Management Plan and Aggregate Resource Notes for the Proposed Esker Trail Road West Pit, St. Louis County, Minnesota

Project 334-41
By Glenn D. Melchert
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This photo shows the general terrain of the lease area looking southwest at test hole 1. The photo was taken September 6, 2012 by C. Jennings.

Minnesota Department of Natural Resources
Division of Lands and Minerals
Jess Richards, Director
500 Lafayette Road
St. Paul, MN 55155-4045

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INTRODUCTION

A field investigation by a MN DNR Lands and Minerals (LAM) geologists on September 6th and 7th, 2012 identified a potentially commercial deposit of aggregate in part of the southwest quarter of Section 36, T. 52N., R. 16W., Grand Lake Township, St. Louis County (Figure 1). More than an estimated 175,000 cubic yards of cobble-rich aggregate may be extractable from about 17.9 acres within the red outline. There is high potential that additional aggregate occurs because the bottom of the gravel was not encountered in any test hole.

This site, the Esker Trail Road West Site (Esker Trail), is about 1.8 miles east of County Road 15 and another 5 miles from U.S. Highway 53 and Twig, Minnesota *via* County Road 15. Esker Trail parallels the northern lease boundary and provides public road access to the site. The site is on School Trust Land administered by MN DNR Forestry at the Cloquet, Minnesota office.

DNR plans to offer an Earth Materials Lease to allow extraction and processing of aggregate at this site. The lease will be awarded to the successful applicant in a competitive bid process.

This report consists of two sections: 1) Pit Management Plan and, 2) Resource Notes; they provide information specific to the Esker Trail Site. The lessee and land manager may use this report as a guide in planning and development of the pit. The Resource Notes section includes data and interpretations generated by DNR geologists.

PIT MANAGEMENT PLAN

Lease Area

The lease area covers approximately 17.9 acres (Figure 1). The lease boundary covers the portion of the gravel deposit that has been tested. The northern boundary is constrained by buffers to scattered wetlands along that perimeter. There are no wetlands within the lease boundary. The highest terrain is near the eastern portion of the deposit. Possible expansions to the south or west will be considered in the future when substantially all of the marketable aggregate within the lease area is extracted and significant portions are reclaimed.

Much of the lease area is variably populated with young trees or more or less open grassland. Timber damages for 10 acres will be determined by DNR Forestry and included in the billing when the lease is issued. Additional timber damages will be charged when the lessee expects to disturb lands beyond 10 acres. The lessee shall consult with DNR Forestry before impacting more than 10 acres.

Permits

A permit may be required from DNR Division of Ecological and Water Resources if dewatering actions are proposed. Written approval for dewatering is also required from the Division of Forestry area forester in the Cloquet office, who is the land manager in the district of this lease. Ditching outside the lease boundary is prohibited. Burning permits are required before anything is burned.

A conditional use permit for extractive uses is not required for state lands.

All applicable State permits are required, such as a Pollution Control Agency Stormwater Permit, for example.

Mining Plan

The mining goal is to extract all of the available marketable aggregate within the lease area and to ensure that phased reclamation occurs in logical areas as the operation progresses.

The lessee may upgrade to their needs and use the existing access route as depicted on Figure 1 for access to the lease or they may propose an alternate access more convenient to the lease site. A proposal for construction of an alternate access requires DNR approval prior to construction. A new access should be routed to minimize sight-lines from the public Esker Trail Road to the pit.

Extraction of the best grade of material, also known as high-grading, is not allowed. An example of high-grading would be where an operator mines a relatively small seam of high-value material while leaving behind very significant quantities of material adjacent that have become unmarketable due to the area being high-graded. High-grading may not be a high risk at this site because the coarse gravel appears to be consistent from hole to hole. DNR expects that the

lessee will manage the pit for the long-term so that all of the lease area can be eventually mined by the lessee.

DNR does not know whether significant quantities of aggregate occur below water within the lease area because there are no data. The lease states mining shall stay 3 feet above water. In the future if the Lessee determines there may be significant marketable aggregate below water, Lessee shall indicate their intent to mine below water to the land manager before doing so anywhere on the lease. The lessee shall submit for consideration a brief plan including locations, depth, and timing for written approval from the land manager. An onsite meeting with a LAM geologist may substitute for the brief plan. At that time the DNR may provide additional guidance or stipulations related to the eventual character of those future wetlands or ponds.

Site preparation

The lessee shall clear the trees from any areas scheduled for mining as they desire (clearing of more than 10 acres requires consultation with DNR Forestry), as long as the vegetative ground cover remains intact. In preparation for expected mining in the upcoming year, the lessee shall salvage the ground cover and topsoil to a depth of at least 5 inches. Lessee should strip and prepare only enough area to cover what they expect to mine in the coming season. This best management practice is intended to reduce the risk for erosion and establishment of weeds. Burning permits are required if anything is to be burned. Lessee shall add the ash to the reserved topsoil piles.

The lessee shall strip and preserve at least the top five inches of soil, even if the actual thickness of the topsoil is less, and preserve it in piles, mounds, or windrows within the lease area. Windrows shall not be placed against or inside the tree line. If areas are encountered where the topsoil is thicker than five inches, the entire topsoil layer shall be salvaged. The lessee shall also include the varied vegetative debris and short vegetation that may be present into the salvaged soil piles. The lessee shall seed the salvaged topsoil piles and other stripping materials within 60 days of placement unless they are to be used for reclamation within 60 days of placement. Seeding protocol is described in the reclamation section below. These piles will eventually be spread over the disturbed areas for final reclamation.

Stripping should not occur earlier than 30 days before mining is to occur, especially during the growing season. The amount of land cleared and stripped should approximately match the amount of land expected to be mined during that calendar year to reduce the risk of weed infestations and erosion.

Lessee shall leave a 50 foot buffer of intact trees, brush, and other vegetation between the right of way of Esker Trail and the pit. The buffer is intended to provide a visual barrier to the pit and also restrict unauthorized access. Portions of the road buffer may contain significant quantities of aggregate. DNR will consider giving permission to the lessee to mine portions of this buffer in the future when the pit nears depletion or at other strategic phases.

Lessee shall take precautions to prevent stormwater runoff generated on disturbed lands within the lease area and access routes beyond the lease boundary from entering any nearby wetlands.

Mine sequencing

DNR expects that mining will generally progress in a logical manner that allows for phased reclamation. To accomplish this, DNR expects that the lessee's mining plan considers mining certain areas ahead of others so as to create a pit edge that can be permanently reclaimed at an early date. High-grading is not allowed. This means that DNR expects that certain portions of the site will be mined to the deposit boundary, mine boundary, economic limit, or other logical edge prior to significantly expanding into other areas.

The road buffer on the east and most of the wetland buffer to the north are logical boundaries. In general, DNR expects that mining will have extended to a boundary and begun permanent reclamation in at least one direction by 10 years after the pit is opened. DNR encourages the lessee to mine to or through the property lines with permission of the affected landowners; otherwise, a setback buffer of 50 feet is required from property lines. Property lines are not a factor for the current lease footprint. LAM geologists are available to hear concerns and alternate proposals.

Specific provisions

Lessee will be required to fence areas, or otherwise prevent access to mining areas upon request of the land manager if they are deemed unsafe to the public. The lessee shall gate the entrance into the pit.

The lessee may be required to construct soil berms along the east side of the lease if needed to minimize or eliminate sight-lines from the road to the pit. There is high terrain near the road that may be adequate to eliminate the pit from being seen from the road.

The lessee is required to manage storm water so that it stays within the pit perimeter. Settling basins are permissible.

Wetlands occur near portions of the lease boundary. The lessee shall ensure a no-disturbance buffer of about 30 feet is maintained around them. The lessee shall manage their activities so that at least three (horizontal) to one (vertical) final sloping (3:1) can be accomplished in final reclamation without encroaching on the buffers between the pit and the wetlands. Rounding of the top of the slope to blend with surrounding terrain may occur within the buffer. Unmarketable materials, except topsoil, may be used to backfill against steep slopes for reclamation.

DNR encourages that when mining activities occur near any wetlands, that those activities be completed in a single mining episode so that those localized areas can be reclaimed the same year as the disturbance. This will lessen impacts to species dependent on those wetlands. This is a DNR goal.

Lessee shall, to the extent that is logical and reasonable, stage their work so that specific areas can be completely mined out and no longer needed for staging so that those areas can be permanently reclaimed.

Reclamation of depleted or mined-out areas, unless needed for staging, shall be completed before winter or no later than June 1st of the following year.

Invasive Species

The lessee will be obligated to control or eradicate noxious weeds according to the noxious weed law found in Minnesota Statute Chapter 18.75-18.91 and, if directed by the land manager, certain other weeds consistent with site management plans and DNR Operational Order 113.

The Minnesota Department of Agriculture defines the species covered under the noxious weed law and which should be controlled and which should be eradicated. Currently they list 26 terrestrial plant species that are covered by the law on the following web link:

http://www.mda.state.mn.us/plants/badplants/~/media/Files/plants/weeds/noxiouslists.ashx

Primary directives of the DNR Operational Order 113 are to "enter clean and leave clean" and enter weed-infested areas last and clean before leaving the infested areas to minimize the risk of spreading invasive species to non-infested areas.

Reclamation

One of the goals of reclamation at the present time is to return the site to forest, but other potential land uses after mining may be considered in the future. Another goal is to landscape for a well-drained gently rolling terrain.

All reclamation costs are borne by the lessee. The upland areas shall be reclaimed to a condition consistent with timber production. This includes shaping banks to blend with adjacent topography and placement of excess stripping, if available, and the reserved topsoil. Lessee may be directed to place excess non-granular stripping in certain areas, such as the steeper slopes, to enhance vegetative growth.

Topsoil will be spread on all mined and significantly disturbed areas ready for reclamation. Temporary reclamation, which could include placement of topsoil, may be required on areas experiencing long periods of inactivity if directed by the land manager, even if those inactive areas may undergo future mining. As stockpiles of topsoil increase, judgments will be made on how much topsoil should be placed in different areas receiving reclamation. When five inches of topsoil are effectively salvaged prior to mining, there should be sufficient topsoil to spread to an average depth close to five inches. There should be no bare spots in areas that receive four to five inches of topsoil dressing.

Topsoil shall be spread to an average depth of at least two inches, at minimum, in areas ready for revegetation. This means, after spreading with heavy equipment, that most locations should have at least two inches, some locations will have three or four inches, and small areas on the order of about ten square feet or less may have less than one inch of topsoil or be barren.

Reclamation in areas where gravel is mined below the water table, if applicable and approved, shall include gentle sloping into the water to a depth of five feet for public safety.

Seed mixes: temporary and permanent

Cool season temporary seed mixes Mn/DOT #100 (winter wheat), #110 (oats), and #150 are recommended for seeding the topsoil and other stripping stockpiles and any other disturbed areas

benefiting from temporary vegetative stabilization. Additional seeding may be required if the existing cover is inadequate to prevent establishment of invasive weeds and erosion. Re-seeding on an annual basis may be necessary when Mn/DOT mixes #100 and #110 are used.

DNR shall approve the seed mix to be used for final reclamation. The seed mix and protocol for establishment of permanent vegetation will be evaluated when portions of the pit are eligible for permanent reclamation and when the pit is about to exceed ten acres in size. Factors to consider at that time may include reforestation options, and other currently unknown land use considerations with the fundamental goal of generating current or future revenue. MN State Seed Mix 36-311 (Woodland Edge NE) is approved at this time.

RESOURCE NOTES

Fieldwork

A DNR geologist completed 17 test holes in the vicinity of the lease area on September 6th and 7th, 2012 (Figure 2). The author was on site for holes 1 through 8. All holes were dug with a Wacker Neuson 3503 Mini-Excavator to a depth of 8 to 9 feet on average. The deepest holes were dug to 9 feet. Samples for gradation analysis were collected from every hole. Geologic logs of the test holes and gradation (sieve) data are presented in Appendices 1 and 2, respectively. GPS coordinates for the test holes are presented in Appendix 3.

Lab Work

DNR personnel in Hibbing sieved 19 raw samples from the 17 test holes for gradation analysis following Mn/DOT sieving protocol.

Data Summary

The DNR interpretation is that the site has high potential to contain substantial quantities of crushable gravel. The gravel is coarse and fairly consistent across the lease area.

Fourteen holes were dug within the lease boundary. Coarse and often cobbly gravel was the primary material revealed. The upper 1.5 to 3 feet typically was a cobbly gravel with a fine sand that dominated the sand fraction. The gravel was thin or absent in test holes 10, 13 and 14 and the hole was dominated by sand. These 3 holes are near the northwest and southeast margins of the lease boundary (Figure 2). It is not known whether gravel occurs at depth (below 9 feet) in these 3 holes. All of the other holes had gravel at the bottom of the hole.

Samples from every hole, except 10, 13, and 14, contained more than 26 percent crushable (+3/4 to 2.5 inch) and four holes contained more than 40% crushable (Appendix B). Analysis of the % retained on the #4 sieve indicates all samples, except the three above, contained more than 45% of the sample coarser than #4 sieve. Of these, six samples tested more than 60% of the sample coarser than #4 sieve.

