

Management Plan and Aggregate Resource Notes for the Proposed Adolph Pit, St. Louis County, Minnesota

Project 334-28
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The timbered land is approximately where the Adolph Lease begins at the northeast corner of the state parcel (photo looks southwest). State land begins approximately at the top of the pit face and extends into the trees. The pit face is about 25 to 30 feet high. The pit floor in the foreground is private. The photo was taken August 23, 2006 by the author.



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INTRODUCTION

A field investigation by a MN DNR Lands and Minerals (LAM) geologist on August 23, 2006 identified a potentially commercial deposit of aggregate in part of the southwest quarter of the northwest quarter of Section 36, T. 50N., R. 16W., Solway Township, St. Louis County (Figure 1). Much about the aggregate resource on the state parcel is unknown because there are a limited number of test holes which did not extend the entire deposit thickness. Pit exposures from the adjacent private pit along with the limited test holes suggest that granular materials may occur on the state land as well. The pit face is about 25 feet high. Crushable gravel may occur in localized areas. There is potential that significant quantities of sand and some gravel may be marketable and extractable from the parcel.

This site, the Adolph Site is about 2 miles west of U.S. Highway 2, County Road 13/Midway Road, and Adolph, Minnesota. County Road 56/Morris Thomas Road parallels the northern lease boundary about ¼ mile from 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 Adolph 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 22.8 acres (Figure 1). The lease boundary extends to the eastern, northern, and western property lines. The property owner to the northeast has stated there is a property corner pin for the northeast corner of the lease area. The boundary to the south falls just inside the overhead utility corridor. Possible expansions to the south will be considered in the future when substantially all of the marketable aggregate within the lease area is extracted and significant portions are reclaimed.

The entire lease area is populated with trees. 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.

DNR is unaware of any legal access to the state property, including the lease site. The lessee is encouraged to pursue access options.

DNR has not surveyed the entire lease area to determine whether wetlands are present. The lessee shall establish a buffer of about 30 feet around wetlands. The lessee should consult DNR staff if there are questions about whether a wetland exists in an area.

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.

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. 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 in place. 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.

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 three property lines 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. 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. If mining extends to property lines adjacent to the private pits, the lessee may leave or create berms along the property lines to restrict access in those areas.

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

If wetlands occur within the lease area, the lessee shall establish a buffer of about 30 feet 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, will 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 10 test holes in the vicinity of the lease area in August of 2006 (Figure 2). All holes were completed with a Hyundai 110-7 Excavator to a depth of 13 to 15 feet. Samples for gradation analysis were collected at 6 holes. 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 6 raw samples from 6 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 varying kinds of sand and some crushable gravel. The gravel may be localized. There are insufficient exploration data to delineate where substantial gravel may occur. The aggregate in the vicinity of test hole 10 may be relatively thin with silt or clay at about 12 feet.

Ten holes were dug. Sand was the primary material revealed. Its texture ranged from gravelly sand to fine sand. Gravel ranging in thickness from 1.5 to 13.5+ feet was revealed in 5 of the holes.

The two gravel samples, from holes 1 and 2, contained from 19 to 27 percent crushable (+3/4 to 2.5 inch). Holes 5 and 9 contained about 4 feet of similar gravel but were not sampled.

There was no overburden in six of the test holes, two others had less than 2 feet, and the remaining two had about 6 feet of overburden.

No quality tests were done on the samples. No hardness tests were run on the pebbles. No potentially deleterious rocks or spall were observed in the field.

Water Levels

Water table was not encountered in any of the test holes. Moisture was encountered in test hole 10 near the bottom of the hole just above a silty layer and does not appear to be water table.

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–Geographic information system, 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–Global positioning system, 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.

