Addendum to the Howard Township Properties; Nonmetallic Mining Reclamation Plan; Northern Sands, LLC; Howard Township; Chippewa County, Wisconsin.

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1.0 Introduction

The following document is an addendum to the Albertville Valley Mine reclamation plan submitted to Chippewa County Land Conservation and Forest Management Department ("The County") titled *Howard Township Properties; Nonmetallic Mining Reclamation Plan; Northern Sands, LLC; Howard Township; Chippewa County, Wisconsin* ("The Plan")**.** On June 17th, 2015 The County approved the reclamation plan as a "Public Hearing Draft." Following the public hearing on July 29th 2015, The County asked that detail be added to the reclamation plan to add clarity to the sections of the plan addressing Intermittent Mining, Reclamation of the Wash Plant/Transload Area, Soil and Vegetative Management, and Criteria for Successful Reclamation. Each of these topics are addressed in the following pages of this report.

2.0 Intermittent Mining

In the event of intermittent cessation of mining operations, the Operator and Site Manager will implement provisions to monitor and manage open mining and processing areas within the mine site in alignment with the Best Management Practices that will be utilized during regular operations. The focus of activities during these events will include maintenance of financial assurance, stormwater systems, erosion controls, stockpiles, and monitoring of open mining areas. If systems failures occur during an intermittent mining period (i.e. structural failures of storm water ponds or conveyances, major erosion control failures with sediment deposition off site or into surface waters) The County will be notified within 24-hours of the observed failure.

Financial Assurance

The Operator will maintain financial assurance during periods of intermittent mining operations for all disturbed areas of the mine site that have not been reclaimed.

Stormwater Management

Wet ponds and infiltration basins will be visually inspected monthly and within 24-hours of precipitation events ≥ 0.5 inches in order to ensure that basin volumes are supplying adequate storage for stormwater runoff. During the inspection, data will be recorded from staff gages within infiltration basins and infiltration rates will be calculated. In the event that the expected infiltration rate in any given basin decreases, the Site Manger and Operator will work with The County to implement changes to increase the infiltration rates back to the original prescribed levels. Pipes, weirs, channel inlets, skimmer grates, and spillways will also be inspected to ensure that they are free from any blockage. Sediment will be removed from these areas as necessary. Wet pond water quality inspections will be conducted quarterly (i.e. Wisconsin Department of Natural Resources Quarterly Visual Inspection – Field Sheet Form 3400-176A). Diversion channels, man-made swales, and culverts will also be inspected quarterly to ensure they are free from blockage and/or adequately vegetated to control water flow on-site. Records of inspections and measurements from staff gauges will be submitted to The County within the annual site report or at a greater frequency upon written request.

Erosion Control

Erosion controls will be inspected quarterly and within 24-hours of precipitation events ≥0.5 inches. Required maintenance will be implemented within 2-weeks of observed erosion controls requiring re-application, refinement, and/or replacement. Disturbed areas requiring vegetation maintenance will be stabilized in accordance with Section 2.6 of The Plan. All observations documented during inspections

will be recorded and submitted to The County within the annual site report or at a greater frequency upon written request.

Inspections will included observations of the following controls:

- Erosion bales in swales and ditches.
- Silt fencing installed at the edges of berms, stockpiles, and outside of the active mine area.
- Seed and mulch applied on berms, stockpiles, diversion channels, and open (i.e. exposed sandstone) and inactive areas of the mine.
- Erosion matting on slopes and other concentrated flow areas.
- Rock rip-rap used as ditch checks, channel liners, and at inlet/outlet structures.
- Stone tracking pads at site access points.

Stockpile Management

Mining and reclamation will be conducted contemporaneously in such a manner that stockpiling of sand on-site will be minimal. Any temporary or intermittent stockpiles on-site will be processed and stored during any intermittent mining periods. Raw product stockpiles will either be processed and stored, or re-shaped/re-positioned into smaller piles in such a manner that potential runoff is minimized. Any piles and berms remaining on-site during interim mining periods will be inspected quarterly and within 24-hours of precipitation events ≥0.5 inches to ensure mulching and or vegetated areas are sufficiently covered such that any runoff from these areas is minimized. All observations will be recorded and submitted to The County within the annual site report or at a greater frequency upon written request.

3.0 Reclamation of the Wash Plant and Transload Area

Processing equipment located in the *Wash Plant/Transload Area* and *Rail Yard* (as noted on Figure 11 of The Plan) includes the wash plant, dry plant, storage barns, and any other equipment utilized in sand processing operations ("The Sand Processing and Transload Facilities"). Following the completion of mining activities, The Sand Processing and Transload Facilities will be managed in accordance with Section 3.1 of The Plan. The Operator, prior to selling or transferring ownership of land parcels associated with The Sand Processing and Transload Facilities to a new owner, will have a Phase I Environmental Site Assessment completed. The Operator will also remedy any issues identified in the Phase I Assessment that are Recognized Environmental Conditions as defined in the ASTM Standard in place at the time. The Operator also understands that a Business Development Plan must be submitted to The County by the new commercial owner/operator of the land parcels associated with the Sand Processing and Transload Facilities prior to any sale or transfer of said lands. If The Sand Processing and Transload Facilities are closed and not re-purposed for commercial use for 60 consecutive months after all mining and reclamation has been completed, the associated infrastructure will be removed from the site. This area would then be reclaimed to wildlife habitat planted to native prairie in accordance with Section 4.0 of this report: *Addendum to the Reclamation Plan for the Northern Sands Albertville Valley Nonmetallic Mine Howard Township; Chippewa County, Wisconsin.*

4.0 Addendum to the Reclamation Plan for the Northern Sands Albertville Valley Nonmetallic Mine Howard Township; Chippewa County, Wisconsin.

See following pages.

ADDENDUM
to the
Reclamation Plan for the Northern Sands
Albertville Valley Non-Metallic Mine
Howard Township
Chippewa County, Wisconsin

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APPLIED ECOLOGICAL SERVICES

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1.0 INTRODUCTION

The collection and organization of information and processes contained in this addendum are specific to the designated post mining land use of Conservation for the proposed Albertville Valley non-metallic mine located in Howard Township, Chippewa County Wisconsin. The conservation land use further delineates the site as woodland and prairie plant communities suitable for wildlife habitat. The reclamation, management, and monitoring plan to meet that objective, as laid out in this addendum, may also serve as a broader template for future non-metallic mining activity. This document is intended to be a direct and regular reference for land managers and regulators alike; therefore, the content and format have been customized to meet not only deliverables for the Red Flint Group on behalf of Northern Sands LLC, but also specific requirements of the Chippewa County Department of Land Conservation & Forest Management. This addendum then is intended to provide the operator with a specific set of recommendations for ecological reclamation, aid the regulator in reclamation assessment and evaluation, and contribute to the conservation of Wisconsin's Western Ridges and Coulees Ecological Landscape.

1.1 Site Background and Land Use History

The Albertville Valley nonmetallic mine site is an approximately 1,300-acre site located in Howard Township, Chippewa County, Wisconsin. The site, lying within the Chippewa River basin, is situated in Wisconsin's Western Coulee and Ridges Ecological Landscape (WDNR 2005). All of Chippewa County was glaciated many times during the Pleistocene Epoch. Elevations range from 790 feet to 1540 feet; local relief is generally between 30 feet and 200 feet. The high relief predominately Cambrian sandstone upland is underlain by fine to coarse-grained sandstone and topped with a smear of loess or loamy sediment. The area consists of deep stream valleys and steep slopes; areas of River Falls and Copper Falls outwash units, consisting of rock outcrops and variably thick highly weathered sediments, are also present (Syverson, WGNHS Bulletin 103, 2007).
The natural divisions of Wisconsin, as determined by amalgamating the bedrock geology, glacial deposits, geomorphic landforms, Aeolian silt and sand deposits, presettlement vegetation, and soils, correspond well to habitat types and their distribution. The dominant land cover types in the immediate vicinity of the Albertville Valley nonmetallic mine site are southern dry/dry-mesic forest and on better soils, agriculture which is predominated by the typical corn, soybean and alfalfa rotation along with areas of pasture. The loess and sandy loam soils historically supported presettlement vegetation including oak savanna, oak openings, southern dry/dry-mesic forest, river bottom forest, and pure stands of prairie. Pine and oak barrens were habitat community types present on a range of sites. Shortly after settlement, many of the fire-adapted and fire-dependent forest, prairie, and barrens communities suffered from wildfire suppression; historic logging activities and modern practices have further altered the remaining forest types. Current individual stands within the proposed mining site vary greatly as a result of these differences in disturbance and the availability of once prevalent seed sources. White oak and red maple are reproducing most successfully on dry and dry-mesic sites while jack pine and red pine show little natural regeneration. Scattered prairie remnants persist here and there around the site, especially on sandy and loamy soils over outwash sands (Kotar, 1996).

2.0 EXISTING LAND COVER

Fall 2015, AES ecologists conducted a rapid ecological site assessment of representative areas within the proposed 1,300+acre Albertville Valley nonmetallic mine site. The field assessment, supplemented with land use and reclamation information gathered from others, revealed three major ecological plant communities within the property; southern dry/dry-mesic forest, dry prairie, and jack pine barrens. Surrounding these natural communities, agricultural fields, pastureland, fallow fields and conifer plantations were observed. Ecological site condition summaries and assessments by community type are presented below.

2.1 Prairie and Jack Pine Remnants

At least two areas within the 1,300 acre Albertville Valley site are currently bona fide prairie remnants. Table 1 lists species identified in these areas. A prairie remnant adjacent to County N in the Phase II area is composed of big blue stem, Indian grass and little blue stem interspersed with various shrubs such as hazel nut, New Jersey tea and gray dogwood along with oak seedlings and saplings. Several native dry prairie forbs found here include purple prairie clover, alum root, black eyed Susan, bergamot, stiff goldenrod, showy goldenrod and prairie bush clover. Invasive plant species such as spotted knapweed, European brome grass and blue grass (*Poa* spp.) are found in various concentrations. The soil parent material is loamy sand and sand over sandstone bedrock; excessively drained with very low available water in the shallow soil profile.