Gradation tests indicate the gravel is relatively clean below the upper few feet. The minus 200 results ranged from 1.2 to 3.7%, excluding holes 10, 13, and 14. The minus 200 in holes 10, 13,

and 14 ranged from 8.1 to 12%. Multiple samples were collected from two holes, holes 2 and 6 (Figure 3). One sample from each hole represented the upper few feet that was influenced by the fine sand, and the other sample represented the apparently cleaner gravel beneath. The minus 200 for the samples representing the upper several feet was about three times greater than the samples representing the deeper gravel.

Quality tests

Five samples were composited and sent to an outside lab for various quality tests. The samples came from holes 1, 2, 5, 6, and 8, representing the core of the lease area.

The quality tests run included Specific Gravity, Absorption, LAR, Magnesium Sulfate-soundness, spall, and flat & elongated (Appendix B, last 5 pages).

The spall test (last page of Appendix B) shows no deleterious particles except for "other soft" on the +#4. Nothing showed on the +1/2", and nothing was detected in the field. These samples were rained on the first night. When the samples were prepped to send to the lab, the author observed that some of the gravel samples had dried into hard chunks. One hypothesis is that these chunks did not completely disaggregate prior to the testing.

No potentially deleterious rocks or spall were observed in the field.

Water Levels

Water table was not encountered in any of the test holes. Test hole 14 revealed some water at the bottom of the hole, but it is not known whether it represented water table. DNR anticipates that large volumes of aggregate can be extracted before the water table comes into play. There are no data to confirm whether marketable aggregate extends into the water.

Digital Data Summary

Photographs documenting the site, test hole excavation and sampling were taken and are available upon request. An ArcGIS shapefile of test hole locations is also available upon request. The test hole locations are labeled with an identification number that corresponds to the test holes labels used in the Figures, Tables, and Appendices in this report.

GLOSSARY

boulder– a stone (usually rounded) larger than 256 mm (10 inches) in diameter.

cobble– a stone larger than 64 mm (2.5 inches) and smaller than a boulder.

deleterious material– any material that detracts from the quality of a sand or gravel product, and if deleterious materials are present in sufficient quantities the gravel product may be unsuitable for particular uses. Common deleterious materials are shale, iron oxides, unsound chert, clay balls, and other soft particles.

feature– a physical phenomenon that exists on the earth's surface, such as a lake, valley, or hill.

GIS–**G**eographic **i**nformation **s**ystem, a computer system for the input, editing, storage, maintenance, analysis, and output of spatial information. Each type or category of data is commonly thought of as a separate layer of information.

GPS–**G**lobal **p**ositioning **s**ystem, a satellite-based system which, in conjunction with a receiver, determines locations on the earth's surface.

gravel– an accumulation of granular material, usually deposited by running water, which contains sufficient pebbles and larger stones to be marketable as gravel. When listed as a percentage of gravel, it is a measurement or estimate of the amount of the material, by weight, that is larger than 2 mm (commonly described as plus #10 mesh or retained on the #10 mesh).

landform– any naturally occurring recognizable physical form or feature on the earth's surface, such as hill, valley, esker, plain, plateau, mountain.

overburden– material of any nature that overlies a deposit of useful material.

pebble– stones ranging in size from 4mm (0.16 inch) to 64 mm (2.5 inch) in diameter.

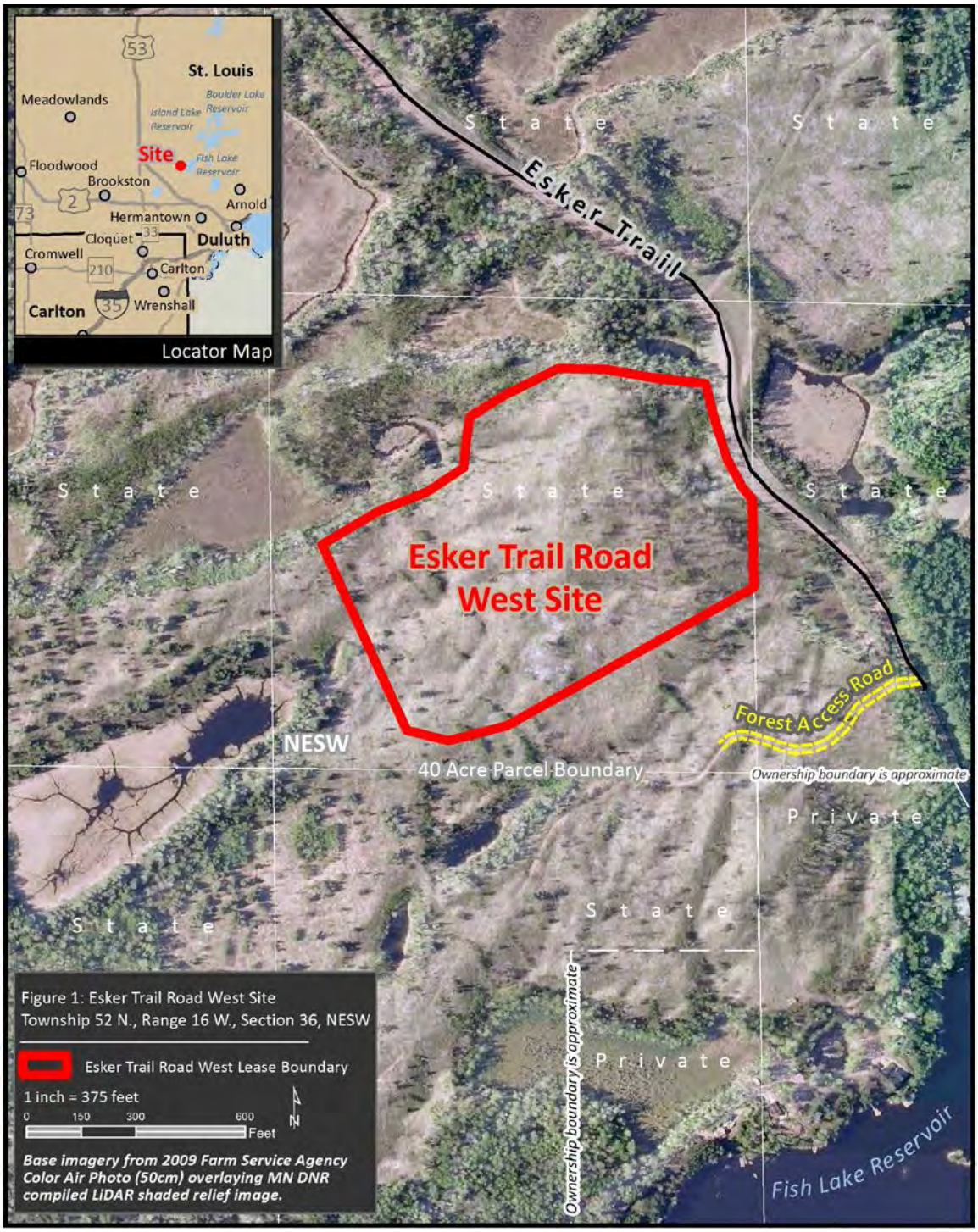


Figure 1. Esker Trail Road West Site Lease Map. The red outline depicts the lease area relative to nearby features. The lease area represents about 19.9 acres in part of the Northeast Quarter of the Southwest Quarter of Section 36, T. 52N., R. 16W., Grand Lake Township, St. Louis County. All lands displayed in the picture are state lands except the area depicted at private in the lower right part of the figure. Esker Trail is a township road.

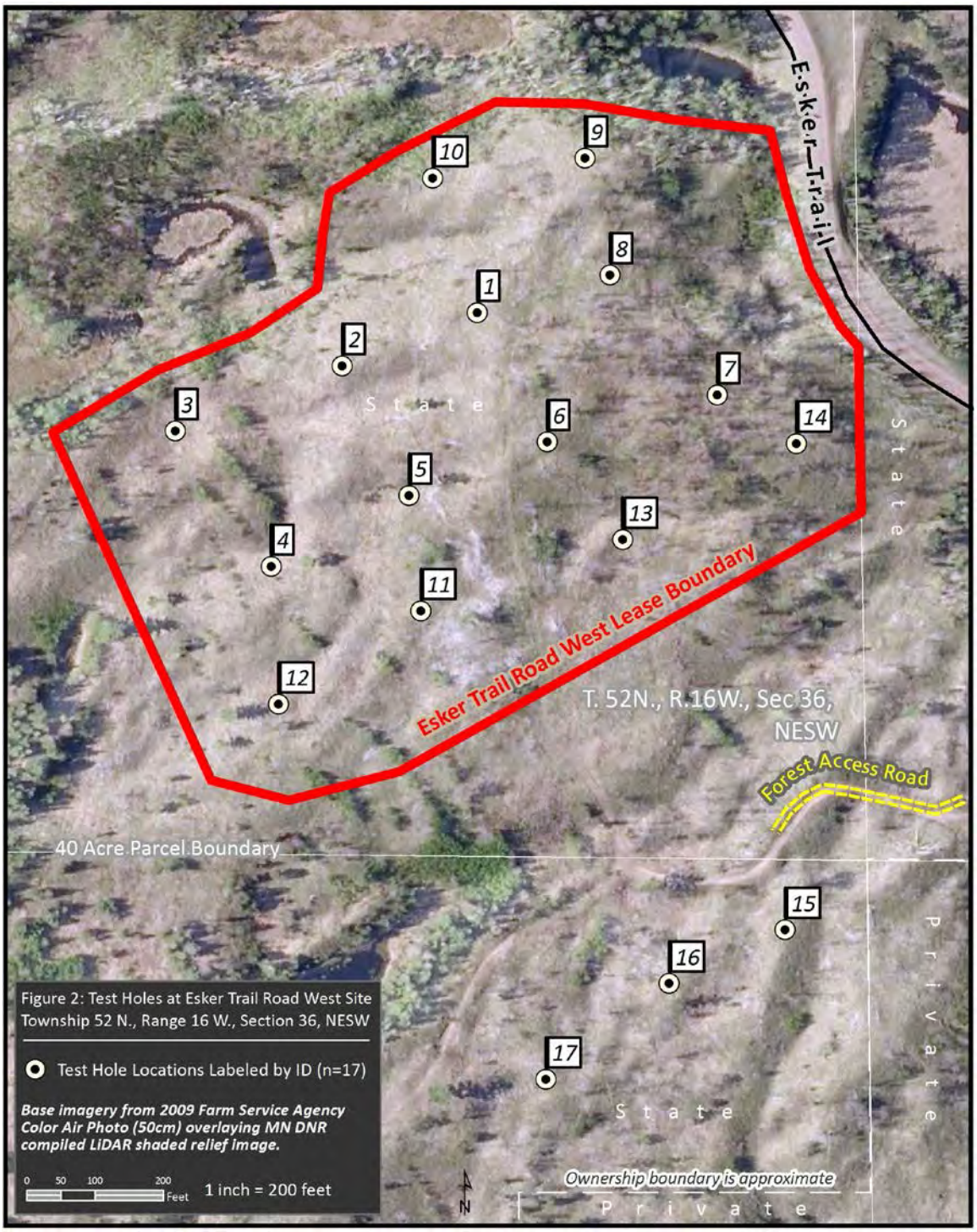


Figure 2. Fourteen test holes within the lease area and three to the south are depicted as white circles filled with a black dot. The box adjacent to each circle includes the ID number for the test hole. Each hole was dug with a mini-excavator to a depth of about 8 feet.

Figure 3. This photo shows the difference in the upper few feet of the gravel deposit compared to the deeper gravel in Test Hole 2. The light colored sample on the left is from the upper 2 feet of the hole and has a high percentage of fine sand. The gradation test indicates the sample on the left had 6.8% passing 200 sieve and the sample on the right had 2.0% passing 200 sieve.

Appendix A. Descriptions of Test Holes—Esker Trail Road West Site.

Each test hole is labeled with a unique test hole ID number. Several attributes are recorded for each layer of sediment observed in each hole. These attributes include: thickness of sediment layer, whether the water table was encountered, color, fines (texture), grading (sorting), sediment, layer, percent gravel, dominant clast size, maximum clast size, whether the layer was sampled, and additional comments. The test hole log is recorded using numerous abbreviations. The expansions of the abbreviations used are listed below.