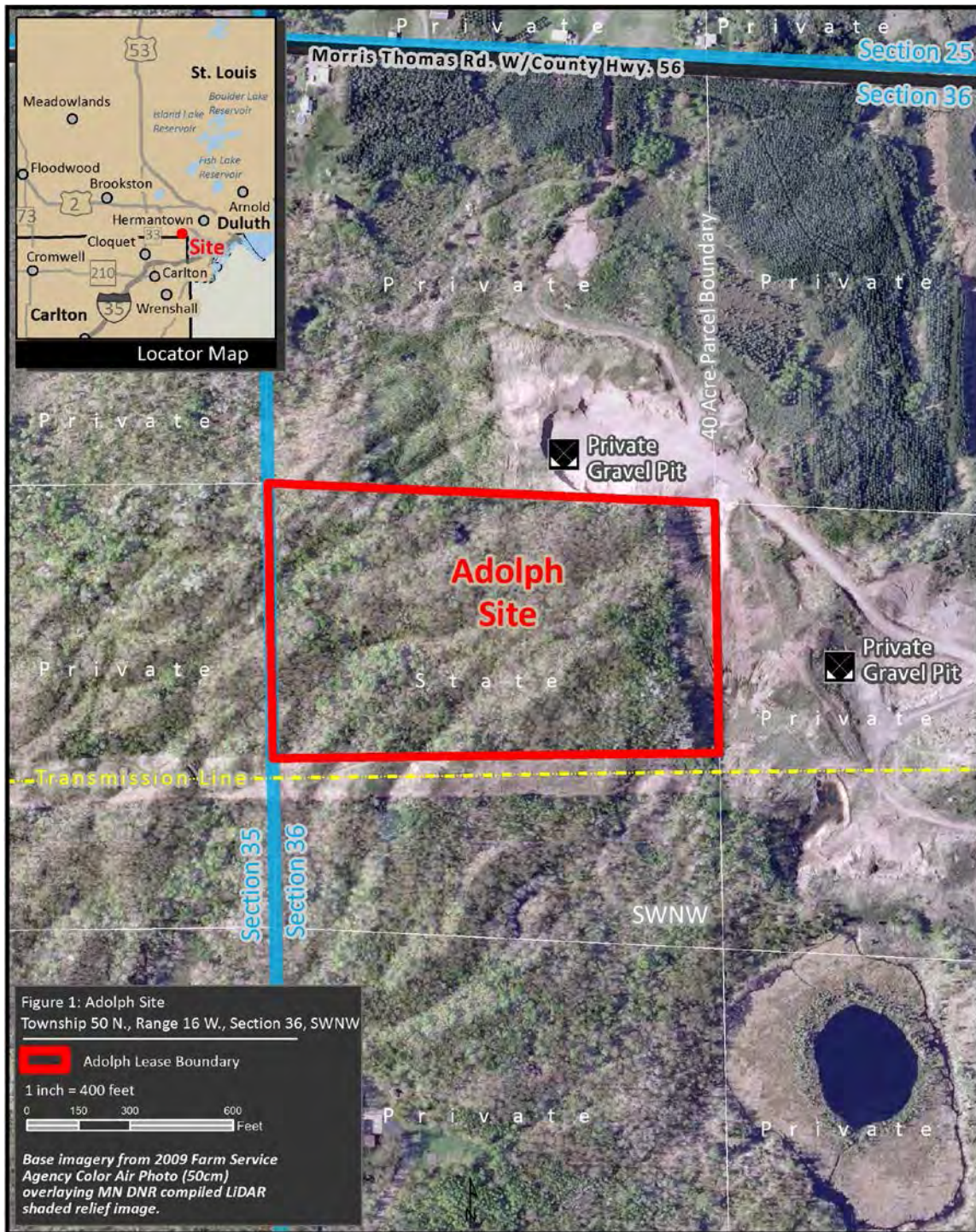


Figure 1. Adolph Site Lease Map. The red outline depicts the lease area relative to nearby features. The lease area represents about 22.8 acres in part of the Southwest Quarter of the Northwest Quarter of Section 36, T. 50N., R. 16W., Solway Township, St. Louis County. The gravel pit to the east and north is private. The utility corridor, immediately south of the lease, contains a high-voltage overhead power line with two pole structures on the state forty.



