ADDENDUM #1

HIGHLAND PUMP STATION IMPROVEMENTS

City of Duluth, Minnesota

SUBMITTAL CERTIFICATION

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

Print Name: Mark D. Wallis, P.E.

Signature: Mark D. Wallis

Date: 6/23/2010 License #: 19145

ADDENDUM #1
HIGHLAND PUMP STATION IMPROVEMENTS
CITY OF DULUTH
PROJECT 0765WA
BID NUMBER 10-0318
JUNE 23, 2010

NOTICE

This Addendum is issued to modify, explain or correct the original drawings, specifications and/or previous addendums and is hereby made a part of the Contract Documents. Please note receipt of this Addendum on the Request for Bid. The bid date remains unchanged.

PROJECT MANUAL

SPECIAL PROVISIONS

SP-14 (2104) REMOVING PAVEMENT AND MISCELLANEOUS STRUCTURES

Page 3, in the fourth item

CHANGE the words "miscellaneous smaller rocks and concrete chunks" to miscellaneous rocks smaller than 1.5 cy and concrete chunks smaller than 1.5 cy."

SP-15 (2105) ROCK BLASTING SPECIFICATIONS

Page 4, in the first paragraph of this item

ADD the sentence "Removal of rocks smaller than 1.5 cy are incidental to the Project."

SP-35 TEMPORARY BYPASS PUMPING

Page 6, in the second paragraph

REPLACE Item 1 with the following.

1. Installation and commissioning of two 150 HP water booster pumps. Contractor may supply pumps or use pumps provided by Owner.
    a. If Contractor provides pumps, each pump must provide at least 2200 gpm. Static head is approximately 156 feet. Provide written documentation that pumps have been completely disassembled, cleaned, and disinfected.

b. If Contractor chooses to use Owner's pumps: Owner will provide 2 Fairbanks-Morse Model 5814 split-case pumps with 8 inch suction and 6 inch discharge, with 150 HP US motors. Contractor shall pick up pumps at Owner's shop, transport pumps to pump repair shop, disassemble, and repair the pumps (remove mechanical seals and convert to packing, install new bearings, gaskets, lip seals, and related wear items such as shaft sleeves, and machining), and trimming existing 16.8 inch impellers to 15.8 inch to produce a pump that will be non-overloading at 150 HP and provide 2200 gpm at a head of 156 feet static plus losses from Contractor's bypass. Verify trim design with Fairbanks-Morse and Engineer. Return pumps to Owner at Substantial Completion.

DIVISION 08 – OPENINGS

Section 08 71 00 – Door Hardware

Page 08 71 00-5, Paragraph 3.05, H.S. 1

REPLACE "One lock ND60RD" with "One lock ND60HD".

ADD Provide construction cores and 5 sets of keys for Owner. Re-core locks prior to Final Completion to Owner's standard, Best. Provide 5 keys.

DIVISION 26 - ELECTRICAL

Section 26 05 00 – Common Work Results For Electrical

Page 26 05 00-1, Part 1-General, Paragraph 1.03.D.1.a

DELETE Paragraph 1.03-D-1-a

ADD Paragraph 1.03-D-1-a as "a. Instrument Control Systems, Inc, as an agent to the City of Duluth, will be acting as the SCADA Contractor specified in Section 26 90 00 -2.02. The contractor shall include all costs associated with installation the work provided by the SCADA Contractor and of coordination between that work and the work provided under this contract."

Section 26 05 90 – Process Instrument & Control

Page 26 05 00-1, Part 2-Products 2.01.D.2

ADD Paragraph 2.01-D-2 as "2. Automatic Systems Co. – contact Bruce Wirth (Phone 1-651-631-9005)."

Page 26 05 00-1, Part 2-Products 2.01.D.3

ADD Paragraph 2.01-D-3 as "3. or other integration firm meeting the qualifications requirements identified above.

DIVISION 31 – EARTHWORK

Section 31 23 16.16 – Structural Excavation for Structures

Page 31 23 16.16-2, Part 2-Products and Materials, Paragraph 2.02

ADD Provide non-frost susceptible engineered fill for all structures and excavations within 5 feet of the structure, including 5 foot thick compacted zone under interior concrete slabs and aprons meeting the following requirements: 100% passing the 4 inch sieve, and less than 7% passing the #200 sieve.