Abbreviations used to describe the test holes

Abbreviations used for Color: lt = light, dk = dark, gry = gray, blk = black, brn = brown, yel = yellow, org = orange, grn = green

Abbreviations used for Fines: c = coarse, s = sandy, vs = very sandy, sli = slight, m = moderately

Abbreviations used for Grading: w = well, p = poor, m = moderately

Abbreviations used for Sediment: grvl = gravel, grvly = gravelly, sd = sand, sdy = sandy, slty = silty, vf = very fine, f = fine, m = medium, c = coarse, carb = carbonate, bldr = boulders, calc = calcareous, occ = occasional, sli = slightly, tr = trace, ts = topsoil, w/ = with

Abbreviations used for Moisture: d = dry, m = moist, w = wet

Other abbreviations used: drlg = drilling, rx = rocks, " = inch, ~ = approximately, TH = test hole, N/A = not applicable, NM = not measured

TEST HOLE LOG Test Hole No. 01

Project Name/No.: ETR WEST/334-41

GSOC #: NA Coordinates	Owner	School Trust	
Township St. Louis County	Date drilled	9/6/2012	
Site Description Date called/Date ready NA	Start time	11:35AM	
Esker Rd, west side, top of hill	End time	11:00:00 12:05 PM	
Utilities NA			

Description	Drilling		Sampled?	Gravel size (in")		Interpretation
Sediment/Color/Grading/Texture	Depth (FT)	Graphic Log	Interval	Range	Predominant	Geological
Silty rd-brn cobble gravel with boulders. Oxidized, dry. Abund. crushable. Lacks sand.	0.0-3.0		N	up to 4"	1"	Glaciofluvial (prob. subglacial) with eolian silt seived into matrix
Cleaner, drk coarse sand and gravel, pred. pbls but occas cbls and bldrs. Well graded.	3.0-8.0		Y-01001	up to 12"	2"	Subglacial fluvial

Total Depth	8 FEET	H2O Table	>8 FEET	Aggregate	5+ FEET
Ended in	SAND AND GRAVEL	Depth		Thickness	

Logged by Geologist: Jennings Drilled by: Rosnau Drill Rig/Auger size: backhoe

Terrain: Knoll

TEST HOLE LOG Test Hole No. 02

Project Name/No.: ETR WEST/334-41

GSOC #: NA Coordinates	Owner	School Trust	
Township St. Louis County	Date drilled	9/6/2012	
Site Description Date called/Date ready NA	Start time	1:00 PM	
Esker Rd, west side, farther down one of the "fingers" of high relief.	End time	13:40	
Utilities NA			

Description	Drilling		Sampled?	Gravel size (in")		Interpretation
Sediment/Color/Grading/Texture	Depth (FT)	Graphic Log	Interval	Range	Predominant	Geological
Very silty rd-brn pbl-cbl gravel with boulders. Oxidized, dry. Abund. crushable. Lacks sand.	0.0-2.0		Y-02002	up to 4"	1"	Glaciofluvial (prob. subglacial) with eolian silt seived into matrix
Grad. to drk crs s and g, si dec. w/ depth. Pred. pbl but occ cbls and bldrs. Well graded.	2.0-7.0		Y-02003	up to 12"	3"	Subglacial fluvial
Clean m-crs gr sand with pbls, trace silt. Occas larger clasts	7.0-9.0		Y-02003	up to 8"	1"	Subglacial fluvial

Total Depth	9 FEET	H2O Table	>9 FEET	Aggregate	9+ FEET
Ended in	SAND AND GRAVEL	Depth		Thickness	

Logged by Geologist: Jennings Drilled by: Rosnau Drill Rig/Auger size: backhoe

Terrain: Knoll

TEST HOLE LOG

Test Hole No. 03

Project Name/No.: ETR WEST/334-41

GSOC #: NA Coordinates		Owner	School Trust
Township St. Louis County		Date drilled	9/6/2012
Site Description	Date called/Date ready NA	Start time	1:45 PM
Esker Rd, west side, farther west down one of the "fingers", lowest on this transect.		End time	14:30
Utilities NA			

Description	Drilling		Sampled?	Gravel size (in")		Interpretation
Sediment/Color/Grading/Texture	Depth (FT)	Graphic Log	Interval	Range	Predominant	Geological
R-br silty fine sand, pbl free.	0.0-2.0		N			Wind blown (eolian) and possibly colluvial silt and fine sand
Bldr,cbl and pbl gravel with silt and sand.	2.0-5.0		Y-03004	up to 12"	3"	Subglacial fluvial with eolian silt seived in.
Well graded crs s w/ pbls, cbls. Fewer pbls at depth. Coarsens up. Trace silt (up to 5%?)	5.0-8.0		Y-03004	up to 7"	2"	Subglacial fluvial

Total Depth	8 FEET	H2O Table	>8 FEET	Aggregate	6+ FEET
Ended in	SAND AND GRAVEL	Depth		Thickness	

Logged by Geologist: Jennings Drilled by: Rosnau Drill Rig/Auger size: backhoe

Terrain: Knoll

TEST HOLE LOG Test Hole No. 04

Project Name/No.: ETR WEST/334-41

GSOC #: NA Coordinates	Owner	School Trust	
Township St. Louis County	Date drilled	9/6/2012	
Site Description Date called/Date ready NA	Start time	2:40 PM	
Esker Rd, west side, lowest on the next transect, SSW of last hole on steep side hill	End time	15:20	
Utilities NA			

Description	Drilling		Sampled?	Gravel size (in")		Interpretation
Sediment/Color/Grading/Texture	Depth (FT)	Graphic Log	Interval	Range	Predominant	Geological
R-br. silty cbl gvl (> 50%)w/ bldrs, sand, pbls. Largest avg size sampled	0.0-1.5		N	up to 12"	5"	Subglacial fluvial with eolian silt seived in.
Pods of cleaner pbl gravel, less silt with depth. Very bouldery. Lacking sand.	1.5-8.0		Y-04005			Colluvial glacifluvial sediment mixed with silt

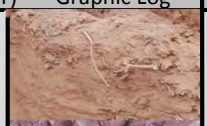
Total Depth	8 FEET	H2O Table	>8 FEET	Aggregate	6.5+ FEET
Ended in	SAND AND GRAVEL	Depth		Thickness	

Logged by Geologist: Jennings Drilled by: Rosnau Drill Rig/Auger size: backhoe

Terrain: Knoll

Project Name/No.: ETR WEST/334-41

GSOC #: NA Coordinates	Owner	School Trust	
Township St. Louis County	Date drilled	9/6/2012	
Site Description Date called/Date ready NA	Start time	3:30 PM	
Esker Rd, uphill, across from #2, near tall white pine, local swale.	End time	16:10	
Utilities NA			

Description	Drilling		Sampled?	Gravel size (in")		Interpretation
Sediment/Color/Grading/Texture	Depth (FT)	Graphic Log	Interval	Range	Predominant	Geological
Dry silty fs (face powder) stone-poor to free. Secondary material (iron, clay), 1.5'	0.0-2.0		N			Eolian and colluvial silt.
Transition with increasing pbls and decreasing silt.	2.0-3.0		Y-05006	Up to 8"	5"	
Cleaner, bouldery coarse sand and gravel with a few % silt.	3.0-8.0		Y-05006	Up to 12"	7'	High energy glaciofluvial

Total Depth	8 FEET	H2O Table	>8 FEET	Aggregate	6+ FEET
Ended in	SAND AND GRAVEL	Depth		Thickness	

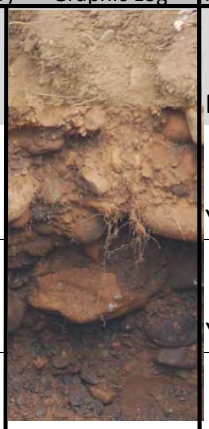
Logged by Geologist: Jennings Drilled by: Rosnau Drill Rig/Auger size: backhoe

Terrain: Knoll

TEST HOLE LOG Test Hole No. 06

Project Name/No.: ETR WEST/334-41

GSOC #: NA Coordinates	Owner	School Trust	
Township St. Louis County	Date drilled	9/6/2012	
Site Description Date called/Date ready NA	Start time	5:00 PM	
Esker Rd, west, hilltop, east of trail	End time	17:40	
Utilities NA			

Description	Drilling		Sampled?	Gravel size (in")		Interpretation
Sediment/Color/Grading/Texture	Depth (FT)	Graphic Log	Interval	Range	Predominant	Geological
Dry silty fs (face powder) stone-poor to free. Secondary material (iron, clay), 1.5'	0.0-1.5		N			Eolian silt.
Graded clast supp. pbl to cbl gvl w/ s. Silt to 4' >65-70% rock? Well rd.	1.5-5.0		Y-06007	.2-8"	5"	High energy glaciofluvial with seived silt
As above but cleaner. S- supp gvl with bldrs as max but smaller pred size	5.0-8.0		Y-06008	.2-12"	3"	High energy glaciofluvial
						

Total Depth	8 FEET	H2O Table	>8 FEET	Aggregate	6.5+ FEET
Ended in	SAND AND GRAVEL	Depth		Thickness	

Logged by Geologist: Jennings Drilled by: Rosnau Drill Rig/Auger size: backhoe

Terrain: Knoll

TEST HOLE LOG Test Hole No. 07

Project Name/No.: ETR WEST/334-41

GSOC #: NA Coordinates	Owner	School Trust	
Township St. Louis County	Date drilled	9/6/2012	
Site Description Date called/Date ready NA	Start time	5:40 PM	
Esker Rd, west, hilltop, in Maple but not raspberries	End time	18:40	
Utilities NA			

Description	Drilling		Sampled?	Gravel size (in")		Interpretation
Sediment/Color/Grading/Texture	Depth (FT)	Graphic Log	Interval	Range	Predominant	Geological
Silty fs w/ occas pbl and cbl	0.0-2.5		N			Windblow silt mixed by seiving, frost & bioturb
Well grd m-vcrs pbly s w/ cbls. Well rounded clasts, tr si.Rk content inc w/ depth. > 60%	2.5-8.0		Y-07009			High energy glaciofluvial with seived silt

Total Depth	8.0 FEET	H2O Table	>8 FEET	Aggregate	5.5+ FEET
Ended in	SAND AND GRAVEL	Depth		Thickness	

Logged by Geologist: Jennings Drilled by: Rosnau Drill Rig/Auger size: backhoe

Terrain: Knoll

TEST HOLE LOG Test Hole No. 08

Project Name/No.: ETR WEST/334-41

GSOC #: NA Coordinates	Owner	School Trust	
Township St. Louis County	Date drilled	9/6/2012	
Site Description Date called/Date ready NA	Start time	6:45 PM	
Esker Rd, west, hilltop, in Maple but not raspberries	End time	19:30	
Utilities NA			

Description	Drilling		Sampled?	Gravel size (in")		Interpretation
Sediment/Color/Grading/Texture	Depth (FT)	Graphic Log	Interval	Range	Predominant	Geological
3-4" O horiz, rbr silty dry fs. w/ scndry Fe,cly at 6", cbly silt at 1' , gradl. Soil perches water	0.0-2.5			.2-2"	1"	Windblow silt mixed by seiving, frost & bioturb
Clast supp. cbl gvl with well graded sand.	2.5-8.0		Y-08010	.2-12"	7"	High energy glaciofluvial

Total Depth	8 FEET	H2O Table	>8 FEET	Aggregate	5.5+ FEET
Ended in	SAND AND GRAVEL	Depth		Thickness	

Logged by Geologist: Jennings Drilled by: Rosnau Drill Rig/Auger size: backhoe

Terrain: Knoll

TEST HOLE LOG Test Hole No. 09

Project Name/No.: ETR WEST/334-41

GSOC #: NA Coordinates		Owner	School Trust
Township St. Louis County		Date drilled	9/7/2012
Site Description	Date called/Date ready NA	Start time	8:30 AM
Esker Rd, west, Farthest NE		End time	9:30
Utilities NA			

Description	Drilling		Sampled?	Gravel size (in")		Interpretation
Sediment/Color/Grading/Texture	Depth (FT)	Graphic Log	Interval	Range	Predominant	Geological
Silty fs, dry, r br w/ pbls	0.0-1.0		N			Windblow silt mixed by seiving, frost & bioturb
Clast sup cbl & pbl gvl w/ si s matrix, imbric pbls, pod of sim size, fining up. Deep silt	1.0-4.0		Y-09011	.2-8"	3"	High energy glaciofluvial with seived silt
Clst supp cbl gvl, matrix is crs-ms & granules, tr silt	4.0-8.0		Y-09011	.2-13"	4"	High energy glaciofluvial

Total Depth	8.0 FEET	H2O Table	>8 FEET	Aggregate	7.0+ FEET
		Depth		Thickness	
Ended in	SAND AND GRAVEL				

Logged by Geologist: Jennings Drilled by: Rosnau Drill Rig/Auger size: backhoe

Terrain: Knoll

TEST HOLE LOG Test Hole No. 10 Page 1 of 1

Project Name/No.: ETR WEST/334-41

GSOC #: NA Coordinates	Owner	School Trust	
Township St. Louis County	Date drilled	9/7/2012	
Site Description Date called/Date ready NA	Start time	9:35 AM	
Esker Rd, west, down trail to edge of open area	End time	10:30	
Utilities NA			

Description	Drilling		Sampled?	Gravel size (in")		Interpretation
Sediment/Color/Grading/Texture	Depth (FT)	Graphic Log	Interval	Range	Predominant	Geological
Silty fs, dry, r br w/ pbls	0.0-2.5		N			Windblow silt mixed by seiving, frost & bioturb with glac fluv
Cleaner cbl gvl w/ sdy matrix	2.5-3.5		Y-10012			High energy glaciofluvial
vfs layer, .5' thick, r br, darker, smooth	3.5-4.0		Y			Quiet water, part of fining up sequence
s, clean, w- sorted (beach) varing from pred. ms to crs s but few to no pbls below 3.5'	4.0-9.0		Y-10012			deltaic or slow glac fluvial

Total Depth	9.0 FEET	H2O Table	>9 FEET	Aggregate	6.5 FEET
Ended in	SAND	Depth		Thickness	

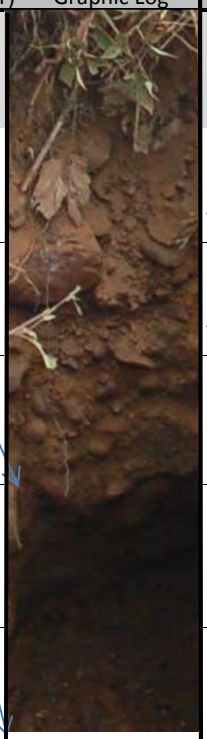
Logged by Geologist: Jennings Drilled by: Rosnau Drill Rig/Auger size: backhoe