Another prairie remnant, bisected by an electric power transmission line corridor and located in the Phase III area of the mining plan, supports a regenerating jack pine barrens community. This area is dominated by the prairie grass little bluestem with occasional occurrences of big bluestem and poverty oats grasses. Forbs are widely dispersed with low density and include prairie bush clover, pussy toes, and showy goldenrod. The soil parent material on the upper slopes is loamy sand and sand over gravel or sandstone bedrock; excessively drained with very low available water in the soil profile. The parent material on the lower more level area is loam over loamy sand outwash; well drained with moderate to moderately high available water in these deeper soil profiles

Table 1. Plant Species observed in Prairie Remnants and Jack Pine Barrens at the Albertville Valley non-metallic mine site Chippewa Co., WI

C	SCIENTIFIC NAME	COMMON NAME	W	WETNESS	PHYSIOG.
4	*Andropogon gerardii*	big bluestem grass	1	FAC-	Nt P-GRASS
4	*Andropogon scoparius*	little bluestem grass	4	FACU-	Nt P-GRASS
3	*Antennaria plantaginea*	plantain leaf pussy toes	5	UPL	Nt-P-FORB
	Artemisia sp	worm wood	5	UPL	Nt-P-FORB
3	*Artemisia ludoviciana*	wild sage	5	UPL	Ad P-FORB
8	*Asclepias syriaca*	common milkweed	5	UPL	Nt P-FORB
8	*Aster azureus*	sky-blue aster	5	UPL	Nt P-FORB
6	*Aster laevis*	smooth blue aster	5	UPL	Nt P-FORB
4	*Danthonia spicata*	poverty oat grass	5	UPL	Nt P-GRASS
5	*Lechea sp*	Pin wheel	5	UPL	Nt-P-FORB
5	*Lespedeza capitata*	round-headed bush clover	3	FACU	Nt P-FORB
3	*Monarda fistulosa*	wild bergamot	3	FACU	Nt P-FORB
1	*Oenothera biennis*	common evening primrose	3	FACU	Nt B-FORB
10	*Panicum leibergii*	prairie panic grass	2	FACU+	Nt P-GRASS

C	SCIENTIFIC NAME	COMMON NAME	W	WETNESS	PHYSIOG.
9	*Petalostemum purpureum*	purple prairie clover	5	UPL	Nt P-FORB
4	*Ratibida pinnata*	yellow coneflower	5	UPL	Nt P-FORB
4	*Rudbeckia hirta*	black-eyed Susan	3	FACU	Nt P-FORB
5	*Solidago rigida*	stiff goldenrod	4	FACU-	Nt P-FORB
5	*Solidago speciosa*	showy goldenrod	5	UPL	Nt P-FORB
5	*Sorghastrum nutans*	Indian grass	2	FACU+	Nt P-GRASS

C – Coefficient of Conservation. Assigned values range from 0-10 and represent how likely a plant is to found in a remnant versus disturbed community. 1 is for natives that are very tolerable of disturbance and 10 is for a native that is typically only found in remnant communities.

W – Coefficient of Wetness. The numbers correlate with the wetness ratings (OBL - Obligate, FACW – Facultative Wet, FAC - Facultative, FACU – Facultative Upland, UPL - Upland) and include the + and – (+being more wet). (OBL = -5, FAC = 0, & UPL = 5, with a gradient in between).

2.2 Southern Dry or Dry Mesic Forest

These natural forest communities represent the oak cover type found on dry, especially sandy, sites. White oak, black oak, and white oak are the dominants. Shrubs are well-developed and diverse. Sites with special ecological significance are those greater than 100 years old with numerous standing and fallen dead trees. Historically, these forest communities were the common woodland type in western Wisconsin prior to fire suppression in the 1800's. White-tailed deer, wild turkey, and numerous species thrive in these woodlands. Both cold and warm season forage and bedding areas exist for deer while food, cover, and nesting areas are present for wild turkey.

Based upon our onsite investigations, we believe that the reclamation of this habitat will reestablish and maintain native wildlife abundance and diversity by providing enhanced habitat, especially if competing species, particularly forest invasive species are controlled. With significant acreage of dry and dry mesic forests, dynamic topography, remnant plant and animal communities and dominant soil types (sands and loams) in the upland areas, the Albertville Valley site is a prime location to consider dry and dry mesic woodland reclamation. The dearth of naturally occurring wildfire has left forest areas over stocked and invaded by more mesic species such as red and sugar maple.

Three dry or dry mesic forest areas of various size and composition were evaluated. Oak regeneration was abundant in the forest areas. The dominant canopy species in the forest are red, white, and black oak (occasional northern pin oak was observed). Hazelnut and bigtooth aspen were common and frequent and often in moderate densities, the latter species abundance is due to relatively recent logging. Many of the dry and dry mesic forest remnants have invasions of the shade-tolerant red and sugar maple in the understory. Sugar maple is often the most common understory tree in successional dry mesic forest in the Midwest, but here, perhaps due to nutrient poor and drier soils, red maple has assumed more of a role in some stands. The shading affect of maple has reduced the shrub and herb layer in places, especially when compared to previous data gathered by Curtis (1959). The prevalent herbaceous species in these 2015forest studies are bracken fern and low bush blueberry, big-leaf aster, and Pennsylvania sedge (Table 2). Several species are moderately common, such as Indian pipe and northern bush honeysuckle; which are quite shade tolerant. Hazelnut is present but in low densities. Occasional species found were bur oak, poverty oat grass, and large pussytoes, all of which are open canopied woodland areas with some shade tolerance. As a whole, the diversity of herbaceous and shrub layer species in the dry or dry mesic forest remnants is low, especially when compared to the data collected previously by Curtis (1959).

The dry and dry mesic forests present on the Albertville Valley mine site, on the whole, are in a state of flux, succeeding to a more mesic condition. This is mainly a result of the absence of fire and herbivory which has resulted in a more closed canopy and the accumulation of organic material (duff layer) that retains moisture. Organic material on the forest floor would be reduced if the historic fire regime were present. Red and sugar maple invasion into the understory and small-sized tree category was evident in most forest areas in all three proposed mining Phase areas. The rather low species diversity, lack of several open-forest species with lower shade tolerance, and invasion by blackberry and other native and non-native woody understory species indicate moderate floristic quality. An encouraging find was several areas sufficiently open (or historically open) to permit oak reproduction and a number of mature oaks were present and displayed an open growth form as evidenced by dead lower lateral branching.

Table 2. Plant Species Observed in 2015 within Southern Dry/ Dry Mesic Forest Habitats at the Albertville Valley property, Chippewa Co., WI

C	SCIENTIFIC NAME	COMMON NAME	W	WETNESS	PHYSIOG.
0	*Acer negundo*	box elder	-2	FACW-	Nt TREE
3	*Acer rubrum*	red maple	0	FAC	Nt TREE
7	*Adiantum pedatum*	maidenhair fern	1	FAC-	CRYPTOGAM
4	*Andropogon scoparius*	little bluestem grass	4	FACU-	Nt P-GRASS
3	*Antennaria plantaginifolia*	pussy toes	5	UPL	Nt P-FORB
5	*Aquilegia canadensis*	wild columbine	1	FAC-	Nt P-FORB
4	*Aster macrophyllus*	big-leaved aster	5	UPL	Nt P-FORB
3	*Betula papyrifera*	paper birch	2	FACU+	Nt TREE
5	*Corylus americana*	American hazelnut	4	FACU-	Nt SHRUB
2	*Cornus racemosa*	gray dogwood	-2	FACW-	Nt SHRUB
3	*Carex pensylvanica*	common oak sedge	5	UPL	Nt P-SEDGE
4	*Danthonia spicata*	poverty oat grass	5	UPL	Nt P-GRASS
8	*Dryopteris spinulosa*	spinulose shield fern	-2	FACW-	CRYPTOGAM
4	*Juncus effusus*	common rush	-5	OBL	Nt P-FORB
2	*Populus tremuloides*	quaking aspen	0	FAC	Nt TREE
3	*Prunus serotina*	wild black cherry	3	FACU	Nt TREE
2	*Pteridium aquilinum latiusculum*	bracken fern	3	FACU	CRYPTOGAM
7	*Quercus alba*	white oak	0	FAC	Nt TREE
5	*Quercus macrocarpa*	bur oak	1	FAC-	Nt TREE
5	*Quercus rubra*	red oak	3	FACU	Nt TREE
5	*Quercus velutina*	black oak	5	UPL	Nt TREE
*	*RHAMNUS CATHARTICA*	common buckthorn	3	FACU	Ad SHRUB
2	*Rubus allegheniensis*	common blackberry	2	FACU+	Nt SHRUB
2	*Rubus occidentalis*	black raspberry	5	UPL	Nt SHRUB
1	*Solidago canadensis*	Canada goldenrod	3	FACU	Nt P-FORB
5	*Solidago speciosa*	showy goldenrod	5	UPL	Nt P-FORB
2	*Urtica procera*	tall nettle	-1	FAC+	Nt P-FORB
4	*Vaccinium angustifolium*	early low blueberry	3	FACU	Nt SHRUB
*	*VERBASCUM THAPSUS*	common mullein	5	UPL	Ad B-FORB
7	*Viburnum acerifolium*	Maple leaf arrow leaf	X	UPL	Nt SHRUB

C – Coefficient of Conservation. Assigned values range from 0-10 and represent how likely a plant is to found in a remnant versus disturbed community. 1 is for natives that are very tolerable of disturbance and 10 is for a native that is typically only found in remnant communities.

W – Coefficient of Wetness. The numbers correlate with the wetness ratings (OBL - Obligate, FACW – Facultative Wet, FAC - Facultative, FACU – Facultative Upland, UPL - Upland) and include the + and – (+being more wet). (OBL = -5, FAC = 0, & UPL = 5, with a gradient in between)

Scientific Name in ALL CAPS is Adventive/Non-native Species

3.0 RECLAMTION PLANT COMMUNITIES

A combination of prairie, southern dry or dry mesic forest, oak openings (Savanna) and Jack pine barrens historically occupied the Albertville Valley non-metallic mine property. These four communities are proposed to be restored as part of the Albertville Valley non-metallic mine reclamation effort.

Post Mining Land Use

Conservation Lands (may include the possibility of limited working lands forest production in the future as a means of habitat management and for revenue). Land Cover Types/Plant Communities – woodland, savanna, barrens, prairie mosaic (future woodlands could be managed as even or mixed aged stands depending on ecological purpose. For example a poplar or hardwood rotation for ruffed grouse habitat could have even age management or a jack pine stand could be selectively cut to ensure possible habitat for warblers or other indigenous species. Open oak woodland savanna is ideal habitat for white-tailed deer and turkey. Prairie grasses are ideally suited to nongame grassland songbirds.

The following narrative provides the site preparation and seeding requirements of these communities followed by a management section and a monitoring section.

3.1 Prairie, Jack Pine and Oak Savanna: Site Preparation and Installation

Areas proposed to be reclaimed as prairie occur in all three mining phases (Figure 17 in the Reclamation Plan). Additionally, a Jack pine reclamation is proposed for the reclaimed woodland area in Phase III and an oak savanna is proposed in the reclaimed woodland area in Phase II. Phase I woodland areas are addressed in later sections of the report.

