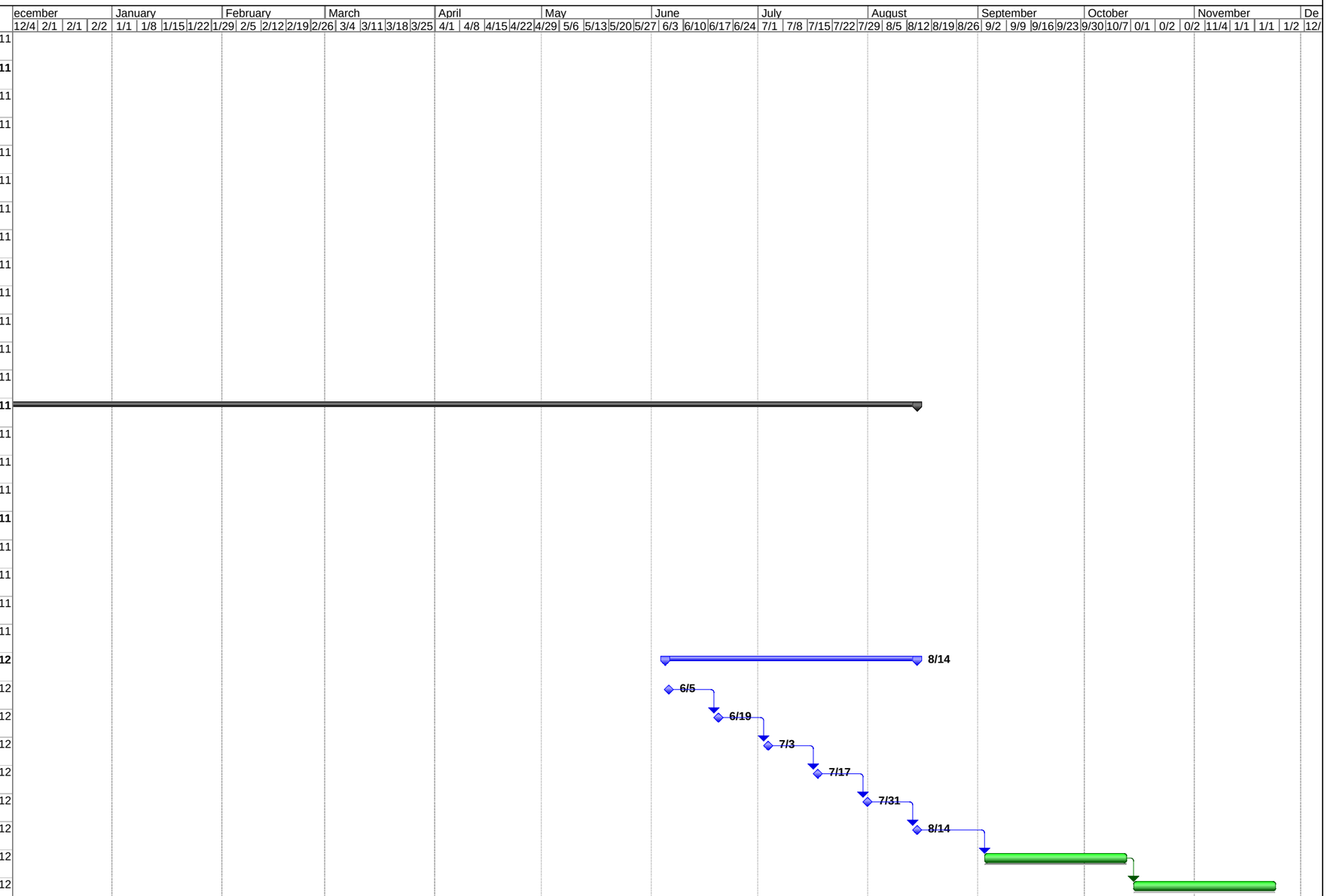


Project: Cov Sys Pilot Schedule-rev2.m
Date: Mon 4/18/11

Task Milestone Summary

EXHIBIT A

PRESTO GEOSYSTEMS

GEOBLOCK®5150 SPECIFICATION

Table 1 Geoblock®5150 Porous Pavement Unit

Item	Specifications & Details
Material	Up to 97% Recycled Polyethylene*
Color	Ranges from dark shades of gray to black
Chemical Resistance	Superior
Carbon Black for Ultraviolet Light Stabilization	1.5% - 2.0%
Unit Minimum Crush Strength @ 21°C (70°F)	2,900 kPa (420 psi)
Material Flexural Modulus at 23°C (73°F)	240,000 kPa (35,000 psi)
Nominal Dimensions (width x length)	0.50 m x 1.00 m (20 in x 40 in)
Nominal Unit Depth	50 mm (2 in)
Nominal Coverage Area	0.50 m² (5.38 ft²)
Cells per Unit	72
Cell Size	79 mm x 81 mm (3.1 in x 3.2 in)
Top Open Area per unit	87%
Bottom Open Area per unit	41%
Interlocking offset tabs	12 tabs per meter (40 in)
Nominal Weight per Unit	4.0 kg (9.0 lb)
Runoff Coefficient @ 63.5 mm/hr (2.5 in) Rainfall	(.15)
Units per Pallet	50

* The percentage of recycled content may vary depending on availability of recycled materials.

NOTE: Dimensions and weight are subject to manufacturing tolerances and are influenced by recycled component characteristics.