DIVISION 44 – POLLUTION CONTROL EQUIPMENT

Section 44 42 56.14 – vertical Split-Case Booster Pumps

Page 44 42 56.14-3, Paragraph 2.01.A, in the first sentence

ADD The words "Patterson Pump Company,"

CONTRACTING SUPPORTING DOCUMENTS

PREVAILING WAGE RATES – US DOL, HEAVY

REPLACE the General Decision Number: MN100139 dated 05/07/2010, Construction Type: Heavy, in its entirety with the attached General Decision Number: MN100139 dated 06/04/2010, Construction Type: Heavy.

APPENDIX

APPENDIX A: GEOTECHNICAL REPORT

ADD the attached Report of Geotechnical Exploration and Review - Proposed Highland Pump Station Improvements, dated June 10, 2010, by American Engineering Testing, Inc.

DRAWINGS

DRAWING PM-3

Mechanical Section 2/PM-3

ADD Two 12 inch flanged gate valves on the horizontal meter run. Place one GV upstream of meter, and one GV downstream of meter, adjacent to 90 degree bend.

DRAWING E-7

ADD The "Highland Station Process Instrumentation Equipment Wiring Schedule" attached to this addendum.

LIST OF ATTACHMENTS

1. Prevailing Wage Rates – US DOL, Heavy, dated 06/04/2010
2. Appendix A – Report of Geotechnical Exploration and Review, dated 06/10/2010, by American Engineering and Testing
3. Drawing E-7 – Highland Station Process Instrumentation Equipment Wiring Schedule

END OF ADDENDUM

General Decision Number: MN100005 **06/04/2010** MN5 Superseded General Decision Number: MN20080005 State: Minnesota

Construction Type: **Highway**

Counties: Anoka, Benton, Chisago, Dakota, Hennepin, Ramsey, Scott, Sherburne, St Louis, Stearns, Washington & Wright Cos in MN

HIGHWAY CONSTRUCTION PROJECTS

Mod Nbr	Publ Date	Mod Nbr	Publ Date	Mod Nbr	Publ Date	Mod Nbr	Publ Date	Mod Nbr	Publ Date	Mod Nbr	Publ Date
0	03/12/2010										
1	03/19/2010										
2	05/07/2010										
3	06/04/2010										

			Rate	Fringe
BRMN0001-015 05/01/2009	BENTON & STEARNS Cos	Cement Mason/Concrete Finisher	$ 32.75	14.35

CARP0087-011 05/01/2009 ANOKA, CHISAGO, DAKOTA, HENNEPIN, RAMSEY, SCOTT, SHERBURNE, WASHINGTON & WRIGHT Cos

Carpenter & Piledrivermen $ 31.37 16.10

CARP0361-014 05/01/2009 **ST LOUIS CO (DULUTH)** **Carpenter & Piledrivermen $ 30.52 14.65**

CARP0361-015 05/01/2009 ST LOUIS CO

Carpenter & Piledrivermen Northern St. Louis County $ 30.12 14.65 Southern St. Louis Co except Duluth $ 30.12 14.65

CARP0930-006 05/01/2009 BENTON & STEARNS Cos Carpenter & Piledrivermen $ 25.53 16.02

ELEC0160-001 05/01/2009 **Line Construction/Street Lighting**

Line Construction :	**Rate**	**Fringe**
(1) Lineman; Cable Splicer; Dynamiter; Special Equipment Operator; & Technician	**$ 34.82**	**29.5%+4.75**
(2) Equipment Operator	**$ 29.95**	**29.5%+4.75**
(3) Truck Driver; & Pole Treating Truck Driver	**$ 24.37**	**29.5%+4.75**
(4) Groundman	**$ 23.33**	**29.5%+4.75**

Line Clearance:	**Rate**	**Fringe**
(5) Tree Trimmer; Tractor	**$ 21.67**	**29.5%+4.75**
(6) Groundman/Truck Driver	**$ 15.17**	**29.5%+4.75**
(7) Groundman	**$ 14.09**	**29.5%+4.75**