Prairies, Jack pine barrens and oak savannas favor a variety of topography with full sun exposure. The reclamation and management of native prairie, jack pine and oak savanna communities is a long-term process requiring proper installation and management. Therefore, it is imperative that a qualified contractor perform the installation and maintenance of reclamation areas. A Native plant Contractor should have experience in native seeding, native tree installation and landscape operations with at least 5 years experience. An Installer should maintain an experienced full-time supervisor on the Project site who will be thoroughly familiar with the type and operation of equipment being used when seeding is in progress.

3.1.1 Site Preparation

Ensure subsoil and topsoil replacement is distributed in a quantity sufficient to meet standards and criteria set forth in this document. The area will be ripped to a depth of 24 inches to alleviate compaction and the potential for shearing. In areas designated for native seed and tree mixes the finished graded surface will be disked with an agricultural disc to at least 4 inches and dragged.

If conditions are such that, by reason of drought, excessive moisture, or other factors, satisfactory results are not likely to be obtained, stop work and resume when directed. Excess undulation or

irregularities in the surface will interfere with operations or maintenance. If such areas are observed these will be leveled before the next specified operation. In areas with a slope greater than 10:1, ensure that disc tracks run parallel to the dominate grade; minimize rilling.

3.1.2 Seed Certification and Provenance

Each grass-seed mono-stand or mixture list will be provided stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

All grass species will be supplied as pure live seed. Submit Lab germination test results for all grass species. For species that are not typically tested, submit an affidavit that describes estimated purity.

Seed will be native to northern Wisconsin regime, preferably from within a 150-mile radius of the project site unless approved otherwise. Inert material, such as sharp clean sand or perlite, mixed with seed at a ratio of not less than two parts seed carrier to one part seed is recommended.

Provide a fresh clean crop of the species and proportions as specified. All legumes will be inoculated with proper rhizobia at the appropriate time for planting. Ensure seeds have proper stratification and/or scarification to break seed dormancy for spring emergence.

3.1.3 Seeding & Tree Planting Dates

Seed and woody material should be installed during one of the following periods:

1. Spring Planting: Between February 15 and June 15.

2. Fall Planting: Between September 15 and December 15.

3.1.4 Seed Installation

After soil replacement in mined areas to be restored to prairie, oak savanna and Jack pine barrens, there may be a need for a herbicide application to prepare the site for seeding. A non-selective herbicide such as roundup can be applied at a rate specified on the label. Wait two weeks (14 days) before conducting seeding after a site preparation herbicide application.

Prairie, Jack pine and oak savanna sites will be seeded with a minimum of 25 native species, of which a minimum of 4 will be native grasses (Table 3). Install seed at a rate of 15 lbs of grasses/acre and 4 lbs of forbs/acre. In the event that seed is unavailable, reasonable approved ecologically sound substitutes will be accepted.

Install all seed with a rangeland type grain drill or no-till planter, such as by Truax, or equivalent where conditions allow. In all other areas broadcast seed into a lightly tilled soil surface. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in two directions at right angles to each other. Roll seeded areas with a cultipack roller.

If soil is too wet or grade is too steep to install seed, seed using a mechanical broadcast seeder, such as by Cyclone seeder. Hand broadcasting of seed may also be employed. Roll or drag broadcast seeded areas will be perpendicular to the slope within 24 hours, or as soon as site conditions allow.

A cover crop of winter rye (*Secale cereale*) will be applied in all native seed mix areas during seeding application at a rate of 30 lb/acre during dormant seeding in fall. Spring seeding cover crop will consist of 30 lb/acre of oats (*Avena sativa*) and/or annual rye (*Lolium mulitflorum*).

Table 3. Potential species for seeding in prairie, Jack pine barrens and oak savanna areas at the Albertville Valley nonmetallic mine site

C	SCIENTIFIC NAME	COMMON NAME	PHYSIOG.
7	*Amorpha canescens*	Leadplant	Nt SHRUB
4	*Andropogon gerardii*	Big bluestem grass	Nt P-GRASS
4	*Andropogon scoparius*	Little bluestem grass	Nt P-GRASS
3	*Artemesia ludoviciana*	Prairie sage	NT-P-FORB
1	*Asclepias syriaca*	Common milkweed	Nt P-FORB
6	*Asclepias tuberosa*	Butterfly weed	Nt P-FORB
2	*Asclepias verticillata*	Whorled milkweed	Nt P-FORB
8	*Aster azureus*	Sky-blue aster	Nt P-FORB
6	*Aster laevis*	Smooth blue aster	Nt P-FORB
6	*Bouteloua curtipendula*	Side-oats grama	Nt P-GRASS
6	*Carex bicknellii*	Bicknell's sedge	Nt-P-SEDGE
3	*Carex gravida*	Heavy sedge	Nt-P-SEDGE
5	*Cassia fasciculata*	Partridge pea	Nt A-FORB
4	*Danthonia spicata*	Poverty oat grass	Nt P-GRASS
4	*Desmodium canadense*	Showy tick trefoil	Nt P-FORB
4	*Elymus canadensis*	Canada wild rye	Nt P-GRASS
3	*Gnaphalium obtusifolium*	Old-field balsam	Nt A-FORB
4	*Euphorbia corollata*	Flowering spurge	Nt-P-FORB
5	*Heliopsis helianthoides*	False sunflower	Nt P-FORB
6	*Helianthus occidentalis*	Western sunflower	Nt P-FORB
7	*Heuchera richardsonii*	Alum root	Nt-P-FORB
7	*Koeleria cristata*	June grass	Nt-P-GRASS
5	*Lespedeza capitata*	Round-headed bush clover	Nt P-FORB
5	*Liatris aspera*	Rough blazing star	Nt-P-FORB
6	*Lupinus perennis*	Wild lupine	Nt P-FORB
3	*Monarda fistulosa*	Wild bergamot	Nt P-FORB
3	*Monarda punctata*	Spotted bergamot	Nt-B-FORB
1	*Oenothera biennis*	Common evening primrose	Nt B-FORB
10	*Panicum leibergii*	Prairie panic grass	Nt P-GRASS
9	*Petalostemum candidum*	White prairie clover	Nt P-FORB
9	*Petalostemum purpureum*	Purple prairie clover	Nt P-FORB
4	*Ratibida pinnata*	Yellow coneflower	Nt P-FORB
4	*Rudbeckia hirta*	Black-eyed Susan	Nt P-FORB
5	*Solidago rigida*	Stiff goldenrod	Nt P-FORB
5	*Solidago speciosa*	Showy goldenrod	Nt P-FORB
4	*Solid ago nemoralis*	Old field goldenrod	Nt P-FORB

C	SCIENTIFIC NAME	COMMON NAME	PHYSIOG.
5	*Sorghastrum nutans*	Indian grass	Nt P-GRASS
5	*Tradescantia ohiensis*	Spiderwort	Nt-P-FORB
3	*Verbena stricta*	Hoary vervain	Nt P-FORB

C – Coefficient of Conservation. Assigned values range from 0-10 and represent how likely a plant is to found in a remnant versus disturbed community. 1 is for natives that are very tolerable of disturbance and 10 is for a native that is typically only found in remnant communities.

3.1.5 Tree and Shrub Planting

After installing species from Table 3 follow up with woody species installation in Jack pine barrens and oak savanna. Plant a combination of Jack pine, bur oak and Hill's oak and hazelnut seedlings in groups (i.e. copses) in the Jack Pine barrens reclamation area. Trees and shrubs may be heavily browsed by deer when young. Use of temporary deer fencing or other effective deterrents to prevent intense mammal herbivory during the first 5-10 years of growth may be needed.

Install woody seedlings, saplings and shrubs at 100 stems/acre in the area to be restored to Jack pine barrens. Additional woody species that could be installed in the Jack pine barrens and oak savanna include New Jersey tea, and black oak.

Plant a combination of bur and white oak with a few hazelnut in the reclaimed oak savanna woodland in copses. Install woody species at a rate of 50 stems/acre.

3.1.6 Mulch

Depending on slope, mulch 2,000 lbs/acre of clean straw over seeded areas and crimp. Slopes 3:1 or greater will likely require erosion control blanket such as SC 75 to stabilize slopes once native seed and cover crop has been applied. Straw or hay for erosion control will be clean, seed-free hay or threshed straw of wheat, rye, oats, or barley

3.2 Dry or Dry Mesic Woodland Reclamation

Phase I woodland reclamation areas (i.e. those areas not planted to prairie, or Jack Pine barrens and oak savanna (opening)) will be restored to dry or dry mesic woodland (Figure 17 in the Reclamation Plan). In the Upper Midwest, northern red oak, white oak, and black oak dominate early seral to midseral stages but are ultimately replaced by sugar maple in the absence of natural perturbations such as fire. The oaks assume prominence after early succession in which bigtooth aspen (*Populus grandidentata*) dominates. Bigtooth aspen usually grows in even-aged mixed stands is a codominant tree in hardwood forests on the drier upland sites. With frequent fires, sugar maple forests are replaced by oak stands. The oaks grow in a range of habitats and moisture regimes – from prairies to valley floors and upland woods.

3.2.1 Establishment Methods

Northern red oak, white oak, and black oaks are widely distributed throughout the eastern and central United States and are a common component of many eastern and central upland deciduous forests. Black oak also occurs in savannas in the transition zone between the eastern deciduous forests and the western prairies. The oaks are well adapted to various rehabilitation projects and have been successfully planted onto mine sites throughout the Midwest. Bigtooth aspen has been planted on mine in the eastern and Midwestern US. Bigtooth aspen has naturally regenerated on sites where the soil is favorable, and is known to regenerate naturally on barren, acidic, metal-contaminated soil treated with a surface application of limestone. Bigtooth aspen will likely colonize a site from off-site seed.

3.2.2 Site Preparation

Ensure subsoil and topsoil replacement is distributed in a quantity sufficient to meet standards and criteria set forth in this document. The area will be ripped to a depth of 24 inches to alleviate compaction and the potential for shearing. In areas designated for native seed and tree mixes the finished graded surface will be rough disked.

If conditions are such that, by reason of drought, excessive moisture, or other factors, satisfactory results are not likely to be obtained, we will stop work and resume when directed. Excess undulation or irregularities in the surface will interfere with operations or maintenance. If such areas are observed these will be leveled before the next specified operation. In areas with a slope greater than 10:1, disk tracks shall run parallel to the dominate grade to minimize rilling.