Terrain: Knoll

TEST HOLE LOG Test Hole No. 11 Page 1 of 1

Project Name/No.: ETR WEST/334-41

GSOC #: NA Coordinates	Owner	School Trust	
Township St. Louis County	Date drilled	9/7/2012	
Site Description Date called/Date ready NA	Start time	10:30 AM	
Esker Rd, west, farthest S transect, w off trail, 380deg panorama of site	End time	11:30	
Utilities NA			

Description	Drilling		Sampled?	Gravel size (in")		Interpretation
Sediment/Color/Grading/Texture	Depth (FT)	Graphic Log	Interval	Range	Predominant	Geological
Lt r br silty clast sup cbl gvl, rd and spher clsts, some sm bldrs	0.0-2.5		N	.2-14"	3"	Windblow silt mixed by seiving, frost & bioturb with glac fluv
pbl gvl w/ si matrix w/ some bldr and cbl outliers	2.5-4.5		Y-11013	.2-12"	1.5"	High energy glacio fluvial
sand, m-crs w/ pbls, 30-40% gvl	4.5-8.0		Y-11013	.2-5"	2"	Lower energy glaciofluvial

Total Depth	8.0 FEET	H2O Table	>8.0 FEET	Aggregate	5.5+ FEET
Ended in	SAND AND GRAVEL	Depth		Thickness	

Logged by Geologist: Jennings Drilled by: Rosnau Drill Rig/Auger size: backhoe Terrain: Knoll

TEST HOLE LOG Test Hole No. 12 Page 1 of 1

Project Name/No.: ETR WEST/334-41

GSOC #: NA Coordinates	Owner	School Trust	
Township St. Louis County	Date drilled	9/7/2012	
Site Description Date called/Date ready NA	Start time	11:30 AM	
Esker Rd, west, small knoll between pine stump and large birch	End time	0:30	
Utilities NA			

Description	Drilling		Sampled?	Gravel size (in")		Interpretation
Sediment/Color/Grading/Texture	Depth (FT)	Graphic Log	Interval	Range	Predominant	Geological
Pbly cbl gvl, clast supp, w/ silty matrix; crs s and gran in matrix inc w/ depth	0.0-2.5		N			Windblow silt mixed by seiving, frost & bioturb with glac fluv
f pbls and s, clean but still a few % silt, some boulders	2.5-7.5		Y-12014			Mod. energy glacio fluvial

Total Depth	7.5 FEET	H2O Table	>7.5 FEET	Aggregate	5.0+ FEET
Ended in SAND AND GRAVEL		Depth		Thickness	

Logged by Geologist: Jennings Drilled by: Rosnau Drill Rig/Auger size: backhoe

Terrain: Knoll

TEST HOLE LOG Test Hole No. 13 Page 1 of 1

Project Name/No.: ETR WEST/334-41

GSOC #: NA Coordinates	Owner	School Trust	
Township St. Louis County	Date drilled	9/7/2012	
Site Description Date called/Date ready NA	Start time	12:30 PM	
Esker Rd, west, high grd east side of trail, sm maples local high but not regional. Sloping to S.	End time	13:00	
Utilities NA			

Description	Drilling		Sampled?	Gravel size (in")		Interpretation
Sediment/Color/Grading/Texture	Depth (FT)	Graphic Log	Interval	Range	Predominant	Geological
Scatt bldrs at sfc but hole is sandy. Si fs to fs w/ si, 1 cbl	0.0-3.0		N			Loess cap (post dates sand depos)
m-crs s, clean to tr silt, mulit colored, w/ granules, f pbls, sct pbls, rare cbls, no obv struct.	3.0-9.0		Y-13015			Suspended load of glaciofluvial system

Total Depth	9 FEET	H2O Table	>9 FEET	Aggregate	6+ FEET
Ended in	SAND	Depth		Thickness	

Logged by Geologist: Jennings Drilled by: Rosnau Drill Rig/Auger size: backhoe

Terrain: Knoll

TEST HOLE LOG Test Hole No. 14 Page 1 of 1

Project Name/No.: ETR WEST/334-41

GSOC #: NA Coordinates	Owner	School Trust	
Township St. Louis County	Date drilled	9/7/2012	
Site Description Date called/Date ready NA	Start time	1:00 PM	
Esker Rd, west, high grd	End time	13:30	
Utilities NA			

Description	Drilling		Sampled?	Gravel size (in")		Interpretation
Sediment/Color/Grading/Texture	Depth 9FT)	Graphic Log	Interval	Range	Predominant	Geological
Si fs, tr larger grains, weakly cem horizon	0.0-3.0		N			Loess cap (post dates sand depos)
m-crs s w/ f pbls 30%? Inc pbl content w/ depth and avg size inc to 1"	3.0-9.0		Y-14016			Suspended load of glaciofluvial system
Water coming into hole after digging ceased						

Total Depth	9.0 FEET	H2O Table	~9.0 FEET	Aggregate	6+ FEET
Ended in	SAND AND GRAVEL			Thickness	

Logged by Geologist: Jennings Drilled by: Rosnau Drill Rig/Auger size: backhoe

Terrain: Knoll

TEST HOLE LOG Test Hole No. 15 Page 1 of 1

Project Name/No.: ETR WEST/334-41

GSOC #: NA Coordinates	Owner	School Trust	
Township St. Louis County	Date drilled	9/7/2012	
Site Description Date called/Date ready NA	Start time	2:00 PM	
Esker Rd, west, trail on way in, middle ridge	End time	15:00	
Utilities NA			

Description	Drilling		Sampled?	Gravel size (in")		Interpretation
Sediment/Color/Grading/Texture	Depth (FT)	Graphic Log	Interval	Range	Predominant	Geological
Cbly pbl gvl w/ silt matrix	0.0-3.0		N	1-10"		High energy glac fluv with eolian seive deposits
Inc s in matrix with depth. Clst sup cbl gvl, less silt more sand	3.0-7.0		Y-15017	.5-12"	8"	Very coarse, ice proximal, hi energy glaciofluvial
Loose, large and oxidized, sides collapsing and limiting depth						

Total Depth	7.0 FEET	H2O Table	>7.0 FEET	Aggregate	4+ FEET
Ended in	SAND AND GRAVEL			Thickness	

Logged by Geologist: Jennings Drilled by: Rosnau Drill Rig/Auger size: backhoe

Terrain: Knoll

TEST HOLE LOG Test Hole No. 16 Page 1 of 1

Project Name/No.: ETR WEST/334-41

GSOC #: NA Coordinates	Owner	School Trust	
Township St. Louis County	Date drilled	9/7/2012	
Site Description Date called/Date ready NA	Start time	2:45 PM	
Esker Rd, west, went down hill because last hole so coarse	End time	15:15	
Utilities NA			

Description	Drilling		Sampled?	Gravel size (in")		Interpretation
Site Description	Depth (FT)	Graphic Log	Interval	Range	Predominant	Geological
Si cbl gvl w/ bldrs, s and gran, clast sup, most over size crushable, 2ndry clay,Fe2.5'	0.0-8.0		Y-16018	.2-10"	8"	High energy glaciofluvial with eolian seive deposits
Difficult excavation, just as clast rich but dec size w/ depth.						

Total Depth	8.0 FEET	H2O Table	>8 FEET	Aggregate	8.0+ FEET
Ended in	SAND AND GRAVEL			Thickness	

Logged by Geologist: Jennings Drilled by: Rosnau Drill Rig/Auger size: backhoe

Terrain: Knoll

TEST HOLE LOG Test Hole No. 17 Page 1 of 1

Project Name/No.: ETR WEST/334-41

GSOC #: NA Coordinates		Owner	School Trust	
Township St. Louis County		Date drilled	9/7/2012	
Site Description	Date called/Date ready NA	Start time	3:15 PM	
Esker Rd, west,farthest SW, low ridge		End time	16:00	
Utilities NA				

Description	Drilling		Sampled?	Gravel size (in")		Interpretation
Site Description	Depth (FT)	Graphic Log	Interval	Range	Predominant	Geological
pbl gvl w/ silt matrix,	0.0-3.0		Y-17019			High energy glaciofluvial with eolian seive deposits
inc m-crs s in matrix as si is dec	3.0-4.5		Y-17019			High energy glaciofluvial
pbly s, some lrg cbls & bldrs, but sandier, looser						Distal glaciofluvial
Total Depth	4.5 FEET		H2O Table	>4.5 FEET	Aggregate	4.5+ FEET
Ended in	SAND AND GRAVEL				Thickness	

Logged by Geologist: Jennings Drilled by: Rosnau Drill Rig/Auger size: backhoe

Terrain: Knoll

Appendix B. Gradation and quality tests for the Esker Trail Road West site. Samples correspond to the test holes described in Appendix A. The quality test data performed by Braun Intertec are found in the last 5 pages of this appendix.

BRAUN INTERTEC

Site: ETR WEST Test Hole #:01
Sample ID: 01001
Sample Interval = 3.0 - 8.0 Feet

Braun Intertec Corporation
3404 15th Avenue East, Suite 9
Hibbing, MN 55746
Phone: 218.263.8869

Material Test Report

Report No: MAT:W13-000522-S2
Issue No: 1

Client: Heather Arends
Minnesota DNR Divisions of Lands and Minerals
500 Lafayette Road
St. Paul, MN, 55155
Project: HB-13-00198
Gradation Testing
1525 3rd Avenue East
Hibbing, MN, 55746
PM: Alex Peritz, aperitz@BraunIntertec.com

Richard L Bober
Laboratory Coordinator
Date of Issue: 4/2/2013

Sample Details

Sample ID:	W13-000522-S2
Alternate Sample ID:	G-02
Sampled By:	Client
Sampling Method:	Not Given
Date Sampled:	9/6/2012
Date Submitted:	3/18/2013
Specification:	For Informational Purposes Only
Source:	On-site
Material Type:	GP-Poorly Graded Gravel
Sample Location:	33441-ETR West/01001

Other Test Results

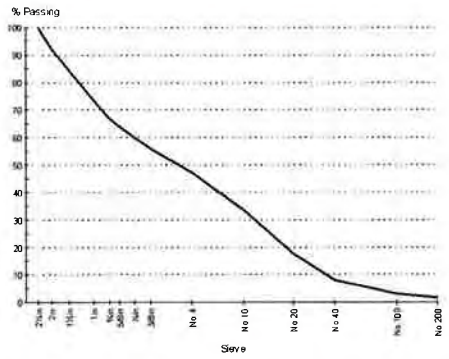
Description	Method	Result	Limits

Particle Size Distribution

Method: ASTM C 136 - 06, ASTM C 117 - 04
Drying by: Hotplate
Date Tested: 3/26/2013

Sieve Size	% Passing	Limits
2½in (63.0mm)	100	
2in (50.0mm)	92	
1½in (37.5mm)	84	
1in (25.0mm)	74	
¾in (19.0mm)	67	
5/8in (16.0mm)	64	
½in (12.5mm)	60	
3/8in (9.5mm)	56	
No.4 (4.75mm)	47	
No.10 (2.0mm)	34	
No.20 (850µm)	18	
No.40 (425µm)	8	
No.100 (150µm)	3	
No.200 (75µm)	1.6	

Chart



Comments

For Informational Purpose Only

BRAUN INTERTEC

Site: ETR WEST Test Hole #:02
Sample ID: 02002
Sample Interval = 0.0 - 2.0 Feet

Braun Intertec Corporation
3404 15th Avenue East, Suite 9
Hibbing, MN 55746
Phone: 218.263.8869

Material Test Report

Report No: MAT:W13-000529-S5
Issue No: 1

Client: Heather Arends
Minnesota DNR Divisions of Lands and Minerals
500 Lafayette Road
St. Paul, MN, 55155
Project: HB-13-00198
Gradation Testing
1525 3rd Avenue East
Hibbing, MN, 55746
PM: Alex Peritz, aperitz@BraunIntertec.com

Richard L Bober
Laboratory Coordinator
Date of Issue: 4/2/2013

Sample Details

Sample ID: W13-000529-S5
Alternate Sample ID: G-26
Sampled By: Client
Sampling Method: Not Given
Date Sampled: 9/6/2012
Date Submitted: 3/18/2013
Specification: For Informational Purposes Only
Source: On-site
Material Type: SP-SM Poorly Graded Sand with Silt
Sample Location: 33441-ETR West/02002

Other Test Results

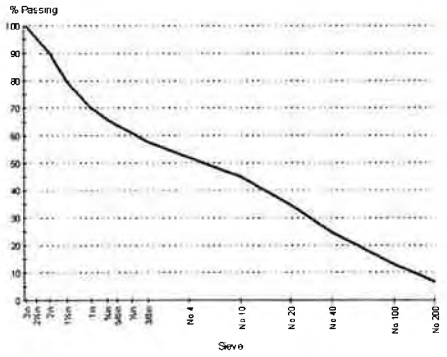
Description	Method	Result	Limits

Particle Size Distribution

Method: ASTM C 136 - 06, ASTM C 117 - 04
Drying by: Hotplate
Date Tested: 3/26/2013