* ENGI0049-005 05/01/2009 **Power Equipment Operator**

AREA 1 (METRO): ANOKA, CHISAGO (S. of the northern boundary of T 34-N & that part consisting substantially of the cities of Thomson, Cloquet, Scanlon & Carlton), DAKOTA, HENNEPIN, RAMSEY, SCOTT, SHERBURNE (south of the northern boundary of T 33-N & E of the western boundary of R 27-W), **ST. LOUIS**, WASHINGTON & WRIGHT (east of & including Hwy #25) Cos

AREA 2 (EASTERN): BENTON (east of the western right of way of HWY #10), CHISAGO (remainder) SHERBURNE (remainder), STEARNS (east of the western right of way of Hwy #15), and WRIGHT (remainder) COs

AREA 3 (WESTERN): BENTON (remainder) and STEARNS (remainder) Cos

AREA 1:			AREA 2:			AREA 3:		
GRP 1	**$ 31.57**	**15.25**	GRP 1	$ 29.11	15.25	GRP 1	$ 24.45	15.25
GRP 2	**$ 30.57**	**15.25**	GRP 2	$ 28.11	15.25	GRP 2	$ 23.45	15.25
GRP 3	**$ 30.02**	**15.25**	GRP 3	$ 27.66	15.25	GRP 3	$ 22.52	15.25
GRP 4	**$ 29.72**	**15.25**	GRP 4	$ 27.36	15.25	GRP 4	$ 22.21	15.25
GRP 5	**$ 26.68**	**15.25**	GRP 5	$ 24.79	15.25	GRP 5	$ 20.50	15.25
GRP 6	**$ 25.47**	**15.25**	GRP 6	$ 23.92	15.25	GRP 6	$ 19.90	15.25

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

Grp 1: All Truck and Crawler Cranes 40 tons and over doing pile driving, sheeting work; caisson work, rotary drilling and boring.

Grp 2: Helicopter Pilot; Concrete Pump; Crane with over 135' Boom, excluding jib; Dragline, Crawler, Hydraulic Backhoe and/or other similar equipment with shovel-type controls, 3 cubic yards and over; Grader or Motor Patrol, Finishing earthwork; bituminous Pile Driving; Tugboat Operator 100 hp and over.

Grp 3: Asphalt Bituminous Stabilizer Plant; Cableway; Concrete Mixer; Stationary Plant over 34E; Derrick (Guy or Stiffleg) (power) (skids or stationary); Dragline, Crawler, Hydraulic Backhoe and/or other similar equipment with shovel type controls, up to 3 cubic yards; Dredge Operator or Engineer; Dredge Operator (power) and Engineer; Front End Loader, 5 cu yd and over; Locomotive Crane; Mechanic or Welder; Mixer (Paving); Concrete Paving Operator; Road Mole including power supply; Mucking Machine including mucking operations, Conway or similar type; Refrigeration Plant Engineer; Tandem Scraper; Tractor Boom type; Truck Crane; Crawler Crane; Tugboat 100 hp and over.