Pre-emergent herbicides may likely be needed to ensure the absence of dense ground cover or highly competitive species. Successful establishment of oak, in terms of fast growth and good quality may be seriously hampered on minelands by harsh environmental conditions, which lead to shoot die-back. While good survival of oak seedlings requires ripping of soils and avoidance of frost pockets or high winds, fertilization is not critical to the early establishment of oak. Eventually the application of phosphate fertilizer may be required on certain sites if the trees are to continue to grow for economic timber. However, the application of nitrogen fertilizer does not appear to stimulate the growth of black oak, white oak, or northern red oak.

In any case, the best survival seems to occur where oak is underplanted in a shelter wood setting such as under bigtooth aspen. In a shelter wood cover situation such as is recommended here, understory control (cutting or spraying non-oak stems to control the understory density so that it does not become overly competitive) results in an increase survival of black oak, white oak (*Quercus alba*), and northern red oak. Oak seedlings in afforested areas without an overplanting require a modicum of herbaceous vegetation in order to survive beyond the first several years.

3.2.3 Plant Material Certification and Provenance

Each tree, shrub, forb, grass, and sedge plant or seed mixture listed will be provided and will state the botanical and common name and number or percentage by weight of each species and variety, and percentage of purity, germination, and weed seed as appropriate. The year of production and date of packaging or age and caliper of tree seedlings will be included.

All grass species will be supplied as pure live seed. Submit Lab germination test results for all grass species. For species that are not typically tested, submit an affidavit that describes estimated purity.

Plant materials will be native to western Wisconsin, preferably within a 150-mile radius of the project site unless approved otherwise. Inert material, such as sharp clean sand or perlite, mixed with seed at a ratio of not less than two parts seed carrier to one part seed is recommended.

A fresh clean crop of the species and proportions as specified will be provided. All legumes will be inoculated with proper rhizobia at the appropriate time for planting. Ensure seeds have proper stratification and/or scarification to break seed dormancy for spring emergence. We will ensure woody

plant materials are inoculated with appropriate mycorrhizae and that tree seedlings (or seed) are properly stored and planted. Tree roots will be kept moist at all times.

3.2.4 Planting Dates

Seed and woody material will typically be installed during the spring planting period as soon as frost is out of the ground and conditions are suitable, but not beyond June 15. Some grass, forb, shrub, and tree species seeds, especially those requiring stratification/scarification may be planted in the fall between September 15 and December 15. Under natural conditions, acorns generally germinate in the spring after dormancy is broken by over-wintering. Some germination occurs during the fall (directly after maturation) and unless germination is rapid, few seeds survive predation by insects, small birds, and mammals.

3.2.5 Seeding

Dry or Dry Mesic Forest sites will be seeded with a minimum of 8 native understory species in including the sedges and ferns. Three native grasses Canada wild rye (*Elymus canadensis),* little bluestem (*Andropogon scoparius)*, and side oats grama (*Bouteloua curtipendula)* from Table 3, seeded at a rate of 4 lbs/acre, will be part of the initial seeding for establishment purposes. The forbs, ferns, and sedge mixture will be seeded at 2 lbs/acre. Herbaceous seeding for the ground story will include Partridgeberry (*Mitchella repens*), Bracken fern (*Pteridium aquilinum*), large-leafed aster (*Aster macrophyllus*), Wood strawberry (*Fragaria vesca*), meadow-rue (*Thalictrum* spp.), false Solomon's-seal (*Smilacina racemosa*), and Pennsylvania sedge (*Carex pensylvanica*). In the event that seed is unavailable, reasonable approved ecologically sound substitutes will be accepted.

Seed will be installed with a rangeland type grain drill or no-till planter, such as by Truax, or equivalent where conditions allow. In all other areas broadcast seed into a roughened soil surface. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.

If soil is too wet or grade is too steep to install seed, seed using a mechanical broadcast seeder, such as by Cyclone seeder. Hand broadcasting of seed may also be employed. Drag broadcast seeded areas perpendicular to the slope immediately or as soon as site conditions allow.

A cover crop of winter rye (*Secale cereale*) will be applied in all native seed mix areas during seeding application at a rate of 5-6 lb/acre during dormant seeding in fall. Spring seeding cover crop will consist of 5-6 lb/acre of oats (*Avena sativa*).

3.2.6 Tree and Shrub Planting

After seeding ground story species follow up with woody species installation in the oak woodland communities. Plants can be propagated by several methods, including transplanting bareroot stock and direct seeding of acorns. Direct seeding is the fastest and cheapest propagation method and can be effective if few seed predators are present. Though herbaceous vegetation appears important to the survival, excessive competition will reduce growth. Therefore, general guidelines for propagation are to control competing vegetation in the understory, ensure adequate propagules, and remove any competing overstory as seedlings become established.

Seed and install seedlings of a combination of red, white, and black oak with a lesser amount of bigtooth aspen. Best survival of bareroot stock is after spring planting. Since survival is generally good with one-year old, bare root seedlings, 12 to 18 inches tall, they are recommended in plantings. Initial growth is centered on root development. Two to three years after planting, top growth should average 8 to 12 inches annually with control of competing vegetation. Tree seedling protection from weather and predation is recommended.

Shrub associates planted in copses will include blueberries (*Vaccinium* spp.), huckleberries (*Gaylussacia* spp.), chokecherry (*Prunus virginiana*), dogwood (*Cornus* spp.), beaked hazel (*Corylus cornuta*), American hazel (*Corylus americana*) and dwarf bush-honeysuckle (*Diervilla lonicera*). Trees and shrubs may be heavily browsed by deer when young. Use of temporary deer fencing or other effective deterrents to prevent intense mammal herbivory during the first 5-10 years of growth may be needed. Install oak seedlings at a density of 250 stems per acre, aspen at 50 stems per acre, and shrub associates at a density of 100 stems per acre. Control of competition will likely be necessary if survivorship of all propagules is high. Tree shelters are recommended.

3.2.7 Mulch

Acorns germinate best in soil which is covered by a layer of leaf litter though litter-covered acorns are likely more vulnerable to rodents, insects, and fungus. Depending on slope, mulch 2,000 lbs/acre of clean leaf litter, or composted equivalent. Salvaged composted woodchips are acceptable so long as attention is paid to maintaining a favorable C/N ratio in the material. Livestock manure should be used only if it is composted. Otherwise it is a definite source of weed seeds. Substitutes could include clean straw. Slopes 3:1 or greater will likely require erosion control blanket such as SC 75 to stabilize slopes once the seed and cover crop has been applied. All mulch materials will be clean and seed-free.

3.2.8 Wildlife Value

Northern Red Oak, White Oak, Black Oak, and Bigtooth Aspen have high wildlife values for food, cover, travel, resting, and breeding purposes. White-tailed deer commonly browse leaves and young seedlings. Pocket gophers occasionally feed on the roots of seedlings. The white-footed mouse, eastern chipmunk, fox squirrel, gray squirrel, red squirrel, white-tailed deer, flying squirrels, and deer mice consume oak acorns. Acorns are an important fall food source for the black bear. Acorns are an important food source for the red-headed woodpecker, red-bellied woodpecker, blue jay, tufted titmouse, grackle, white-breasted nuthatch, sapsuckers, ruffed grouse, and other birds that could potentially inhabit the site. They represent a particularly important food source for the wild turkey.

Oak provides good cover for a wide variety of birds and mammals. Young oaks with low branches serve as particularly good winter cover. Oak leaves often persist longer than those of many of its plant associates and in some areas, young oaks may represent the only brushy winter cover in dense pole stands. Oaks frequently serve as perching or nesting sites for various songbirds. Many cavity nesters, such as the hairy woodpecker, utilize oak. The well-developed crowns of oaks provide shelter and hiding cover for tree squirrels and other small mammals. Many birds and mammals use twigs and leaves as nesting materials. Large oaks provide denning sites for a variety of mammals.

Aspen provides the basic habitat for ruffed grouse ; they feed on the leaves in the summer, staminate flower buds in the winter, and catkins prior to the breeding season. Approximately 116 nongame bird species breed in early successional aspen-birch forests.

4.0 MANAGEMENT RECOMMENDATIONS

The Management Plan follows an adaptive management process throughout the life of the reclamation program. Northern Sands LLC will provide documentation on adaptive management needs of this program in the annual reporting to the RA. Adaptive management is defined as the day to day, season to season refinements in reclamation programming needed to achieve success against the performance criteria. This adaptive refinement is an anticipated normal process for reclamation and mitigation projects. Adaptive management affords Northern Sands LLC the option to take advantage of the latest scientific and technological techniques for successfully accomplishing the reclamation.

In addition to controlling invasive species such as spotted knapweed another issue that may arise during the ten (10) years of the reclamation and management effort is deer browsing on native woody plants. Deer deterrence methods will be evaluated and implemented, if necessary.

The Management programs need to be flexible because of the variability exhibited by the temporal and spatial resources. Plans, at times, need to be changed in response to new data and insights. For those reasons, this Management Plan should not be viewed as being "fixed in stone". The diversity and plant community goals and outcomes are firm, but the acreages of each community may vary from the "*Plan.*" Plans on a map need to be flexible. This Plan is a starting point in an ongoing process of restoring the biodiversity and natural processes of the reclaimed areas. Regular monitoring will provide the feedback on the effectiveness of the plan and will generate information to evaluate and justify the need for changes. This process of evaluation, adjustment, refinement, and change is called "Adaptive Management." Adaptive management is a fundamental tool for use in the reclamation, management and maintenance work.

4.1 General Site-wide Recommendations

Some recommendations are not specific to any particular portion of the site but will be applicable in numerous areas or will apply to the site as a whole. Based upon the natural resource inventory/rapid ecological assessment performed in 2015, the following general recommendations are provided. These recommendations are in concert with the overall goal of improving habitat for wildlife (both game and non-game species), based on vegetation community reclamation.

The reclaimed mine site will likely offer a complete trophic structure for broad-based animal taxa ranging from Karner blue butterflies to white-tailed deer. The site is well suited to game and nongame species alike. The surrounding landscape will supply a ready supply of species for recruitment immediately upon stabilization, especially with the establishment of plant communities. The proposed post-mining habitats will likely be re-occupied by white-tailed deer and turkey, perhaps others such as ruffed grouse. With the increase in proposed prairie it is likely that nongame grassland songbirds will be represented as well. A species count can be established on a routine basis to determine the composition and frequency of use by various taxa. Efforts to maintain these ecological communities on the site are relatively inexpensive except for some specific problem areas

that may arise which may require more significant effort. Routine management tasks for the restored communities are enumerated below:

4.2 Prairie, Jack Pine and Oak Savanna Management

First Year:

Mow reclamation grass areas, 2-4 times during the early growing season. Avoid mowing tree copses.