Sieve Size	% Passing	Limits
3in (75.0mm)	100	
2½in (63.0mm)	96	
2in (50.0mm)	90	
1½in (37.5mm)	80	
1in (25.0mm)	70	
¾in (19.0mm)	66	
5/8in (16.0mm)	64	
½in (12.5mm)	61	
3/8in (9.5mm)	58	
No.4 (4.75mm)	52	
No.10 (2.0mm)	45	
No.20 (850µm)	35	
No.40 (425µm)	25	
No.100 (150µm)	13	
No.200 (75µm)	6.8	

Chart



Comments

For Informational Purpose Only

BRAUN INTERTEC

Site: ETR WEST Test Hole #:02
Sample ID: 02003
Sample Interval = 2.0 - 9.0 Feet

Braun Intertec Corporation
3404 15th Avenue East, Suite 9
Hibbing, MN 55746
Phone: 218.263.8869

Material Test Report

Report No: MAT:W13-000522-S3
Issue No: 1

Client: Heather Arends
Minnesota DNR Divisions of Lands and Minerals
500 Lafayette Road
St. Paul, MN, 55155
Project: HB-13-00198
Gradation Testing
1525 3rd Avenue East
Hibbing, MN, 55746
PM: Alex Peritz, aperitz@BraunIntertec.com

Richard L Bober
Laboratory Coordinator
Date of Issue: 4/2/2013

Sample Details

Sample ID:	W13-000522-S3
Alternate Sample ID:	G-03
Sampled By:	Client
Sampling Method:	Not Given
Date Sampled:	9/6/2012
Date Submitted:	3/18/2013
Specification:	For Informational Purposes Only
Source:	On-site
Material Type:	GP-Poorly Graded Gravel
Sample Location:	33441 ETR West/02003

Other Test Results

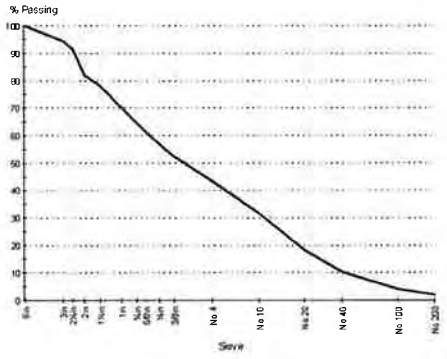
Description	Method	Result	Limits

Particle Size Distribution

Method: ASTM C 136 - 06, ASTM C 117 - 04
Drying by: Hotplate
Date Tested: 3/26/2013

Sieve Size	% Passing	Limits
6in (150mm)	100	
3in (75.0mm)	94	
2½in (63.0mm)	92	
2in (50.0mm)	82	
1½in (37.5mm)	78	
1in (25.0mm)	70	
¾in (19.0mm)	65	
5/8in (16.0mm)	61	
½in (12.5mm)	57	
3/8in (9.5mm)	52	
No.4 (4.75mm)	43	
No.10 (2.0mm)	32	
No.20 (850µm)	18	
No.40 (425µm)	10	
No.100 (150µm)	4	
No.200 (75µm)	2.0	

Chart



Comments

For Informational Purpose Only

BRAUN INTERTEC

Site: ETR WEST Test Hole #:03
Sample ID: 03004
Sample Interval = 2.0 - 8.0 Feet

Braun Intertec Corporation
3404 15th Avenue East, Suite 9
Hibbing, MN 55746
Phone: 218.263.8869

Material Test Report

Report No: MAT:W13-000526-S6
Issue No: 1

Client: Heather Arends
Minnesota DNR Divisions of Lands and Minerals
500 Lafayette Road
St. Paul, MN, 55155
Project: HB-13-00198
Gradation Testing
1525 3rd Avenue East
Hibbing, MN, 55746
PM: Alex Peritz, aperitz@BraunIntertec.com

Richard L Bober
Laboratory Coordinator
Date of Issue: 4/2/2013

Sample Details

Sample ID:	W13-000526-S6
Alternate Sample ID:	G-20
Sampled By:	Client
Sampling Method:	Not Given
Date Sampled:	9/6/2012
Date Submitted:	3/18/2013
Specification:	For Informational Purposes Only
Source:	On-site
Material Type:	SP Poorly Graded Sand
Sample Location:	33441-ETR West/03004

Other Test Results

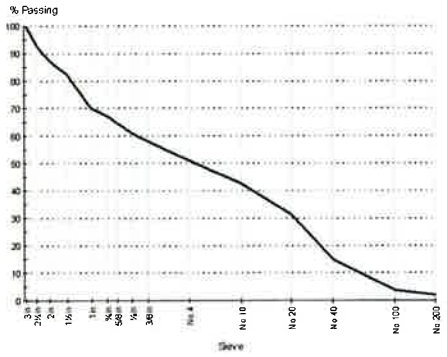
Description	Method	Result	Limits

Particle Size Distribution

Method: ASTM C 136 - 06, ASTM C 117 - 04
Drying by: Hotplate
Date Tested: 3/26/2013

Sieve Size	% Passing	Limits
3in (75.0mm)	100	
2½in (63.0mm)	93	
2in (50.0mm)	87	
1½in (37.5mm)	82	
1in (25.0mm)	70	
¾in (19.0mm)	67	
5/8in (16.0mm)	65	
½in (12.5mm)	61	
3/8in (9.5mm)	58	
No.4 (4.75mm)	51	
No.10 (2.0mm)	43	
No.20 (850µm)	31	
No.40 (425µm)	15	
No.100 (150µm)	4	
No.200 (75µm)	2.0	

Chart



Comments

For Informational Purpose Only

BRAUN INTERTEC

Site: ETR WEST Test Hole #:04
Sample ID: 04005
Sample Interval = 1.5 - 8.0 Feet

Braun Intertec Corporation
3404 15th Avenue East, Suite 9
Hibbing, MN 55746
Phone: 218.263.8869

Material Test Report

Report No: MAT:W13-000524-S4
Issue No: 1

Client: Heather Arends
Minnesota DNR Divisions of Lands and Minerals
500 Lafayette Road
St. Paul, MN, 55155
Project: HB-13-00198
Gradation Testing
1525 3rd Avenue East
Hibbing, MN, 55746
PM: Alex Peritz, aperitz@BraunIntertec.com

Richard L Bober
Laboratory Coordinator
Date of Issue: 4/2/2013

Sample Details

Sample ID:	W13-000524-S4
Alternate Sample ID:	G-11
Sampled By:	Client
Sampling Method:	Not Given
Date Sampled:	9/6/2012
Date Submitted:	3/18/2013
Specification:	For Informational Purposes Only
Source:	On-site
Material Type:	GP-Poorly Graded Gravel
Sample Location:	33441-ETR West/04005

Other Test Results

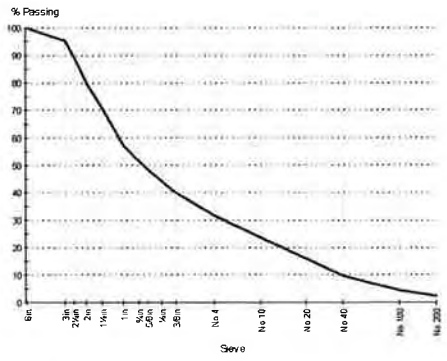
Description	Method	Result	Limits

Particle Size Distribution

Method: ASTM C 136 - 06, ASTM C 117 - 04
Drying by: Hotplate
Date Tested: 3/26/2013

Sieve Size	% Passing	Limits
6in (150mm)	100	
3in (75.0mm)	95	
2½in (63.0mm)	89	
2in (50.0mm)	80	
1½in (37.5mm)	71	
1in (25.0mm)	57	
¾in (19.0mm)	52	
5/8in (16.0mm)	48	
½in (12.5mm)	44	
3/8in (9.5mm)	40	
No.4 (4.75mm)	32	
No.10 (2.0mm)	24	
No.20 (850µm)	16	
No.40 (425µm)	10	
No.100 (150µm)	4	
No.200 (75µm)	2.5	

Chart



Comments

For Informational Purpose Only

BRAUN INTERTEC

Site: ETR WEST Test Hole #:05
Sample ID: 05006
Sample Interval = 2.0 - 8.0 Feet

Braun Intertec Corporation
3404 15th Avenue East, Suite 9
Hibbing, MN 55746
Phone: 218.263.8869

Material Test Report

Report No: MAT:W13-000522-S4
Issue No: 1

Client: Heather Arends
Minnesota DNR Divisions of Lands and Minerals
500 Lafayette Road
St. Paul, MN, 55155
Project: HB-13-00198
Gradation Testing
1525 3rd Avenue East
Hibbing, MN, 55746
PM: Alex Peritz, aperitz@BraunIntertec.com

Richard L Bober
Laboratory Coordinator
Date of Issue: 4/2/2013

Sample Details

Sample ID:	W13-000522-S4
Alternate Sample ID:	G-04
Sampled By:	Client
Sampling Method:	Not Given
Date Sampled:	9/6/2012
Date Submitted:	3/18/2013
Specification:	For Informational Purposes Only
Source:	On-site
Material Type:	GP-Poorly Graded Gravel
Sample Location:	33441 ETR West/05006

Other Test Results

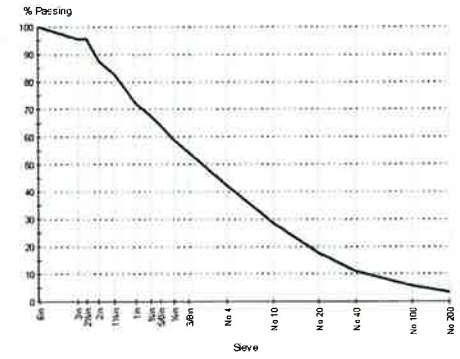
Description	Method	Result	Limits

Particle Size Distribution

Method: ASTM C 136 - 06, ASTM C 117 - 04
Drying by: Hotplate
Date Tested: 3/26/2013

Sieve Size	% Passing	Limits
6in (150mm)	100	
3in (75.0mm)	96	
2½in (63.0mm)	96	
2in (50.0mm)	88	
1½in (37.5mm)	83	
1in (25.0mm)	72	
¾in (19.0mm)	68	
5/8in (16.0mm)	64	
½in (12.5mm)	59	
3/8in (9.5mm)	54	
No.4 (4.75mm)	42	
No.10 (2.0mm)	29	
No.20 (850µm)	18	
No.40 (425µm)	11	
No.100 (150µm)	6	
No.200 (75µm)	3.3	

Chart



Comments

For Informational Purpose Only

BRAUN INTERTEC

Site: ETR WEST Test Hole #:06
Sample ID: 06007
Sample Interval = 1.5 - 5.0 Feet

Braun Intertec Corporation
3404 15th Avenue East, Suite 9
Hibbing, MN 55746
Phone: 218.263.8869

Material Test Report

Report No: MAT:W13-000529-S7
Issue No: 1

Client: Heather Arends
Minnesota DNR Divisions of Lands and Minerals
500 Lafayette Road
St. Paul, MN, 55155
Project: HB-13-00198
Gradation Testing
1525 3rd Avenue East
Hibbing, MN, 55746
PM: Alex Peritz, aperitz@BraunIntertec.com

Richard L Bober
Laboratory Coordinator
Date of Issue: 4/2/2013

Sample Details

Sample ID:	W13-000529-S7
Alternate Sample ID:	G-28
Sampled By:	Client
Sampling Method:	Not Given
Date Sampled:	9/6/2012
Date Submitted:	3/18/2013
Specification:	For Informational Purposes Only
Source:	On-site
Material Type:	GP-Poorly Graded Gravel
Sample Location:	33441-ETR West/06007

Other Test Results

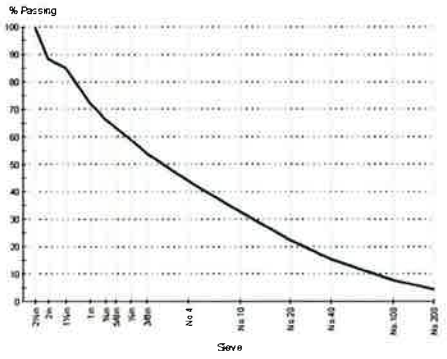
Description	Method	Result	Limits

Particle Size Distribution

Method: ASTM C 136 - 06, ASTM C 117 - 04
Drying by: Hotplate
Date Tested: 3/26/2013

Sieve Size	% Passing	Limits
2½in (63.0mm)	100	
2in (50.0mm)	88	
1½in (37.5mm)	85	
1in (25.0mm)	72	
¾in (19.0mm)	66	
5/8in (16.0mm)	63	
½in (12.5mm)	59	
3/8in (9.5mm)	54	
No.4 (4.75mm)	44	
No.10 (2.0mm)	33	
No.20 (850µm)	22	
No.40 (425µm)	15	
No.100 (150µm)	8	
No.200 (75µm)	4.3	

Chart



Comments

For Informational Purpose Only

BRAUN INTERTEC

Site: ETR WEST Test Hole #:06
Sample ID: 06008
Sample Interval = 5.0 - 8.0 Feet

Braun Intertec Corporation
3404 15th Avenue East, Suite 9
Hibbing, MN 55746
Phone: 218.263.8869

Material Test Report

Report No: MAT:W13-000522-S1
Issue No: 1

Client: Heather Arends
Minnesota DNR Divisions of Lands and Minerals
500 Lafayette Road
St. Paul, MN, 55155
Project: HB-13-00198
Gradation Testing
1525 3rd Avenue East
Hibbing, MN, 55746
PM: Alex Peritz, aperitz@BraunIntertec.com