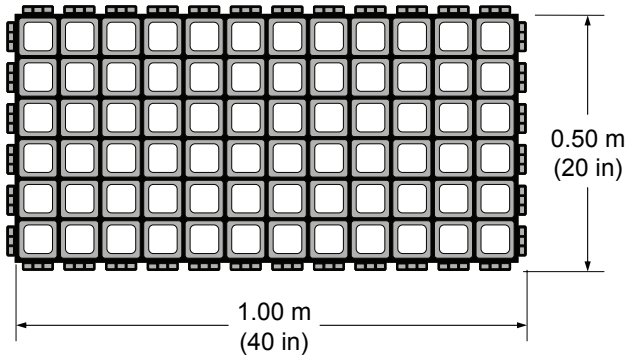


Figure 1 The Geoblock5150 Unit

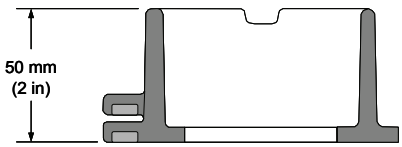


Figure 2 The Geoblock Cell and Interlocking Offset Tab

PRESTO GEOSYSTEMS
670 N PERKINS STREET, APPLETON, WISCONSIN, USA 54914
Ph: 920-738-1328 or 800-548-3424 ■ Fax: 920-738-1222
e-mail: INFO@PRESTOGEO.COM WWW.PRESTOGEO.COM

JUNE 1, 2008

Table 2 Base Recommendations for the Geoblock®5150 Unit

Load Description[1]	*Depth of Engineered Base*	
	CBR[2] *2 – 4*[3]	*CBR*[2] *> 4*[3]
Heavy Fire Truck Access & H-20 loading. Typical 758 kPa (110 psi) maximum tire pressure. Single axle loadings of 145 kN (32 kip), tandem axle loadings of 220 kN (48 kip). Gross vehicle loads of 36.3 tonne (80,000 lb). Infrequent passes[4].	150 mm (6 in)	100 mm (4 in)
Light Fire Truck Access & H-15 loading. Typical 586 kPa (85 psi) maximum tire pressure. Single axle loadings of 110 kN (24 kip). Gross vehicle loads of 27.2 tonne (60,000 lb). Infrequent passes[4].	100 mm (4 in)	50 mm (2 in)
Utility & Delivery Truck Access & H-10 loading. Typical 414 kPa (60 psi) maximum tire pressure. Single axle loadings of 75 kN (16 kip). Gross vehicle loads of 18.1 tonne (40,000 lb). Infrequent passes[4].	50 mm (2 in)	50 mm (2 in)
Cars & Pick-up Truck Access. Typical 310 kPa (45 psi) maximum tire pressure. Single axle loadings of 18 kN (4 kip). Gross vehicle loads of 3.6 tonne (8,000 lb). Infrequent passes[4].	None	None
Trail Use. Loading for pedestrian, wheelchair, equestrian, bicycle, motorcycle and ATV traffic.	None	None

[1] The Geoblock system can be applied in areas where loading is greater than those listed above. In these situations, call Presto Geosystems or an authorized Presto Geosystems' representative for specific recommendations.

[2] CBR is the abbreviation for California Bearing Ratio. Methods for determining CBR vary from more sophisticated laboratory methods to simple field identification methods that use hand manipulation of the soil. Alcoa does not recommend one method over the other, however, the user must have a high degree of confidence in the results produced by the chosen method.

[3] If other-than-CBR soil strength values exist, use available correlation charts to relate the value to CBR.

[4] Infrequent passes is defined as the number of passes over any period of time that causes no lasting damage to the vegetation. This number will be a function of vegetation type and age, climatic conditions, and maintenance practices. This number is not a function of the Geoblock material.

product specifications

SYNTEC GEOSYNTHETICS

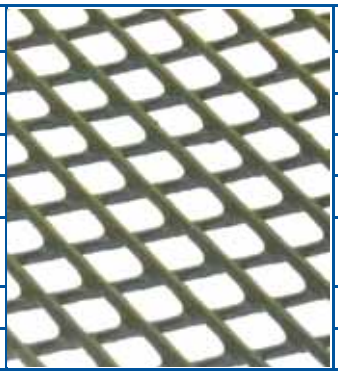
EXHIBIT B

GRASS PROTECTION MESH

FEATURING TENAX GP

Tenax Grass Protection (GP) is a high density polyethylene mesh designed for protecting and reinforcing grassed areas to be used by lightweight vehicles. Once established, Tenax GP will protect the grass roots from damage and help prevent wheel rutting. Due to its unique design, Tenax GP proves to be extremely flexible and provides a visually pleasant and stable surface structure

Product Description	Diamond Mesh Ground Protection Fence				
Polymer	HDPE				
Stabilizer	UV Stabilizer 2 yr min				
Color	Green				
Packaging	Rolls secured with clear tape				
	ENGLISH			METRIC	
Mesh Size MD x TD	1 1/8" x 3/4"			28 mm x 20 mm	
Roll					
• Size	6.7'x 60'			2.04 m x 18.3 m	
• Weight	165 lbs			75 kg	
TENSILE STRENGTH* (ASTM D 4595)	MD	TD		MD	TD
• Breakage Strength	890 lbs/ft	450 lbs/ft		13,000 N/m	6,570 N/m
• Breakage Strain	>20%	>85%		>20%	>85%



MD: Machine Direction
TD: Transverse Direction

*TEST METHOD: ASTM D 4595 modified with a strain rate of 2"/min
The above values are typical values. Values are subject to change without notice due to product modification and/or improvements at TENAX's discretion.

Manufactured by Tenax Corporation, 4800 E. Monument Street, Baltimore, MD 21205; represented exclusively by SynTec, LLC.

SYNTEC
GEOSYNTHETICS EVOLVED

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www.synteccorp.com

04/20/2010