Control undesirable plant species by hand pulling prior to the development and maturity of the plant. Hand removal will include the removal of all above and below ground stems, roots, and flower masses prior to development of seeds.

If necessary, herbicide must be appropriate for target species and applied by a licensed applicator, trained in plant identification

Second Year:

Undesirable species will be controlled as necessary by mowing, hand pulling, and selective herbicide application.

Evaluate fuel loads and develop prescribed burn plan for Year 3 implementation.

Third Year:

Undesirable species will be controlled as necessary by hand pulling, and selective herbicide application.

Initiate prescribed burn if fuel loads are sufficient and be careful to avoid woody species copses

Fourth Year: Conduct prescribed burn and selective herbicide applications as necessary.

Fifth Year: Conduct prescribed burn and selective herbicide applications as necessary.

Sixth and Seventh Year: Selective herbicide applications as necessary. Assess fuel loads.

Eight Year: Conduct prescribed burn and selective herbicide application as necessary

Ninth Year: Selective herbicide applications as necessary.

Tenth Year: Conduct prescribed burn and selective herbicide application as necessary

4.3 Dry or Dry Mesic Woodland Management

First Year:

Mow those patchy areas where no woody species will be impacted once or twice during the early growing season.

Selectively control mechanically or chemically herbaceous competition around all woody stems and in particular around oak stems.

Control undesirable plant species by hand pulling prior to the development and maturity of the plant. Hand removal will include the removal of all above and below ground stems, roots, and flower masses prior to development of seeds.

If chemical control is necessary, herbicide selection must be appropriate for target species and applied by a licensed applicator, trained in plant identification.

Second Year through Year Eight:

Selectively control herbaceous competition around and over woody stems and in particular around oak stems. Avoid excessive shading of oak stems. Selectively reduce the stem density of aspen.

Control undesirable plant species by hand pulling prior to the development and maturity of the plant.

Hand removal will include the removal of all above and below ground stems, roots, and flower masses prior to development of seeds.

If chemical control is necessary, herbicide selection must be appropriate for target species and applied by a licensed applicator, trained in plant identification.

Ninth and Tenth Year:

Control undesirable plant species by hand pulling prior to the development and maturity of the plant. Hand removal will include the removal of all above and below ground stems, roots, and flower masses prior to development of seeds.

If chemical control is necessary, herbicide selection must be appropriate for target species and applied by a licensed applicator, trained in plant identification. Aggressively remove invasive native and non-native shrubs and small trees in the understory (e.g. blackberry, black cherry).

Attempt limited prescribed burn: Back burn through the forested understory to remove accumulation of organic material and fire-kill non-adapted tree species. This is dependent on size of woody species growth.

5.0 LONG-TERM MANAGEMENT

Continue to increase contiguous acreage of prairie establishment areas by additional reclamation efforts in previously mined locations. Also, attempt to re-create natural transitions to savanna habitats on the margins of prairie established areas.

It is anticipated that after ten (10) years of ecological reclamation and management, efforts will transition into a long-term management program. The long-term management program is critical for maintaining the value of the investment, perpetuating the plant community, and maximizing the ecological and aesthetic benefits of the native plant communities. Management tasks within particular management units will be guided by the individual landowners.

6.0 ECOLOGICAL PERFORMANCE STANDARDS

In order to evaluate the success and trajectory of the reclaimed plant communities, a set of performance standards have been developed along with monitoring methods for assessing the performance standards for soils, plants, and animals.

6.1 Qualitative Vegetation Performance Standards

Several qualitative vegetation goals for the Prairie and woodland reclamation/reclamation Areas are proposed and are consolidated below:

- There will be habitat availability to support wider use by native plants after reclamation within the Albertville Valley non-metallic Mine property.

- The new habitat areas on reclaimed mined lands will provide breeding and migratory seasonal habitat-use opportunities.

These qualitative goals will be used as the framework for analysis over the ten (10) year monitoring reporting period. The quantitative vegetation monitoring tasks will be used to assess the achievement of the plant performance standards described below.

6.2 Quantitative Vegetation Performance Standards

As part of this reclamation plan, a set of quantitative vegetation performance standards have been proposed to assess the success of native prairie and woodland reclamation. The set of criteria proposed are modifications of those that have been accepted by other regulatory agencies on projects of similar size and complexity. Quantitative vegetation monitoring and data analysis from Years 1, 2, 3, 5, 8 and 10 will be used to measure performance and determine compliance according to the following performance standards**.**

6.3 Plant Species Composition

Species selected for the planting will be appropriate for the community to be planted. A minimum number of native perennial species must be present within five years after seeding and planting in each plant community to meet the total community species diversity performance standard and are as follows:

-Native Prairie: minimum of fifteen (15) native perennial species
-Dry or Dry Mesic Woodland: minimum of eight (8) native perennial species
-Oak savanna: minimum of 15 native perennial species
-Jack Pine Barrens: minimum of 15 native perennial species

Also, after 5 years in areas restored to Prairie, Jack Pine and Oak Savanna, each plant community will have at least a native Mean C value of 3.0 and a native FQI of 15.0 using the Wisconsin Floristic Quality Assessment methodology (Bernthal 2003).

6.4 Native Woody Species Cover and Density

As individual trees and shrubs, as well as the different species, grow at variable rates, the native woody canopy cover (trees and shrubs) in areas restored to dry or dry mesic woodland will be 8% or greater by year 10 as measured as line intercept along transects established to collect herbaceous cover data.

Oak savanna and jack Pine barrens will have a woody live stem density ≥ 25 stems/acre.

Dry or Dry Mesic woodland will have a woody live stem density of saplings greater than 0.5 meter in height ≥ 100 woody stems/acre.

6.5 Plant Species Dominance

A plant species' dominance will be determined by calculating each plant species' Importance Value (IV) with two (2) parameters, frequency and cover. The IV equals the sum of the percent relative frequency and percent relative cover divided by two (2). This dominance performance standard will be achieved when the native perennial species within each plant community monitored represents at least 70% of the total dominance measure.

6.6 Birds

The performance standard for birds will be achieved conducting and documenting bird surveys. The goal of the reclamation is to provide habitat for a variety of bird and other wildlife species, including bird species such as those target species listed below. Though there is historical confirmation of breeding status for these species in the area according to the Wisconsin Breeding Bird Atlas there can be no guarantee these birds will be observed.

Table 4. Target Bird Species

Species	Important Habitats
Eastern Meadowlark	Restored Prairie
Savannah Sparrow	Restored Prairie
Dickcissel	Restored Prairie
Field Sparrow	Restored Prairie
Clay-colored Sparrow	Restored Prairie margins
Vesper Sparrow	Restored Prairie
Wild Turkey	All
American Kestrel	Restored Prairie
Eastern Bluebird	Prairie Edge
Tufted Titmouse	Woodland
Northern Flicker	Woodland
Hairy Woodpecker	Woodland
American Crow	All
Mourning Dove	All

Species	Important Habitats
Eastern Phoebe	All
Blue Jay	All

6.7 Soils

6.7.1 Soil Structure, Drainage, and Depth

The reestablishment of structure and internal drainage are paramount in a trajectory toward long-term soil health on a reclaimed mine site. Over time natural pedogenic processes (catalytic activities) such as freeze thaw, frost heaving, rhizoshperic interactions, soil biological activities, etc. enhance the soil water relationship in the soil pedon by helping to reestablish soil structure and internal drainage (available water holding capacity), both strongly correlated with soil bulk density.

Typically a soil bulk density $\leq$ 1.6 g/cm^3 does not inhibit root penetration (*f* site specific characteristics and the particle density of predominate materials). Based on a rapid desktop analysis of the NRCS soils information for the major soil units in each area proposed for mining, the premining bulk density range through the upper 24 inches of soil is 1.5 -1.6g/cm^3. Therefore, a reasonable performance measure for soil structure is bulk densities $\leq$ 1.6 g/cm^3 or soil strength $\leq$ 300 psi to a depth of 24 inches. A more detailed discussion of soil strength is found in section 7.6.3.C.(1) of this report.

Based on a rapid desktop analysis of NRCS data, the dominant soils in areas proposed for mining exhibit soil depths in Phase I that range from < 40 inches to > 60 inches. Topsoil thickness averages about 9 inches of sandy loam over sand and bedrock; in Phase II, the soil depth range is < 22 inches through > 60 inches. Topsoil thickness depths range from 2 inches of fine sand over sand and bedrock to 8 inches of loamy sand over coarse sand and bedrock; in Phase III the soil depth range is < 12 inches through > 60 inches. Topsoil thickness depths range from 2 inches of fine sand over sand and bedrock to 6 inches of loam over weathered residuum sandstone bedrock.

The performance measure for soil depth will be variable and based on a variance around the mean depth of soils in each cell as quantified by the soil island references described in section 7.6.2.D of this report. Section 7.6.2 describes the standards and operational processes in more detail. The soil laydown depths performance measure consists of verified depths based on the soil island reference areas noted in section 7.6.2.D compared with depths in the equivalent reclaim area. The overall desired thickness is achieved whenever the soil laydown thickness of each equivalent reclaimed cell within a phase is within a standard deviation of the mean of the soil island reference area or as otherwise approved by the RA.

6.7.2 Soil Chemistry and Fertility

Soil chemistry and fertility are determined based on a combination of thorough analyses of the materials on hand and the basic needs of the intended post mining plant community. A one size fits all approach is typically not appropriate when creating a diversified habitat mosaic on the landscape, especially when the pre-mining plant communities evolved in a landscape moisture gradient ranging

from mesic to xeric conditions; and soil fertility ranging from moderate fertility to extremely low fertility. The majority of the proposed mining area is composed of low fertility droughty sands.

Since premining and post mining soil chemistry, especially with contemporaneous reclamation, will likely remain relatively unchanged, the following soil chemistry and fertility performance measures may be adjusted based on subsequent laboratory analyses of premining soil conditions. Based on a rapid desktop analysis of the NRCS soils information for major soil units in each area proposed for mining and recommendations in the Wisconsin Extension *Soil Test Recommendations* bulletin a2809 performance measures are proposed herein. There is an important caveat regarding setting a base level for nitrogen. Base nitrogen in the soil is a snapshot in time. Nearly all residual soil N is contained in and is an essential part of the organic matter or humus (about 5 to 6 percent N by weight). The N in soil results from biological fixation and from accumulation of plant residues over a long period of time. For mineral soils, an approximate range of total N content in the surface six inches is .02 to .50 percent. Since N is contained largely in humus that forms from plant residues, its concentration decreases with depth in the soil profile. Base nitrogen levels depend on the productivity of the soil/plant system. The general overall productivity of this proposed mine site is low. Further, nitrogen can negatively affect productivity of oaks and prairie and favors weedy competition. Nitrogen is highly mobile in the environment and thus has the potential to degrade the environment. Nitrogen in the soil will depend on the amount of organic matter in the soil and the soil texture. Sandy soils are likely to leak labile nitrogen and not hold much nitrogen in more stable forms. Typically a nitrogen performance measure for prairie and oak woodland would not be recommended. The organic matter performance measure in section 6.7.3 below is a good surrogate for N.