Richard L Bober
Laboratory Coordinator
Date of Issue: 4/2/2013

Sample Details

Sample ID: W13-000522-S1
Alternate Sample ID: G-01
Sampled By: Client
Sampling Method: Not Given
Date Sampled: 9/6/2012
Date Submitted: 3/18/2013
Specification: For Informational Purposes Only
Source: On-site
Material Type: GP-Poorly Graded Gravel
Sample Location: 33441-ETR West/06008

Other Test Results

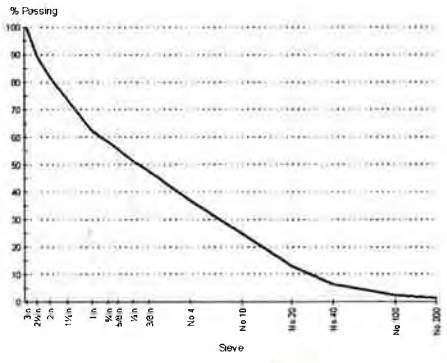
Description	Method	Result	Limits

Particle Size Distribution

Method: ASTM C 136 - 06, ASTM C 117 - 04
Drying by: Hotplate
Date Tested: 3/26/2013

Sieve Size	% Passing	Limits
3in (75.0mm)	100	
2½in (63.0mm)	90	
2in (50.0mm)	82	
1½in (37.5mm)	74	
1in (25.0mm)	62	
¾in (19.0mm)	58	
5/8in (16.0mm)	56	
½in (12.5mm)	51	
3/8in (9.5mm)	48	
No.4 (4.75mm)	37	
No.10 (2.0mm)	25	
No.20 (850µm)	13	
No.40 (425µm)	6	
No.100 (150µm)	2	
No.200 (75µm)	1.2	

Chart



Comments

For Informational Purpose Only

BRAUN INTERTEC

Site: ETR WEST Test Hole #:07
Sample ID: 07009
Sample Interval = 2.5 - 8.0 Feet

Braun Intertec Corporation
3404 15th Avenue East, Suite 9
Hibbing, MN 55746
Phone: 218.263.8869

Material Test Report

Report No: MAT:W13-000529-S3
Issue No: 1

Client: Heather Arends
Minnesota DNR Divisions of Lands and Minerals
500 Lafayette Road
St. Paul, MN, 55155
Project: HB-13-00198
Gradation Testing
1525 3rd Avenue East
Hibbing, MN, 55746
PM: Alex Peritz, aperitz@BraunIntertec.com

Richard L Bober
Laboratory Coordinator
Date of Issue: 4/2/2013

Sample Details

Sample ID:	W13-000529-S3
Alternate Sample ID:	G-24
Sampled By:	Client
Sampling Method:	Not Given
Date Sampled:	9/6/2012
Date Submitted:	3/18/2013
Specification:	For Informational Purposes Only
Source:	On-site
Material Type:	GP-Poorly Graded Gravel
Sample Location:	33441-ETR West/07009

Other Test Results

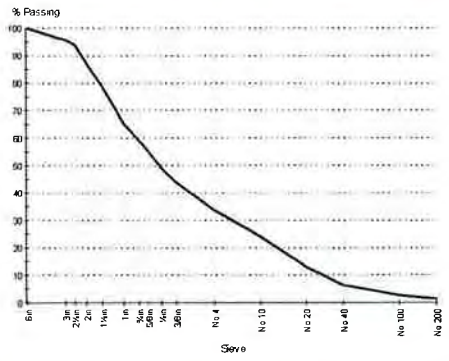
Description	Method	Result	Limits

Particle Size Distribution

Method: ASTM C 136 - 06, ASTM C 117 - 04
Drying by: Hotplate
Date Tested: 3/26/2013

Sieve Size	% Passing	Limits
6in (150mm)	100	
3in (75.0mm)	96	
2½in (63.0mm)	94	
2in (50.0mm)	87	
1½in (37.5mm)	78	
1in (25.0mm)	65	
¾in (19.0mm)	59	
5/8in (16.0mm)	55	
½in (12.5mm)	49	
3/8in (9.5mm)	44	
No.4 (4.75mm)	34	
No.10 (2.0mm)	24	
No.20 (850µm)	13	
No.40 (425µm)	6	
No.100 (150µm)	3	
No.200 (75µm)	1.3	

Chart



Comments

For Informational Purpose Only

BRAUN INTERTEC

Site: ETR WEST Test Hole #:08
Sample ID: 08010
Sample Interval = 2.5 - 8.0 Feet

Braun Intertec Corporation
3404 15th Avenue East, Suite 9
Hibbing, MN 55746
Phone: 218.263.8869

Material Test Report

Report No: MAT:W13-000522-S5
Issue No: 1

Client: Heather Arends
Minnesota DNR Divisions of Lands and Minerals
500 Lafayette Road
St. Paul, MN, 55155
Project: HB-13-00198
Gradation Testing
1525 3rd Avenue East
Hibbing, MN, 55746
PM: Alex Peritz, aperitz@BraunIntertec.com

Richard L Bober
Laboratory Coordinator
Date of Issue: 4/2/2013

Sample Details

Sample ID:	W13-000522-S5
Alternate Sample ID:	G-05
Sampled By:	Client
Sampling Method:	Not Given
Date Sampled:	9/6/2012
Date Submitted:	3/18/2013
Specification:	For Informational Purposes Only
Source:	On-site
Material Type:	GP-Poorly Graded Gravel
Sample Location:	33441-ETR West/08010

Other Test Results

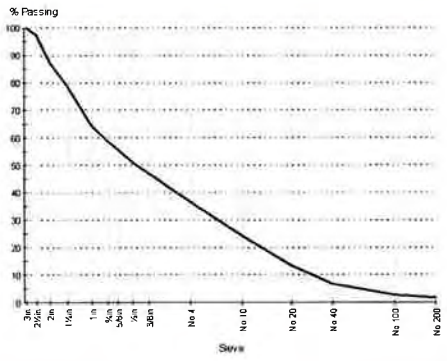
Description	Method	Result	Limits

Particle Size Distribution

Method: ASTM C 136 - 06, ASTM C 117 - 04
Drying by: Hotplate
Date Tested: 3/26/2013

Sieve Size	% Passing	Limits
3in (75.0mm)	100	
2½in (63.0mm)	97	
2in (50.0mm)	87	
1½in (37.5mm)	79	
1in (25.0mm)	64	
¾in (19.0mm)	59	
5/8in (16.0mm)	56	
½in (12.5mm)	51	
3/8in (9.5mm)	47	
No.4 (4.75mm)	37	
No.10 (2.0mm)	24	
No.20 (850µm)	13	
No.40 (425µm)	7	
No.100 (150µm)	3	
No.200 (75µm)	1.6	

Chart



Comments

For Informational Purpose Only

BRAUN INTERTEC

Site: ETR WEST Test Hole #:09
Sample ID: 09011
Sample Interval = 1.0 - 8.0 Feet

Braun Intertec Corporation
3404 15th Avenue East, Suite 9
Hibbing, MN 55746
Phone: 218.263.8869

Material Test Report

Report No: MAT:W13-000526-S4
Issue No: 1

Client: Heather Arends
Minnesota DNR Divisions of Lands and Minerals
500 Lafayette Road
St. Paul, MN, 55155
Project: HB-13-00198
Gradation Testing
1525 3rd Avenue East
Hibbing, MN, 55746
PM: Alex Peritz, aperitz@BraunIntertec.com

Richard L Bober
Laboratory Coordinator
Date of Issue: 4/2/2013

Sample Details

Sample ID: W13-000526-S4
Alternate Sample ID: G-18
Sampled By: Client
Sampling Method: Not Given
Date Sampled: 9/7/2012
Date Submitted: 3/18/2013
Specification: For Informational Purposes Only
Source: On-site
Material Type: GP-Poorly Graded Gravel
Sample Location: 33441-ETR West/09011

Other Test Results

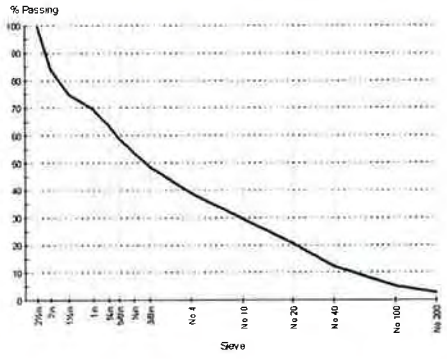
Description	Method	Result	Limits

Particle Size Distribution

Method: ASTM C 136 - 06, ASTM C 117 - 04
Drying by: Hotplate
Date Tested: 3/26/2013

Sieve Size	% Passing	Limits
2½in (63.0mm)	100	
2in (50.0mm)	84	
1½in (37.5mm)	75	
1in (25.0mm)	70	
¾in (19.0mm)	64	
5/8in (16.0mm)	59	
½in (12.5mm)	54	
3/8in (9.5mm)	49	
No.4 (4.75mm)	39	
No.10 (2.0mm)	30	
No.20 (850µm)	21	
No.40 (425µm)	12	
No.100 (150µm)	5	
No.200 (75µm)	2.7	

Chart



Comments

For Informational Purpose Only

BRAUN INTERTEC

Site: ETR WEST Test Hole #:10
Sample ID: 10012
Sample Interval = 2.5 - 9.0 Feet

Braun Intertec Corporation
3404 15th Avenue East, Suite 9
Hibbing, MN 55746
Phone: 218.263.8869

Material Test Report

Report No: MAT:W13-000526-S5
Issue No: 1

Client: Heather Arends
Minnesota DNR Divisions of Lands and Minerals
500 Lafayette Road
St. Paul, MN, 55155
Project: HB-13-00198
Gradation Testing
1525 3rd Avenue East
Hibbing, MN, 55746
PM: Alex Peritz, aperitz@BraunIntertec.com

Richard L Bober
Laboratory Coordinator
Date of Issue: 4/2/2013

Sample Details

Sample ID:	W13-000526-S5
Alternate Sample ID:	G-19
Sampled By:	Client
Sampling Method:	Not Given
Date Sampled:	9/7/2012
Date Submitted:	3/18/2013
Specification:	For Informational Purposes Only
Source:	On-site
Material Type:	SP-SM Poorly Graded Sand with Silt
Sample Location:	33441-ETR West/10012

Other Test Results

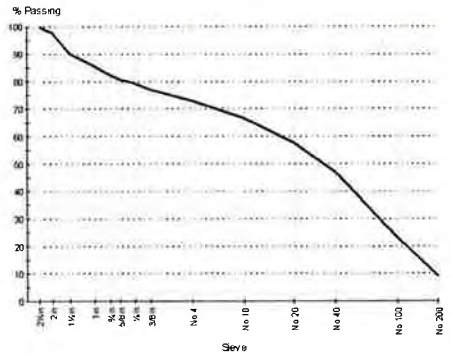
Description	Method	Result	Limits

Particle Size Distribution

Method: ASTM C 136 - 06, ASTM C 117 - 04
Drying by: Hotplate
Date Tested: 3/26/2013

Sieve Size	% Passing	Limits
2½in (63.0mm)	100	
2in (50.0mm)	98	
1½in (37.5mm)	90	
1in (25.0mm)	86	
¾in (19.0mm)	82	
5/8in (16.0mm)	81	
½in (12.5mm)	79	
3/8in (9.5mm)	77	
No.4 (4.75mm)	73	
No.10 (2.0mm)	67	
No.20 (850µm)	58	
No.40 (425µm)	47	
No.100 (150µm)	23	
No.200 (75µm)	9.1	

Chart



Comments

For Informational Purpose Only

BRAUN INTERTEC

Site: ETR WEST Test Hole #:11
Sample ID: 11013
Sample Interval = 2.5 - 8.0 Feet

Braun Intertec Corporation
3404 15th Avenue East, Suite 9
Hibbing, MN 55746
Phone: 218.263.8869

Material Test Report

Report No: MAT:W13-000526-S3
Issue No: 1

Client: Heather Arends
Minnesota DNR Divisions of Lands and Minerals
500 Lafayette Road
St. Paul, MN, 55155
Project: HB-13-00198
Gradation Testing
1525 3rd Avenue East
Hibbing, MN, 55746
PM: Alex Peritz, aperitz@BraunIntertec.com

Richard L Bober
Laboratory Coordinator
Date of Issue: 4/2/2013

Sample Details

Sample ID:	W13-000526-S3
Alternate Sample ID:	G-17
Sampled By:	Client
Sampling Method:	Not Given
Date Sampled:	9/7/2012
Date Submitted:	3/18/2013
Specification:	For Informational Purposes Only
Source:	On-site
Material Type:	SP Poorly Graded Sand
Sample Location:	33441-ETR West/11013

Other Test Results

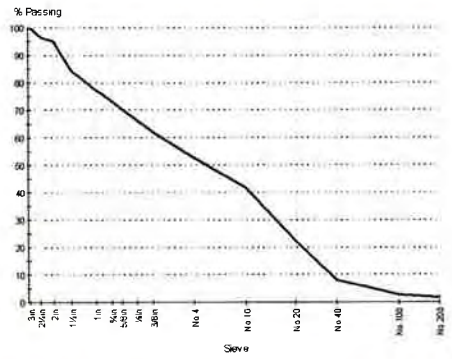
Description	Method	Result	Limits

Particle Size Distribution

Method: ASTM C 136 - 06, ASTM C 117 - 04
Drying by: Hotplate
Date Tested: 3/26/2013