Figure 2. Ten test holes within and near the lease area are depicted as white circles filled with a black dot. The box adjacent to each circle includes the unique ID number for the test hole. Each hole was dug with an excavator to a depth of about 14 feet. The camera icons at the upper right portion of the figure show approximate locations from which a set of panoramic photos looking toward the state land were taken. These photos are found in Figures 3 and 4.



Figure 3. This set of photos was taken from the private pit looking south toward state land (Labeled Photo A in Figure 2). The state lease area begins approximately at the tree line. Two different camera angles give the appearance the pit wall projects from the page, but in fact it is linear. The pit wall does turn north in the far right portion of the photo. That area is not state.



Figure 4. This set of photos was taken from the private pit looking west toward state land (Labeled Photo B in Figure 2). The state lease area begins approximately at the tree line.

Appendix A. Descriptions of Test Holes—Adolph 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

Appendix A. Geologic log descriptions of ten test holes dug at the Adolph site August 23, 2006. See above for descriptions of abbreviations used in this table. Water table was not detected in any test hole. Intervals sampled for gradation tests are indicated in the comments column.

Test Hole ID	From (feet)	To (feet)	Color	Fines (C, S, VS)	Grading (W, P)	Sediment	% Gravel (field estimate)	Dominant clast (inches)	Maximum clast (inches)	Moisture (d, m, w)	Comments
1	0	0.2	blk	s	p	sandy loam	tr			d	~2 1/2" of topsoil
1	0.2	2.5	lt red brn	s		silty very fine sand	tr			d	
1	2.5	6.5	dk red brn	nm	nm	grvly silt	nm		nm	m	Superior Lobe Till, occ bldr to 18"
1	6.5	14	dk red brn	s to vs	w	slty sd & grvl	50	3/8 & 1	8	m	Most cobbles 2-4", muddy in places. Possible CL1/CL5. Sample #01001 from 6.5 to 14 ft.
2	0	0.5	blk			loamy sd				d	
2	0.5	4	brn	s	w	sd w/ f grvl	20	1/4	2	d	grvl mostly < 3/4"
2	4	14	brn	s	w	sd & grvl	50	1/2-2	12	d/m	grvl mostly < 4". Sample #02002 from 0.5 to 14 ft.
3	0	7	lt brn	s	mw	f-m sd	tr	3/4	9	d	some cobbles/small bldrs, possible sdy till
3	7	8	dk brn	c	w	sd w/ f grvl	15	1/4	3/4	d/m	good sand. Sample #03003 from 7 to 14 ft.
3	8	14	brn	s	p	slty f sd & slty sd w/ grvl	10	1	9	d/m	thin scattered layers of sd to sdy grvl. Possibly similar to sd exposed in prvt pit at north line.
4	0	1.5	lt brn	s		f sd	tr			d	

Test Hole ID	From (feet)	To (feet)	Color	Fines (C, S, VS)	Grading (W, P)	Sediment	% Gravel (field estimate)	Dominant clast (inches)	Maximum clast (inches)	Moisture (d, m, w)	Comments
4	1.5	3	dk brn	s	w	cobbly grvl	40	1.5	6	d	good grvl layer, parallels hillside slope.
4	3	13	lt brn	s	p	vf-f sd	0			d	
5	0	0.3	blk	s	w	grvly loam				d	topsoil
5	0.3	4	dk brn	s	w	c grvl	65	2	6	d	good grvl
5	4	14	red brn	Nap	Nap	vf sd & silt	0			d	poor
6	0	6	dk red brn			silt & f sd	tr		20	d	occ 12- 20" bldrs. Till?
6	6	15	lt brn	sli	w	f-m sd	tr	1	2	d	clean, occ pebbles. Sample #06004 from 6 to 15 ft.
7	0	0.5	dk brn to blk			loamy sd				d	
7	0.5	14.5	lt brn	c	w	m sd	tr	1/4	1	d	rare granules & pebbles. Sample #07005 from 0.5 to 14.5 ft.
8	0	4	lt brn		w	f-m sd	tr			d	occ pebbles/cobbles
8	4	14	red brn	s/c	w	f sd	0			d	no rock, rare clay layer (2" thick). Fairly clean, finer sd than TH 6 & 7.
9	0	4	lt to dk brn	s	w	sd w/ grvl	35	1	9	d	varied sd & grvl layers.
9	4	8	red brn	s	p	f sd	0			d/m	
9	8	14	lt brn	c	w	m sd	0			d	