According to bulletin a2809 soils in the vicinity of the mine are likely naturally low in phosphorous and potassium. Furthermore the NRCS soil survey data reveal relatively low cation ion exchange capacities (CEC) for the major soil units in the prospective mining areas. CEC is measure of the soil's ability to hold cations such as potassium and phosphate. The range is 9-12 in Phase I, 1.5-11.5 in Phase II, and < 1.5-11.5 in Phase III. Apart from nitrogen, the soil chemistry and fertility performance measures are as follows: acceptable range for pH = 5-7; P = 10 ppm extractable phosphorous and K = 60 ppm extractable potassium.

6.7.3 Type and Amount of Organic Matter

Like soil chemistry, the determination of organic matter is based on a combination of thorough analyses of the materials on hand and the basic needs of the intended post mining plant community. It is also dependant on the edaphic processes and mechanism. The site's productivity and rate of mineralization will play a major role in establishing the dynamic equilibrium of soil organic carbon. Soils naturally contain varying amounts of organic (organic matter) and inorganic (carbonates) carbon at any given time. In general, the amount of organic matter in soils is small but its importance is significant. Organic matter influences water holding, fertility, structure, biology, and overall soil quality. There are basically two pools of organic carbon in the soil; labile and stable. Plant and animal materials are basic throughput creating organic matter in the soil. Sandy soils in our climatic regime typically have low percentages of organic matter because plant productivity is low and mineralization is high.

Based on a rapid desktop analysis of the NRCS soils information for the major soil units in each area proposed for mining, the organic matter content ranges in the sandiest surface texture areas from < 0.4 percent to ≥ 2 percent in areas with loam or silt loam surface textures. Therefore, the performance measure for soil organic matter is 0.4 percent when surface textures are sand (including modifiers such as fine sand or loamy sand) and 1.5 percent when soil textures are loamy (including modifiers such as sandy loam, silt loam, etc.).

7.0 ECOLOGICAL MONITORING AND REPORTING

Site stability – begins with stable engineered landform, while relief and elevations may have been altered, the landform should mimic the original surface to the extent practicable in contour, drainage direction, pattern, and density. There is no substitute for good engineering. This approach creates a more resilient landform over time and establishes complex aspects which help to diversify vegetation and habitat by creating a series of gradients. It will also help create a more effective stormwater management plan. Secondary site stabilization is achieved mechanically, chemically and vegetatively. Vegetation is the least costly, but typically some combination is used. Assessment of vegetation, along with topographic reconstruction, will be the primary methods used to evaluate stability and habitat conditions.

7.1 Vegetation Monitoring

Annual vegetative monitoring will begin in the first year after substantial completion of the reclamation activities in each designated area and will continue periodically for ten (10) years.

Ecological monitoring provides important data about the effectiveness of the reclamation and management plan. Monitoring requires the response of the native plant communities be checked during the ten (10) year permit monitoring schedule by measuring ecological indicators of plant community recovery. Effectiveness is judged against the goals and objectives of the project design. Goals can be modified over time as a result of this feedback. The results of annual monitoring are used to direct the management activities for the upcoming year. Photography will be used to document ecological change during reclamation and management. Management reports detailing locations and dates of reclamation and management efforts undertaken will be completed during the permit compliance period (a 10 year period) for each reclamation unit. The monitoring requirements and sampling methods are described below:

Plant density and species diversity – can be based on a combination of baseline data, technical standards, and representative reference areas. This site will be composed of a mosaic of woodland, savanna, barrens, and prairie. The habitats will be facsimiles of the original communities because of the impossibility of recreating strictly scientifically defined ecological communities. To create the full composition, structure, and functions would be prohibitively expensive and impractical due in no small degree to the state of scientific knowledge. Therefore each community will consist of a meaningful representation of the compositional and structural elements of the identified plant community/habitat type such that the physiognomy of the community is discernible and measurable. In other words each plant community will look somewhat similar to how it is supposed to look. The assessment of the site and broad-based experience with plant communities enables the reclamation practitioner to mimic the natural look and feel of the plant communities at the construction document detail level. Further, each will function in process and mechanism as an

intact community and provide the ecological benefits associated with animal habitat, site stabilization, aesthetics, recreation, etc. There is a veritable menu of approaches to design, install and help establish each plant community. In other words, there is no one recipe or means to the end. The following monitoring methodologies are proposed with the species percent cover and percent frequency being the primary data collection parameters.

Data will be collected:

- In one (1) square meter sample quadrats along permanent transects.
- In one square meter quadrats at stratified random locations across each reclaimed cell.
- As line intercept of woody species % cover and as stem density in woodlands.
- In plant species searches along transects.
- As plant cover and frequency of occurrence in quadrats.

7.2 Measurement Methods and Techniques

This section is a description of each method to measure the reclamation outcomes for the various plant communities restored within the Northern Sands LLC Howard Township property.

7.3 Line Transects and One (1) Square Meter Quadrats

Vegetation sampling transect locations for collection of the monitoring data, collected as part of the ten (10) years of ecological monitoring, will be field located. The transect end points will be GPS surveyed and permanently marked with ground flush steel rebar rod. Starting from one (1) end of each transect, a 50 or 100-meter measuring tape will be pulled taut and vegetation sampling quadrats will be placed at ten (10) meter increments along each transect. A circular, meter square quadrat will be centered over the tape at each ten (10) meter increment and the herbaceous plant (and woody species less than 0.5 meter height) percent areal cover (a measure of the vertical projection of photosynthetic leaf area) will be measured in each quadrat. It is anticipated that approximately one (1) meter square quadrat will be used/acre (40 quadrats required for 40 acre reclamation area) during July through September. Eight (8) additional circular, meter square quadrats will be located using a stratified random pattern across each reclaimed cell to ensure comprehensive and representative spatial coverage of the vegetation on any given reclaimed cell. The permanent quadrats combined with stratified random quadrats will result in robust quantitative ecological sampling of the herbaceous and small woody plant areas.

Along transects established in the restored woodland, the cover of woody tree species vegetation will be recorded as line intercept along transects to the nearest centimeter. Line intercept cover will be expressed as a percentage of the transect length (i.e. typically a 100 meter transect length). In addition in a two meter wide belt along each transect containing woody species the species of woody species greater than 0.5 meter in height will be recorded as to species and quantity.

The recorded data analyzed in each quadrat or along a Transect will include;

- Percent areal cover by plant species, including all woody plants less than one (0.5) meter in height in quadrats.
- Frequency of occurrence (percent of the total number of sample quadrats in which each species occurs)

- Richness (number of plant species) in transects
- Absolute and relative cover from quadrats
- Line intercept cover of woody tree species along transects established in restored woodlands, expressed as a percent cover and woody species stem density.
- Absolute and relative frequency of occurrence from quadrats
- Importance Value (IV), the summation of relative cover and frequency of occurrence for a given species divided by two (2) from quadrats.

7.4 Timed Meander Search Technique

Plant species richness and diversity in each community type will be sampled using the Timed Meander Search (TMS) technique (Goff 1982). The TMS technique involves slowly walking through each plant community type and listing new plant species while blocking the search into increments of time. The TMS sampling technique will cover representative areas of the site. The TMS method develops time-equated plant species lists. The data contribute to the development of total plant species lists and help quantify diversity for each plant community. The data contribute not only to the species lists and diversity measurements, but statistics can be used to help characterize community development and compare different areas within the same community type.

Community Floristic Quality Index

The monitoring strategy for prairie, jack pine barrens and oak savanna restorations will use a landscape specific scale tool for the plant communities proposed for restoration. The Wisconsin version of the Floristic Quality Assessment (FQA) will be implemented as a site level general assessment method for the Northern Sands' Howard nonmetallic mine site (Bernthal 2003). The FQA can assess any on site community, provides a standard, repeatable method and can be accomplished directly in the field by a trained plant ecologist. The FQA can be used for land management, restoration, identification, evaluation and comparison of restored areas and natural areas. The FQA is based on the concept of species conservatism. Each plant species is assigned a coefficient of conservatism (C). The C value is an estimate of the probability that a species is likely to occur in a landscape relatively unaltered from what is believed to be the pre-settlement condition. Species with the highest C values (9-10) have a narrow ecological condition, are intolerant of disturbance and are unlikely to be found outside un-degraded remnant conditions. Species with a Mean C of 3 or less typically tolerate disturbance. Native Coefficients of Conservatism values range from 0 to 10. Floristic Quality Assessment uses two related but separate measures: 1) the Mean Coefficient of conservatism, and 2) the Floristic Quality Index (FQI).

To use the FQA, the plant community is inventoried or sampled to compile an accurate and as complete as possible vascular plant species list for a community or a site. While non-native species can be included and assigned a zero value, we recommend calculating the FQI using only native plant species. The C values of all identified native species area summed and divided by the total number of native species observed to obtain a Mean C value. The FQI is calculated by multiplying the Mean C by the square root of the total number of native species. The FQI is a quick method for evaluating a sites quality but has some biases so the FQI should not be used as the only metric for determining a sites biological integrity or restoration success.

7.5 Bird Surveys

Northern Sands LLC intends to document and characterize breeding bird use of the habitats created through reclamation activities. Therefore, breeding birds will be sampled as a measure of wildlife habitat quality. Bird surveys will be conducted in Years 1, 2, 3, 5, 8, and 10. 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 for bird species will occur in spring and fall for detecting migratory bird species. Sampling points will be spatially correlated or may coincide with transect end points and habitat types.

Representative study locations will be chosen throughout the Property after an initial reconnaissance of the property as part of the baseline faunal data collection. Locations to be studied on the site will be identified once a fundamental understanding of the complexity, patchiness, and types of avian habitat present on site is ascertained. Study points were spaced sufficiently throughout the site to ensure independence of data from other study points.

Avian surveys will use modified methods 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 1982 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 and the American Ornithological Union.