Sieve Size	% Passing	Limits
3in (75.0mm)	100	
2½in (63.0mm)	97	
2in (50.0mm)	95	
1½in (37.5mm)	84	
1in (25.0mm)	77	
¾in (19.0mm)	73	
5/8in (16.0mm)	70	
½in (12.5mm)	66	
3/8in (9.5mm)	62	
No.4 (4.75mm)	53	
No.10 (2.0mm)	42	
No.20 (850µm)	22	
No.40 (425µm)	8	
No.100 (150µm)	3	
No.200 (75µm)	1.6	

Chart



Comments

For Informational Purpose Only

BRAUN INTERTEC

Site: ETR WEST Test Hole #:12
Sample ID: 12014
Sample Interval = 2.5 - 7.5 Feet

Braun Intertec Corporation
3404 15th Avenue East, Suite 9
Hibbing, MN 55746
Phone: 218.263.8869

Material Test Report

Report No: MAT:W13-000524-S5
Issue No: 1

Client: Heather Arends
Minnesota DNR Divisions of Lands and Minerals
500 Lafayette Road
St. Paul, MN, 55155
Project: HB-13-00198
Gradation Testing
1525 3rd Avenue East
Hibbing, MN, 55746
PM: Alex Peritz, aperitz@BraunIntertec.com

Richard L Bober
Laboratory Coordinator
Date of Issue: 4/2/2013

Sample Details

Sample ID:	W13-000524-S5
Alternate Sample ID:	G-12
Sampled By:	Client
Sampling Method:	Not Given
Date Sampled:	9/7/2012
Date Submitted:	3/18/2013
Specification:	For Informational Purposes Only
Source:	On-site
Material Type:	GP-Poorly Graded Gravel
Sample Location:	33441-ETR West/12014

Other Test Results

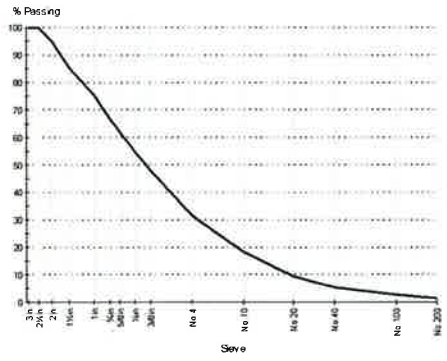
Description	Method	Result	Limits

Particle Size Distribution

Method: ASTM C 136 - 06, ASTM C 117 - 04
Drying by: Hotplate
Date Tested: 3/26/2013

Sieve Size	% Passing	Limits
3in (75.0mm)	100	
2½in (63.0mm)	100	
2in (50.0mm)	95	
1½in (37.5mm)	85	
1in (25.0mm)	76	
¾in (19.0mm)	67	
5/8in (16.0mm)	62	
½in (12.5mm)	55	
3/8in (9.5mm)	48	
No.4 (4.75mm)	32	
No.10 (2.0mm)	18	
No.20 (850µm)	9	
No.40 (425µm)	5	
No.100 (150µm)	3	
No.200 (75µm)	1.5	

Chart



Comments

For Informational Purpose Only

BRAUN INTERTEC

Site: ETR WEST Test Hole #:13
Sample ID: 13015
Sample Interval = 3.0 - 9.0 Feet

Braun Intertec Corporation
3404 15th Avenue East, Suite 9
Hibbing, MN 55746
Phone: 218.263.8869

Material Test Report

Report No: MAT:W13-000524-S6
Issue No: 1

Client: Heather Arends
Minnesota DNR Divisions of Lands and Minerals
500 Lafayette Road
St. Paul, MN, 55155
Project: HB-13-00198
Gradation Testing
1525 3rd Avenue East
Hibbing, MN, 55746
PM: Alex Peritz, aperitz@BraunIntertec.com

Richard L Bober
Laboratory Coordinator
Date of Issue: 4/2/2013

Sample Details

Sample ID:	W13-000524-S6
Alternate Sample ID:	G-13
Sampled By:	Client
Sampling Method:	Not Given
Date Sampled:	9/7/2012
Date Submitted:	3/18/2013
Specification:	For Informational Purposes Only
Source:	On-site
Material Type:	SM-Silty Sand
Sample Location:	33441-ETR West/13015

Other Test Results

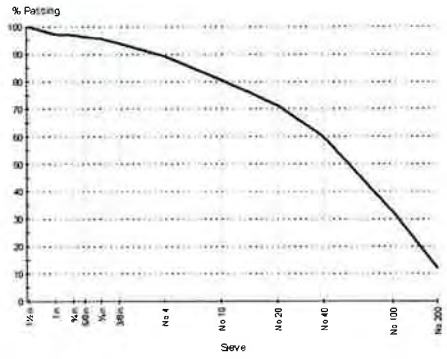
Description	Method	Result	Limits

Particle Size Distribution

Method: ASTM C 136 - 06, ASTM C 117 - 04
Drying by: Hotplate
Date Tested: 3/26/2013

Sieve Size	% Passing	Limits
1½in (37.5mm)	100	
1in (25.0mm)	97	
¾in (19.0mm)	97	
5/8in (16.0mm)	96	
½in (12.5mm)	96	
3/8in (9.5mm)	94	
No.4 (4.75mm)	89	
No.10 (2.0mm)	81	
No.20 (850µm)	71	
No.40 (425µm)	60	
No.100 (150µm)	33	
No.200 (75µm)	12	

Chart



Comments

For Informational Purpose Only

BRAUN INTERTEC

Site: ETR WEST Test Hole #:14
Sample ID: 14016
Sample Interval = 3.0 - 9.0 Feet

Braun Intertec Corporation
3404 15th Avenue East, Suite 9
Hibbing, MN 55746
Phone: 218.263.8869

Material Test Report

Report No: MAT:W13-000526-S1
Issue No: 1

Client: Heather Arends
Minnesota DNR Divisions of Lands and Minerals
500 Lafayette Road
St. Paul, MN, 55155
Project: HB-13-00198
Gradation Testing
1525 3rd Avenue East
Hibbing, MN, 55746
PM: Alex Peritz, aperitz@BraunIntertec.com

Richard L Bober
Laboratory Coordinator
Date of Issue: 4/2/2013

Sample Details

Sample ID:	W13-000526-S1
Alternate Sample ID:	G-15
Sampled By:	Client
Sampling Method:	Not Given
Date Sampled:	9/7/2012
Date Submitted:	3/18/2013
Specification:	For Informational Purposes Only
Source:	On-site
Material Type:	SP-SM Poorly Graded Sand with Silt
Sample Location:	33441-ETR West/14016

Other Test Results

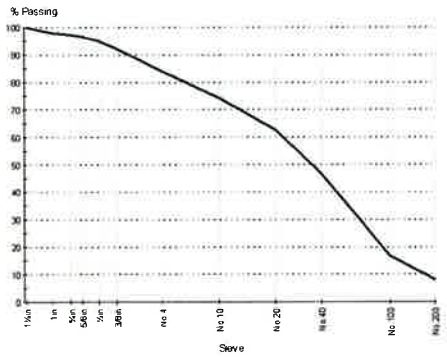
Description	Method	Result	Limits

Particle Size Distribution

Method: ASTM C 136 - 06, ASTM C 117 - 04
Drying by: Hotplate
Date Tested: 3/26/2013

Sieve Size	% Passing	Limits
1½in (37.5mm)	100	
1in (25.0mm)	98	
¾in (19.0mm)	97	
5/8in (16.0mm)	97	
½in (12.5mm)	95	
3/8in (9.5mm)	92	
No.4 (4.75mm)	84	
No.10 (2.0mm)	74	
No.20 (850µm)	63	
No.40 (425µm)	47	
No.100 (150µm)	17	
No.200 (75µm)	8.1	

Chart



Comments

For Informational Purpose Only

BRAUN INTERTEC

Site: ETR WEST Test Hole #:15
Sample ID: 15017
Sample Interval = 3.0 - 7.0 Feet

Braun Intertec Corporation
3404 15th Avenue East, Suite 9
Hibbing, MN 55746
Phone: 218.263.8869

Material Test Report

Report No: MAT:W13-000524-S7
Issue No: 1

Client: Heather Arends
Minnesota DNR Divisions of Lands and Minerals
500 Lafayette Road
St. Paul, MN, 55155
Project: HB-13-00198
Gradation Testing
1525 3rd Avenue East
Hibbing, MN, 55746
PM: Alex Peritz, aperitz@BraunIntertec.com

Richard L Bober
Laboratory Coordinator
Date of Issue: 4/2/2013

Sample Details

Sample ID:	W13-000524-S7
Alternate Sample ID:	G-14
Sampled By:	Client
Sampling Method:	Not Given
Date Sampled:	9/7/2012
Date Submitted:	3/18/2013
Specification:	For Informational Purposes Only
Source:	On-site
Material Type:	GP-Poorly Graded Gravel
Sample Location:	33441-ETR West/15017

Other Test Results

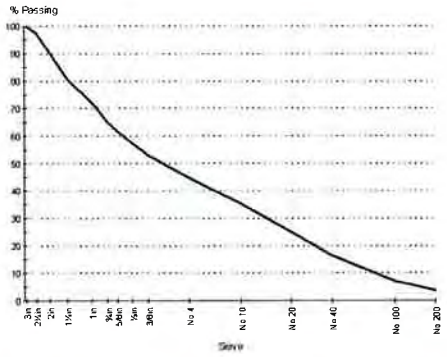
Description	Method	Result	Limits

Particle Size Distribution

Method: ASTM C 136 - 06, ASTM C 117 - 04
Drying by: Hotplate
Date Tested: 3/26/2013

Sieve Size	% Passing	Limits
3in (75.0mm)	100	
2½in (63.0mm)	97	
2in (50.0mm)	90	
1½in (37.5mm)	81	
1in (25.0mm)	72	
¾in (19.0mm)	65	
5/8in (16.0mm)	62	
½in (12.5mm)	57	
3/8in (9.5mm)	53	
No.4 (4.75mm)	45	
No.10 (2.0mm)	35	
No.20 (850µm)	25	
No.40 (425µm)	16	
No.100 (150µm)	7	
No.200 (75µm)	3.7	

Chart



Comments

For Informational Purpose Only

BRAUN INTERTEC

Site: ETR WEST Test Hole #:16
Sample ID: 16018
Sample Interval = 0.0 - 8.0 Feet

Braun Intertec Corporation
3404 15th Avenue East, Suite 9
Hibbing, MN 55746
Phone: 218.263.8869

Material Test Report

Report No: MAT:W13-000526-S2
Issue No: 1

Client: Heather Arends
Minnesota DNR Divisions of Lands and Minerals
500 Lafayette Road
St. Paul, MN, 55155
Project: HB-13-00198
Gradation Testing
1525 3rd Avenue East
Hibbing, MN, 55746
PM: Alex Peritz, aperitz@BraunIntertec.com

Richard L Bober
Laboratory Coordinator
Date of Issue: 4/2/2013

Sample Details

Sample ID: W13-000526-S2
Alternate Sample ID: G-16
Sampled By: Client
Sampling Method: Not Given
Date Sampled: 9/7/2012
Date Submitted: 3/18/2013
Specification: For Informational Purposes Only
Source: On-site
Material Type: GP-Poorly Graded Gravel
Sample Location: 33441-ETR West/16018

Other Test Results

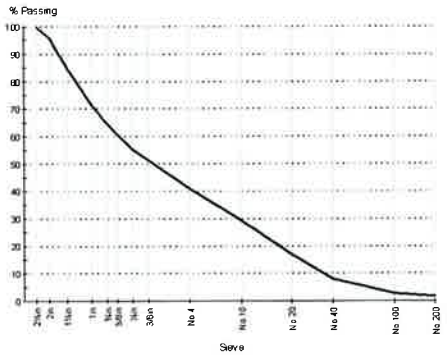
Description	Method	Result	Limits

Particle Size Distribution

Method: ASTM C 136 - 06, ASTM C 117 - 04
Drying by: Hotplate
Date Tested: 3/26/2013

Sieve Size	% Passing	Limits
2½in (63.0mm)	100	
2in (50.0mm)	96	
1½in (37.5mm)	85	
1in (25.0mm)	72	
¾in (19.0mm)	65	
5/8in (16.0mm)	61	
½in (12.5mm)	55	
3/8in (9.5mm)	51	
No.4 (4.75mm)	41	
No.10 (2.0mm)	29	
No.20 (850µm)	17	
No.40 (425µm)	8	
No.100 (150µm)	3	
No.200 (75µm)	1.5	

Chart



Comments

For Informational purpose Only

BRAUN INTERTEC

Site: ETR WEST Test Hole #:17
Sample ID: 17019
Sample Interval = 0.0 - 4.5 Feet

Braun Intertec Corporation
3404 15th Avenue East, Suite 9
Hibbing, MN 55746
Phone: 218.263.8869

Material Test Report

Report No: MAT:W13-000529-S2
Issue No: 1

Client: Heather Arends
Minnesota DNR Divisions of Lands and Minerals
500 Lafayette Road
St. Paul, MN, 55155
Project: HB-13-00198
Gradation Testing
1525 3rd Avenue East
Hibbing, MN, 55746
PM: Alex Peritz, aperitz@BraunIntertec.com