Test Hole ID	From (feet)	To (feet)	Color	Fines (C, S, VS)	Grading (W, P)	Sediment	% Gravel (field estimate)	Dominant clast (inches)	Maximum clast (inches)	Moisture (d, m, w)	Comments
10	0	8	lt brn		w	f-m sd	tr		2	d	Sample #10006 from 0 to 12 ft.
10	8	12	brn		w	m sd	tr			m	wet sd near 12 ft.
10	12	14	dk brn	vs	w	muddy sd	5	1/4	1	w	clay layer at 12 ft, possible slty grvl at bottom of hole.

Appendix B. Sieve results for six samples at the Adolph site. Samples correspond to the test holes described in Appendix A.

	Project #		33428	33428	33428	33428	33428	33428		
	Sample #		01001	02002	03003	06004	07005	10006		
Hole ID		1	2	3	6	7	10			
From		6.5	0.5	7	6	0.5	0			
To		14	14	14	15	14.5	12			
Feet of	Material=	7.5	13.5	7	9	14	12	Class 5 Maximum	Class 5 Maximum	
Percent by weight of total sample passing respective sieves	4"	100mm	100	100	100	100	100	100		
	3"	75mm	100	100	100	100	100	100		
	2.5"	63mm	100	100	100	100	100	100		
	2"	50mm	97	92	100	100	100	100		
	1.5"	37.5mm	89	86	95	100	100	100		
	1.25"	31.5mm	88	82	94	100	100	100		
	1"	25mm	86	77	91	100	100	100	100	100
	3/4"	19mm	81	73	87	100	100	98	100	90
	5/8"	16mm	77	70	85	99	100	96		
	1/2"	12.5mm	72	67	81	99	100	95		
	3/8"	9.5mm	66	63	79	99	99	93	90	50
	#4	4.75mm	50	51	69	98	99	87	80	35
	#10	2.0mm	48	40	61	97	99	83	65	20
	#16	1.18mm	41	31	54	97	98	81		
	#30	0.60mm	34	19	47	96	98	77		
	#40	0.425mm	31	14	43	96	97	73	35	10
	#50	0.30mm	27	9	39	92	84	62		
#100	0.15mm	23	4	32	72	37	34			
#200	0.075mm	18.8	2.3	23.3	40.3	10.9	21.2	10.0	3.0	

Appendix C. GPS coordinates for the ten Test Hole locations from the Adolph site. Coordinates were captured August 23, 2006 by a hand-held Garmin GPSmap 76S with WAAS correction. The Y_PROJ and X_PROJ represent UTM NAD83 Zone 15 Northing and Easting coordinates, respectively.

TEST_HOLE_ID	LAT	LONG	Y_PROJ	X_PROJ
1	46.77352874	-92.32254054	5180220	551722
2	46.77358774	-92.32179481	5180227	551779
3	46.77460145	-92.32113473	5180340	551828
4	46.77450355	-92.32109676	5180329	551831
5	46.77359093	-92.32132089	5180227	551815
6	46.77331617	-92.32011926	5180198	551907
7	46.77273103	-92.32116382	5180132	551828
8	46.77353234	-92.31939163	5180222	551962
9	46.77354843	-92.31871228	5180224	552014
10	46.77374382	-92.31764887	5180247	552095