Raw field data will be entered into a database to create a list of birds as well as for summary and analysis. This study will determine the breeding status of species identified during surveys. Avian breeding status on the site will follow the criteria adopted by the Illinois Department of Conservation (IDOC) for the Breeding Bird Atlas Project[7] or other appropriate criteria. These criteria will be used to document the status and distribution of breeding birds and are adopted for use in this study. Criteria are:

1) Observed: A species, male or female, was observed during the breeding season, but no evidence exists to indicate the species is breeding.

2) Possible: A species, male or female, was observed in suitable habitat and at a time during the breeding season that indicated it was possible that breeding occurred. Singing males often indicate possible breeding.

3) Probable: Several types of observations are available that would indicate the species is

probably breeding. Multiple males singing in suitable habitat, a pair (male and female) observed in suitable habitat, a permanent territory is identified by multiple observations of a singing male, male/male conflicts, courtship or copulation is observed, or agitated behavior.

4) Confirmed: This is the most important level of classification. Observation in this category indicates direct evidence that the species is breeding at the site. Nest building by species other than wrens or woodpeckers, physiological breeding evidence, distraction displays, a used nest or eggshells, recently fledged young, an occupied nest, adults carrying a fecal sac or food, a nest with eggs, or a nest with young seen or heard.

7.6 Soil Management Program

7.6.1 Soils – Premining Inventory and Mapping

A. Introduction

In order to protect soil resources in areas designated for disturbance by non-metallic mining operations and to enhance the potential of achieving successful reclamation, premining soil surveys and soil handling methodologies will meet the requirements and objectives of NR 135 and the local Regulatory Authority (Chippewa County Department of Land Conservation &Forest Management).

The premining soil survey:

(1) characterizes the soils occurring within the proposed permit area;

(2) determines the salvage depths and volumes of suitable soil and specific soil consociations and complexes available for salvage within the proposed permit area (the term "soil", as used herein throughout this addendum, refers to the A, E, B, and C horizons);

(3) determines whether soil and specific soil consociations and complexes are available in an adequate quantity and quality for use in reclamation; and

(4) defines the need for special handling techniques of specific soil types that will facilitate specific reclamation needs.

B. Specifications of Soil Inventory and Maps

The soil inventory and map specifications typically follow the NRCS National Soil Survey Handbook (February 2015) and NRCS Soil Survey Manual (October 1993 – in the process of updating).

(1) A first order (intensive) in combination with second order soil survey data is required to facilitate reclamation. Soil survey specifications include:

Mapping units: consociations and complexes.

Map scale: 1:20000 or as otherwise consistent with other reclamation plan maps. The map scale will be large enough to allow areas of minimum size to be delineated legibly at about 5 acres.

(a) Phases - (modifiers of a soil series) are important to suitability, salvage, and reclamation potential. Phases include, but are not limited to texture, erodibility, slope, rockiness, and depth to bedrock (paralithic or lithic contact).

(b) Consociations - delineated areas dominated by a single soil taxon and similar soils. As a rule of thumb, at least 50 percent of the pedons in each consociation typify the soil component providing the name for the map unit. Most of the remainder consists of soils similar to the typifying soil such that management interpretations for reclamation are not affected significantly. Dissimilar inclusions, different soils, within a map unit are generally < 25 percent. A special symbol will be used for miscellaneous areas less than an acre within a consociation (such as a rock outcrop or wet area).

(c) Complexes - consist of two or more dissimilar taxa components or miscellaneous areas occurring in a regularly repeating pattern. The major components of a complex cannot be mapped separately at a scale of about 1:158400.

(d) Similar components occur together in landscapes and are much alike in most properties. Dissimilar components differ appreciably in chemical or physical properties, and the differences generally are great enough to affect interpretations for reclamation use. Some dissimilar components are limiting, while others are nonlimiting for reclamation use. Soils that cannot be used feasibly for reclamation purposes are especially critical to identify.

(2) NRCS soil surveys (second order), even when suitable for the purpose of premine soil surveys, will need refinement and additional information to meet the standards for their use in reclamation.

(3) Soil pedon description submitted for each soil sample site will include the following attributes: the kind, thickness, and arrangement of horizons; their structure, color, texture, coarse fragment content, carbonates if present; quantity and size of roots; and consistence (NRCS Field Book for Describing and Sampling Soils, 2002).

C. Description and Characterization of Soils

(1) A soil survey narrative will consist of:

(a) Description of each soil series by depth, drainage class, parent material, physiographic location, precipitation, typical horizon and profile characteristics, infiltration, permeability, effective rooting depth, available water holding content, surface runoff, and wind and water erosion hazard (typically obtained from the NRCS Official Series Description);

(b) Description of each mapping unit by slope, NRCS hydrologic soil-group, kinds of soils and the percent of each kind of soil in the mapping unit, whether or not the soils are typical for the series, their limitations for use in reclamation, the position of the soils in the

landscape, and the current and native vegetation associated with the soils (typically obtained from the county soil survey map unit description);

(c) Soil pedon descriptions in accordance with B (3) above; and

(d) Chemical and physical characteristics of the soils at each soil sample site (see D below).

(2) Maps - the soils information will be presented to the RA on a set of maps which meet the following criteria:

(e) The maps will clearly show all soil mapping unit boundaries and assigned numbers;

(f) A soil survey legend will be included on the soil maps and will consist of a listing of all mapping units and their symbols.

D. Sampling

(1) Vertical Distribution

(a) Representative soil profiles of each major soil taxon in a mapping unit for each mining phase will be sampled to a depth of 60 inches (~150 centimeters) or to a lithic or paralithic (bedrock) contact, whichever occurs first. We may sample paralithic materials depending upon the available soil resource and the proposed mining and reclamation plan soil mass balance.

(b) After the profile has been exposed and described, representative continuous 2-quart (top to bottom of each horizon) samples will be collected from each specific genetic horizon. Two-quart samples will provide an adequate amount of soil material for analysis and for sample splits or duplicate or additional analysis that may be necessary.

(c) Layers or horizons less than 3 inches (7 centimeters) thick may be combined with an adjacent layer for sampling purposes. Horizons or layers greater than 24 inches (60 centimeters) thick will be split so that no sample represents a layer exceeding 24 inches (60 centimeters) in thickness.

(2) Horizontal Distribution

(a) The precise number and location of sampling sites required for each soil taxon will be based on a site-specific evaluation of what is needed to adequately characterize the qualitative and quantitative nature of the soils.

(b) Sampling adequacy will include profile descriptions and sampling for analysis on at least three (3) representative sample locations for the soil taxa naming each major map unit within each cell of a proposed mining phase.

(c) If it is clearly evident that additional information is needed after reviewing the initial results of the survey, we will provide necessary additional samples.

(3) Sampling techniques

(a) We will prevent contamination and changes in chemical and physical properties of the soils to the maximum extent possible during sampling and transport.

(b) Soil samples will be placed into clean polyethylene plastic bags and transported to the laboratory as soon as possible. The samples will not be exposed to extremes of temperature during transport. If the soils require shipping or storage for extended periods of time, they will be air-dried at room temperature (not greater than 95^0 F) or frozen.

(4) Sample Site Location – will be established using a sub-meter accuracy GPS unit and coordinates recorded. The site will be photo-documented in the four cardinal directions.

E. Analysis

(1) Quality Assurance/Quality Control - the accuracy of the laboratory will be substantiated by providing results of the laboratory's analysis of standard samples or an equivalent analysis program. In order to substantiate the precision of the laboratory analysis, periodic duplicate analyses on samples will be run at the primary laboratory facility.

(2) Analytical Parameters - each soil sample will be prepared and analyzed for the following reclamation parameters using standard procedures and will include recommendations for plant growth:

(a) Routine parameters include pH (soil), pH (buffer), available phosphorus (P1), P2 phosphorus, exchangeable potassium (K), exchangeable magnesium (Mg), exchangeable calcium (Ca), organic matter, and sum of bases cation exchange capacity (CEC).

(b) Non-routine parameters include Total Nitrogen, Organic matter or organic carbon (ignition) ASTM 2974, Bulk density (and or soil strength), and Soil texture (pipette method).

(c) Micronutrients, if needed include iron, zinc, manganese, and copper.

(d) Other tests may be made as necessary.

7.6.2 Soils – Salvage and Redistribution Standards

A. Soil Volumetrics

(1) The soil survey and laboratory information will be utilized in determining the suitability of each mapping unit for salvage. We will present the proposed depths, acreage, and volumes of the soils to be salvaged for each mapping unit within the areas proposed for disturbance. This information will be listed and summarized in tabular form.

(2) Estimated salvage depths for consociation mapping units will be determined from the information collected for the dominant soil taxa.

(3) Estimated salvage depths for mapping units that are complexes will be determined by a weighted average salvage depth of the major soil taxa in the complex.

B. Soil Replacement Depth - we will initially calculate and adjust soil replacement depth(s) and needed volumes for the whole disturbed area. This is for the purpose of determining the mass balance between soil salvage and soil replacement on equivalent-sized reclaimed areas. See subsection H below.

C. Soil Handling - our soil handling program will consider soil salvage and equivalent area replacement to promote the reestablishment of the desired post mining land use plant communities and to minimize erosion and issues of stability. Soil handling techniques may include the use of variable soil depths, the selection and use of soils with specific chemical and/or physical properties, and the placement of certain soils in specific topographic positions. For example, special handling techniques could be utilized in salvaging alluvium and colluvium for drainage reconstruction and sandy and skeletal soils for use as tree, shrub, and dry prairie root media.

In cases where there is a documented shortage of soil materials with specific attributes essential to the establishment of a particular plant community, we may consider mixing and or borrowing from areas that may have excess and using overburden and clean processing materials as soil substitution alternates in the soil handling plan. This may include reconstruction of the plant rooting profile by mixing selectively salvaged soil materials in reclaimed areas designated for prairie or woodland depending on the soil properties desired. Some plant communities on site either prefer or readily tolerate plant growth media (coarse-textured soil) generally with enhanced soil permeability properties. Further these materials may help reduce competition from herbaceous species due to limited moisture holding capacity in the upper portion of the reconstructed profile.

D. Soil Islands - during each phase of the soil salvage operations, small undisturbed areas of soil (soil islands) representative of the major map unit will temporarily be left in place for documentation. A stake on each soil island can be used to quantify the salvage depth of the soil represented and help make adjustment, if necessary, to the overall soil mass balance.

E. Direct Haul of Soil Materials to graded areas is preferred to stockpiling and will be implemented whenever possible as part of our contemporaneous reclamation strategy. This soil handling technique is known to result in fewer impacts to soil aggregation, organics, and microorganism populations, while enhancing the establishment of viable herbaceous and woody plant propagules.