Richard L Bober
Laboratory Coordinator
Date of Issue: 4/2/2013

Sample Details

Sample ID: W13-000529-S2
Alternate Sample ID: G-23
Sampled By: Client
Sampling Method: Not Given
Date Sampled: 9/7/2012
Date Submitted: 3/18/2013
Specification: For Informational Purposes Only
Source: On-site
Material Type: SP Poorly Graded Sand
Sample Location: 33441-ETR West/17019

Other Test Results

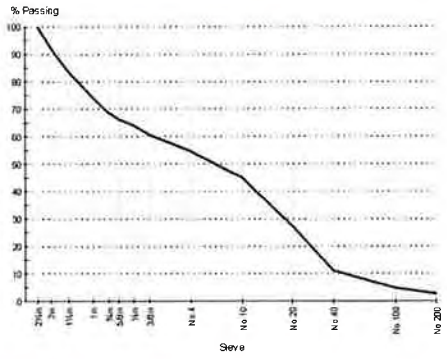
Description	Method	Result	Limits

Particle Size Distribution

Method: ASTM C 136 - 06, ASTM C 117 - 04
Drying by: Hotplate
Date Tested: 3/26/2013

Sieve Size	% Passing	Limits
2½in (63.0mm)	100	
2in (50.0mm)	92	
1½in (37.5mm)	84	
1in (25.0mm)	74	
¾in (19.0mm)	69	
5/8in (16.0mm)	66	
½in (12.5mm)	64	
3/8in (9.5mm)	61	
No.4 (4.75mm)	55	
No.10 (2.0mm)	45	
No.20 (850µm)	27	
No.40 (425µm)	11	
No.100 (150µm)	5	
No.200 (75µm)	2.8	

Chart



Comments

For Informational Purpose Only

BRAUN INTERTEC

Site: ETR WEST
Composite Sample: 01001, 02002, 05006, 06008, 08010

Braun Intertec Corporation
11001 Hampshire Avenue South
Minneapolis, MN 55438
Phone: 952.995.2000

Flat and Elongated Particles

Report No: EIND:W13-000575-S2
Issue No: 1

Client: Heather Arends
Minnesota DNR Divisions of Lands and Minerals
500 Lafayette Road
St. Paul, MN, 55155

Project: HB-13-00198
Gradation Testing
1525 3rd Avenue East
Hibbing, MN, 55746

PM: Alex Peritz, aperitz@BraunIntertec.com

Dallas Miner
Laboratory Supervisor
Date of Issue: 4/23/2013

Sample Details

Sample ID:	W13-000575-S2	**Alternate Sample ID:**	
Sampled By:		**Date Sampled:**	
Sampling Method:		**Source:**	
Material:		**Specification:**	For Informational Purposes Only
Sample Location:	01001, 02003, 05006, 06008, 08010		

General Test Information

ASTM D 4791 - 05

Dimensional Ratio:	3:1	**Total Weighted Elongated Particles (%):**	0
Total Weighted Flat Particles (%):	0	**Total Weighted Flat + Elongated Particles (%):**	0
Total Weighted Flat & Elongated Particles (%):	0		

Flat and Elongated Particles

Sieve Size	Retained (%)	Total Particles Count	Total Particles Weight (g)	Elongated Weight (%)	Elongated Weighted (%)	Flat Weight (%)	Flat Weighted (%)
2in (50.0mm)	10.0		4958.2	0	0	0	0

Flat and Elongated Particles

Sieve Size	Flat + Elongated Weight (%)	Flat + Elongated Weighted (%)	Flat & Elongated Weight (%)	Flat & Elongated Weighted (%)
2in (50.0mm)	0	0	0	0

Comments

BRAUN INTERTEC

Site: ETR WEST
Composite Sample: 01001, 02003, 05006, 06008, 08010

Braun Intertec Corporation
11001 Hampshire Avenue South
Minneapolis, MN 55438
Phone: 952.995.2000

Soundness Test Report

Report No: SSS:W13-000575-S2
Issue No: 1

Client: Heather Arends
Minnesota DNR Divisions of Lands and Minerals
500 Lafayette Road
St. Paul, MN, 55155

Project: HB-13-00198
Gradation Testing
1525 3rd Avenue East
Hibbing, MN, 55746

PM: Alex Peritz, aperitz@BraunIntertec.com

Dallas Miner
Laboratory Supervisor
Date of Issue: 4/23/2013

Sample Details

Sample ID: W13-000575-S2
Sampled By:
Sampling Method:
Material:
Sample Location: 01001, 02003, 05006, 06008, 08010
Alternate Sample ID:
Date Sampled:
Source:
Specification: For Informational Purposes Only

General Test Information

ASTM C 88 - 05

Test Type: Combined
Solution Type: Magnesium Sulfate
Plus Number 4 (%): 59
Total Weighted Coarse Loss (%): 4
Preparation: Freshly Prepared
Minus Number 4 (%): 41
Total Weighted Fine Loss (%): 22

Fine Aggregate

Sieve Size	Gradation of Original Sample (%)	Weight of Test Fractions Before Test (g)	Percentage Passing Designated Sieve After Test (%)	Weighted Percentage Loss (%)
4.75mm (No.4) to 2.36mm (No.8)	26	100.0	22.9	6.0
2.36mm (No.8) to 1.18mm (No.16)	25	100.0	29.3	7.5
1.18mm (No.16) to 600µm (No.30)	20	100.0	27.6	5.5
600µm (No.30) to 300µm (No.50)	12	100.0	22.4	2.8
300µm (No.50) to 150µm (No.100)	6		0.0	0.0

Coarse Aggregate

Sieve Size	Gradation of Original Sample (%)	Weight of Test Fractions Before Test (g)	Percentage Passing Designated Sieve After Test (%)	Weighted Percentage Loss (%)
75.0mm (3in) to 63.0mm (2½in)	9	4830.4	0.2	0.0
63.0mm (2½in) to 37.5mm (1½in)	27	4963.9	0.8	0.2

Qualitative Examination

Retained Sieve Size	No. of Particles	Splitting #	Crumbling #	Cracking #	Flaking #	Disintegration #
63.0mm	8	0	0	0	0	0

Comments

BRAUN INTERTEC

Site: ETR WEST
Composite Sample: 01001, 02003, 05006, 06008, 08010

Braun Intertec Corporation
11001 Hampshire Avenue South
Minneapolis, MN 55438
Phone: 952.995.2000

Soundness Test Report

Report No: SSS:W13-000575-S2
Issue No: 1

Client: Heather Arends
Minnesota DNR Divisions of Lands and Minerals
500 Lafayette Road
St. Paul, MN, 55155

Project: HB-13-00198
Gradation Testing
1525 3rd Avenue East
Hibbing, MN, 55746

PM: Alex Peritz, aperitz@BraunIntertec.com

Dallas Miner
Laboratory Supervisor
Date of Issue: 4/23/2013

Sample Details

Sample ID: W13-000575-S2
Alternate Sample ID:
Sampled By:
Date Sampled:
Sampling Method:
Source:
Material:
Specification: For Informational Purposes Only
Sample Location: 01001, 02003, 05006, 06008, 08010

General Test Information

ASTM C 88 - 05

Test Type: Combined
Preparation: Freshly Prepared
Solution Type: Magnesium Sulfate
Minus Number 4 (%): 41
Plus Number 4 (%): 59
Total Weighted Fine Loss (%): 22
Total Weighted Coarse Loss (%): 4

Coarse Aggregate

Sieve Size	Gradation of Original Sample (%)	Weight of Test Fractions Before Test (g)	Percentage Passing Designated Sieve After Test (%)	Weighted Percentage Loss (%)
37.5mm (1½in) to 19.0mm (¾in)	28	1541.7	1.5	0.4
19.0mm (¾in) to 9.5mm (3/8in)	19	1002.8	8.7	1.7
9.5mm (3/8in) to 4.75mm (No.4)	17	300.4	9.0	1.5

Qualitative Examination

Retained Sieve Size	No. of Particles	Splitting #	Crumbling #	Cracking #	Cracking %	Flaking #	Disintegration #
50.0mm	10	0	0	1	10.0	0	0
37.5mm	13	0	0	0		0	0
25.0mm	21	0	0	0		0	0
19.0mm	26	0	0	0		0	0

Comments

Braun Intertec Corporation
11001 Hampshire Avenue South
Minneapolis, MN 55438
Phone: 952.995.2000

Material Test Report

Report No: MAT:W13-000575-S2
Issue No: 1

Client: Heather Arends
Minnesota DNR Divisions of Lands and Minerals
500 Lafayette Road
St. Paul, MN, 55155
Project: HB-13-00198
Gradation Testing
1525 3rd Avenue East
Hibbing, MN, 55746
PM: Alex Peritz, aperitz@BraunIntertec.com

Dallas Miner
Laboratory Supervisor
Date of Issue: 4/23/2013

Sample Details

Sample ID: W13-000575-S2
Alternate Sample ID: 33441-ETR West
Sampled By:
Sampling Method:
Date Sampled:
Date Submitted: 3/29/2013
Specification: For Informational Purposes Only
Source:
Material Type:
Sample Location: 01001, 02003, 05006, 06008, 08010

Test Results

Description	Method	Result	Limits
Specific Gravity (OD)	ASTM C 127 - 07	2.71	
Specific Gravity (SSD)		2.75	
Apparent Specific Gravity		2.85	
Absorption (%)		1.8	
Density Determined Without First Drying?		No	
Additional Notes			
Date Tested		4/10/2013	
Specific Gravity (OD)	ASTM C 128 - 07	2.66	
Specific Gravity (SSD)		2.73	
Apparent Specific Gravity		2.86	
Absorption (%)		2.7	
Density Determined Without First Drying?			
Additional Notes			
Date Tested		4/10/2013	
Loss by abrasion and impact (%)	ASTM C 131 - 06	14	
Grading designation		C	
Date Tested		4/12/2013	
Procedure	ASTM C 40 - 04	Glass color standard	
Organic plate No.		3	
Gardner color standard No.		11	
Date Tested		4/9/2013	
Test Type	ASTM C 88 - 05	Combined	
Preparation		Freshly Prepared	
Solution Type		Magnesium Sulfate	
Minus Number 4 (%)		41	
Plus Number 4 (%)		59	
Total Weighted Fine Loss (%)		22	
Total Weighted Coarse Loss (%)		4	
Date Tested		4/23/2013	

Comments

N/A

Braun Intertec Corporation
11001 Hampshire Avenue South
Minneapolis, MN 55438
Phone: 952.995.2000

Material Test Report

Report No: MAT:W13-000575-S2
Issue No: 1

Client: Heather Arends
Minnesota DNR Divisions of Lands and Minerals
500 Lafayette Road
St. Paul, MN, 55155

Project: HB-13-00198
Gradation Testing
1525 3rd Avenue East
Hibbing, MN, 55746

PM: Alex Peritz, aperitz@BraunIntertec.com

Dallas Miner
Laboratory Supervisor
Date of Issue: 4/23/2013

Sample Details

Sample ID: W13-000575-S2
Alternate Sample ID: 33441-ETR West
Sampled By:
Sampling Method:
Date Sampled:
Date Submitted: 3/29/2013
Specification: For Informational Purposes Only
Source:
Material Type:
Sample Location: 01001, 02003, 05006, 06008, 08010

Test Results

Description	Method	Result	Limits
Shale +1/2" %	MnDOT 1209-08	0.0	
Shale +#4 %		0.0	
Soft Iron Oxide +#4 %		0.0	
Total Spall +1/2" %		0.0	
Total Spall +#4 %		0.0	
Other Soft +#4 %		7.0	
Clay Balls & Lumps +#4 %		0.0	
Sum of Spall - Soft - Clay Balls & Lumps +#4 %		7.0	
Carbonate +#4 %		0.0	
Slate +#4 %		0.0	
Date Tested		4/5/2013	

Comments

N/A

Appendix C. GPS coordinates for Test Holes at the Esker Trail Road West site. Coordinates were captured by a hand-held Garmin GPSmap 76S with WAAS correction. The Y_PROJ and X_PROJ fields represent UTM NAD83 Zone 15 Northing and Easting coordinates, respectively.

TEST_HOLE_ID	LAT	LONG	Y_PROJ	X_PROJ
1	46.94387918	-92.31439015	5199155	552179
2	46.94366955	-92.31518509	5199131	552119
3	46.94341348	-92.31617030	5199102	552044
4	46.94286514	-92.31561441	5199041	552087
5	46.94314669	-92.31480103	5199073	552148
6	46.94335632	-92.31398664	5199097	552210
7	46.94353988	-92.31298618	5199118	552286
8	46.94402511	-92.31360870	5199172	552238
9	46.94449567	-92.31375061	5199224	552227
10	46.94442183	-92.31464546	5199215	552159
11	46.94268166	-92.31473791	5199022	552154
12	46.94231185	-92.31557694	5198980	552090
13	46.94296187	-92.31354911	5199053	552244
14	46.94334165	-92.31252300	5199096	552322
15	46.94138607	-92.31261511	5198879	552316
16	46.94117510	-92.31329874	5198855	552265
17	46.94079431	-92.31402621	5198812	552210