F. Stockpiles of suitable reclamation soil materials such as topsoil, subsoil, unweathered parent materials, overburden, clean processing materials, and other materials will be maintained in clearly marked segregated piles on stable ground clear of drainageways, depressions, and contaminated areas. The temporary stabilization of these areas may include a combination of mechanical, chemical, and vegetative methods. Seed used for vegetative stabilization will be native prairie seeds and an innocuous cover crop. Aggressive non-native species selection will be avoided in order to minimize or prevent widespread contamination.

G. Soil Compaction - the proposed soil reconstruction will be designed to minimize the compaction of soil and re-graded areas. Operations will not be conducted under wet conditions. Vehicle traffic

on the replaced soil will be minimized. The preferred method of soil handling to prevent compaction is the loader/truck end dump/low pressure dozer cycle because of the overall reduced ground pressure while maintaining efficiency of operations. Repeat traffic over an area will be minimized.

H. Soil Scarification – in general, re-spread topsoil will be laid down in uniform lifts over re-graded subsoil unless the approved plan designates variable depth reconstruction. The re-spread soil on a reclaim area will resemble the soil island reference as noted in section 7.6.2.D. The entire re-spread soil thickness will be tilled or scarified (ripped, subsoiled, or plowed) to a depth of at least 24 inches (~60 centimeters) to relieve compaction and reduce the likelihood of slippage between layers, especially on sloping ground. Mine soils exhibit layering and abrupt textural boundaries due to placement of materials. Layering can cause soil layers to shear and abrupt boundaries can influence the movement of water in the soil and restrict rooting depth which also influences plant productivity. Scarification, conducted in phases if the soil thickness exceeds the effective depth of the implement being used, helps alleviate compaction and shearing. In all cases the scarification will penetrate the regarded subsoil surface.

I. Prevention and Mitigation of Erosion Features such as rill and gully erosion developing in reclaimed areas will be considered in a two-step process. Prevention will include designing the final surface contours to mimic the natural and stable premining drainage pattern and density. Remediation will be based on the magnitude of erosion damage. Repairs may include tillage operations, re-grading, bringing in more soil materials to fill-in erosion features and reseeding, straw bales (keyed-in and anchored), installation of erosion control matting, and etc. Mitigation measures will be in accordance with the RA.

7.6.3 Soils – Re-spread Criteria

A. Soil Thickness Sampling Program

Our re-spread soil thickness sampling program will determine the accuracy of soil replacement to the specified thicknesses as noted in item H above. Soil re-spread areas will be sampled for depth on a grid pattern at 100-foot intervals and recorded. The recorded soil replacement thicknesses along with a map showing sample locations (using sub-meter GPS coordinates) will be incorporated into a comprehensive report for documentation and review.

B. Soil Factors

We will verify compliance through the following soil-related factors:

(1) Soil replacement - achieving uniform soil laydown depths is challenging and end results may be variable. Therefore to substantiate depths we will verify quantified depths based on the soil island reference areas noted in section 7.6.2.D and compare with depths in equivalent reclaim areas. The overall desired thickness is achieved whenever the soil laydown thickness of each equivalent reclaimed cell within a phase is within a standard deviation of the mean of the soil island reference area or as otherwise approved by the RA.

(2) Erosion and Stability Aspects - all active erosion features that may impair post-mining land use or contribute to off-site sedimentation will be effectively stabilized pursuant to the stabilization measures that have been previously addressed in subsection I. above. We will document the reconstruction of the natural geomorphic drainage pattern and density on the reclaimed surface using an acceptable computer generated DEM based on actual field elevations or advanced LIDAR. We will field inventory each reclaimed cell within a phase using photo-documentation to demonstrate that appropriate measures have been taken to reduce soil loss and impairment of vegetation. In addition, surface anomalies such as areas of differential settling or nick points in reconstructed drainages will be noted and repaired.

(3) Blending Adjacent Undisturbed and Reclaimed Area Edges with a newly reclaimed cell will be surveyed and photo-documented to confirm that grading activities and soil laydown were performed to allow for a smooth transition between reclaimed fields and adjacent undisturbed areas. The DEMs from (2) above will corroborate the blending as approved. The reclamation will be blended smoothly with adjoining areas to prevent future erosion and instability problems. In accordance with the RA and, if appropriate, an occasional rock highwall may be left as a vernacular artifact representing and mimicking the original geomorphology of the premining landscape.

C. Soil Physical, Chemical, and Biological Properties Evaluation

Mine soils are inherently heterogeneous. Soils may not exhibit the natural in situ colors or the trend of regularly decreasing organic matter with increasing depth due to inadvertent mixing of subsoil and topsoil during the premine soil salvage operation.

(1) Soil Physical Properties - reclaimed mine soils differ from premine soils primarily in physical properties. A significant artifact of mine soils is the vertically and horizontally erratic nature of post mining physical characteristics of soils. Even when soils retain some semblance of their original horizons (topsoil/subsoil (rooting media)), the original structure which is a highly important physical property of soil, will not be intact. Structure is destroyed during material handling. Removal and replacement of soil with heavy equipment disturbs the entire soil profile and tends to compact the soil pedon. Compaction is the most important plant productivity limiting property on reclaimed soils. Compacted soils have high soil strength, high bulk density, and massive structure. Structure effects soil porosity, pore size distribution, and pore connectivity. Porosity is important to the soil, water, air, plant, plant root relationships. The end result can be difficulty establishing vegetation or vegetation exhibiting low primary productivity.

As stated in subsection H. above all soils will be scarified to help alleviate compaction. Roots cannot enter soils with excessive strength thus plant productivity is reduced. Measurements of soil strength include bulk density, shear strength, compressive strength, and resistance to penetration. Bulk density is the most commonly reported measurement. Alternatively, a hand-held or ATV mounted constant rate recording cone penetrometer is suitable to determine soil strength within 50cm by measuring the resistance of a soil to penetration.

Pursuant to subsection E.(2)(b) above soil bulk density and/or soil strength will be measured. If the soil bulk density is $\leq$ 1.6 g/cm^3 and/or the soil strength is $\leq$300 psi then the soil is adequately conditioned physically to not inhibit plant root development.

(2) Chemical Characterization – the inventory of soil chemical properties will be done in accordance with subsection E.(2) above. Mine soils usually have similar chemical characteristics to premine soils when handled appropriately.

We presume, since woodland and prairie vegetation naturally occurs under premining soil conditions that there will be no need for fertilizer amendments. However if vegetation fails to establish to a degree of productivity expected soils may be amended with natural or synthetic plant nutrients including organic matter. Plant nutrient recommendations from the lab will be based on forestry or CRP recommendations contained in UWEX handbook a2809.

(3) Biological Activity – will be qualitatively enhanced if non-diseased, clean premine area vegetative materials are chipped and stockpiled. Direct haul of topsoil during contemporaneous reclamation and the redistribution of chipped or composted vegetation materials will likely maintain or enhance the soil biology.

We propose to use soil organic matter content as an indicator for soil biology and base soil nitrogen content. In general for sandy surface soils the organic matter content will be $\leq$ 1 percent; the loam and silt loam surface textures will have an organic matter content $\geq$ 2 percent.

7.7 Schedule for Monitoring Implementation

There is a commitment for the highest quality of workmanship for soil management and establishing successful native plant community reclamation. Quantitative vegetation monitoring and plant species searches will occur in July through September in years 1, 2, 3 5, 8 and 10. The July to September vegetation monitoring window provides the most reliable data as plant growth and cover are maximal for assessing vegetation. Soil management QA/QC is ongoing.

7.8 Data Analysis

Plant data usefulness is directly related to the quality of the data collected. Quantitative data will be collected once annually along transects and analyzed as to plant species absolute and relative frequency and species absolute and relative cover. The relative frequency and relative cover values will be summed and divided by 2 to develop an Importance Value (the species dominance value) for each species in each transect. Plant community data from several transects from the same community may be combined. In each reclaimed area/community a total species list will include natives and non-natives.

Woody species cover expressed as % line intercept will be calculated as well as individual and total woody species stem density using belt transects. A belt transect adds the width dimension to the length dimension of a regular transect.

7.9 Contingency Planning for Biological Non-Performance

Northern Sands LLC will prepare contingency plans for areas of the proposed prairie and woodland reclamation areas that are in substantial non-compliance with the performance criteria established for each vegetation reclamation zone. Substantial non-compliance is defined to occur when the measured performance of the monitored vegetation variables for which quantitative performance

criteria have been established are not being met or anticipated to be met on the timeline in the plan. Contingency plans will provide a process by which to resolve poor and non-performance issues and locations. Plans will be delivered to Chippewa County by its consultant/contractor after poor and non-performance areas are acknowledged during annual monitoring reviews and a non-performance trend is decisively shown in the monitoring data. Commensurate monitoring and reporting will be provided to document resolution of biological and soil management non-performance.

7.10 Annual Reclamation Report Content

The initiation of the prairie and woodland reclamation and monitoring timeline is triggered with placement and/or reshaping of soil including both subsoil and topsoil in mined areas and the completion of substantial seeding and planting. The annual monitoring reports will document the floral and faunal (birds) conditions of the reclaimed plant communities based on the collected qualitative and quantitative data. Progress towards achievement of the performance standards will also be documented and reported.

The annual monitoring report will document soil management along with the trends of native and non-native plant populations. As a part of this performance requirement, the annual reports will provide an analysis of trends by species, by plant sub-group and by plant community, using richness, frequency of occurrence, and Importance Values. The annual report will consist of an introduction, methods, results and discussion and literature cited sections. The processed soil and vegetation data will be displayed graphically and the data analysis will be supplied as an appendix to the applicable report.

Photographic documentation of the year's conditions will also be provided. Annual reports, consisting of the soil and vegetation analysis, will be submitted to the reviewing agencies annually, by January 31, unless a written extension is requested and approved. The annual monitoring reports are proposed to be submitted for a period of ten (10) years for each of the reclaimed areas. All milestones related to soils, plants, and animals, when achieved in a given year will be noted in the annual report.

8.0 LITERATURE

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Certification of Reclamation Plan Addendum

The Owner/Operator and Site Manager certify that reclamation will be carried out in accordance with the Reclamation Plan Addendum (*Addendum to the Howard Township Properties; Nonmetallic Mining Reclamation Plan; Northern Sands, LLC; Howard Township; Chippewa County, Wisconsin*) and that the post mining land use complies with federal, state, and local laws in effect at the time of the submittal.

Authorized Representative of Owner/Operator

Paul Van Eijl, President, Northern Sands, LLC

Site Manager

Paul Ayres, CEO, Red Flint Group, LLC