Grp 4: Air Track Rock Drill; Articulated Hauler Terex, Caterpillar or similar type; Automatic Road Machine (CMI or similar); Backfiller; Bituminous Paver; Screed; Bituminous Spreader & Finishing Operator (power); Bituminous Roller 8 Tons and over; Boom Truck (power operated boom); Brokk or R.T.C. 750 remote control or similar types with all attachments; Cat and Scraper; Cat Tractors with Rock Wagons or similar types; Challenger 75-D or 85-D when pulling scraper or bulldozer; Chip Harvester & Tree Cutter over 150 HP; Concrete Batch Plant; Concrete Distributor & Spreader Finishing Machine; Concrete Mixer on jobsite over 14S; Concrete Mobile; Crushing Plant (gravel & stone) or Gravel Washing, Crushing and Screening Plant; Curb Machine; Directional Boring Machine, all types; Dope Machine (pipeline); Drill Rigs; Heavy Rotary, Churn, or Cable Drill; Dual Tractor Operator; Elevating Grader; Engineer in charge of plant; Fork Lift or Straddle Carrier; Fork Lift or Lumber Stacker; Front End Loader over 1 cu. yd.; GPS Operator remote operating of equipment; Grader (Motor Patrol); Hoist Engineer (power); Hydraulic Tree Planter; Launcherman (Tankerman or Pilot); Lead Greaser; Locomotive, all types; Milling, Grinding and Planing Machine; Multiple Machines such as Air Compressors, Welding Machines, Generators, Pumps; Pavement Breaker or Tamping Machine (power driven); Mighty Mite or similar type; Payhauler or similar type; Pickup Sweeper, 1 cu. yd. and over Hopper capacity; Pipeline Wrapping; Cleaning or Bending Machine; Power Plant Engineer 100 KWH and over: Power Actuated Horizontal Boring Machine over 6"; Pugmill; Pumpcrete; Rubber-Tired Farm Tractor, Backhoe Attachment; Scraper up to 32 cubic yards; Scraper - Struck capacity 32 cu. yds and over; Self-Propelled Traveling Soil Stabilizer; Skid Steer Loader over one cubic yard with backhoe attachment; Slip Form (power driven, paving); Tie Tamper & Ballast Machine; Tractor, Bulldozer; Tractor over 50 HP with power take-off; Trenching Machine all utilities, excludes walk behind trencher; Tub Grinder-Morbark or similar type; Well Point Installation, Dismantling or Repair Mechanic.

Grp 5: Air Compressor Operator 600 CFM or over; Bituminous Roller Operator under 8 Tons; Bituminous Rubber Tired Roller; Longitudinal Float Operator, Joint Machine Operator and Spray Operator; Concrete Saw Operator (multiple blade) (power operated); Form Trench Digger (power); Front End Loader Operator, up to and including 1 cu yd; Injection Patching, Tack, Emulsion Aggregate Truck/PMI or similar; Gunite Operator Gunall; Hydraulic Log Splitter; Loader (Barber Greene or similar type); Post Hole Driving Machine, Post Hole Auger; Power Actuated Augers and Boring Machine; Power Actuated Jacks; Pump; Self-Propelled Chip Spreader (Flaherty or similar); Sheep Foot Compactor with Blade 200 HP and over; Shouldering Machine(power) Apsco or similar type including self-propelled; sand & chip spreader; Skid Steer Operator up to 1 cu yd; Stump Chipper and Tree Chipper; Tractor, Bulldozer, 50 HP or less; Tree Farmer (a machine); Vibrating Extractor

Grp 6: Challenger 75-D or 85-D when pulling disk or roller; Conveyor; Dredge Deck Hand; Fireman or Tank Car Heater; Gravel Screening Plant (portable not crushing or washing); Greaser (Truck or Tractor); Leverman; Mechanic, Space Heater (temporary heat); Oiler (Power Shovel, Crane, Dragline); Power Sweeper; Rollers on gravel compaction; Self-Propelled Vibrating Packer (35 HP and over); Sheep Foot Rollers; Tractor Operator Wheel Type (over 50 HP)

*CRANE OVER 135' BOOM, EXCLUDING JIB - $ .25 PREMIUM; CRANE OVER 200' BOOM, EXCLUDING JIB - $ .50 PREMIUM

UNDERGROUND WORK: TUNNELS, SHAFTS, ETC. - $ .25 PREMIUM UNDER AIR PRESSURE - $ .50 PREMIUM

HAZARDOUS WASTE PROJECTS (PPE Required): LEVEL A - $1.25 PREMIUM LEVEL B - $ .90 PREMIUM LEVEL C - $ .60 PREMIUM

IRON0512-003 05/01/2009 ANOKA, BENTON, CHISAGO, DAKOTA, HENNEPIN, RAMSEY, SCOTT, SHERBURNE, STEARNS, WASHINGTON & WRIGHT COs

Ironworker $ 33.80 20.44

			Rate	Fringe
IRON0512-020 05/01/2009	**ST. LOUIS CO**	**Ironworker**	**$ 29.76**	**19.50**

		Rate	Fringe
LABO0010-005 05/01/2008	**Landscaper (Seeding, Sodding &Planting of evergreen & deciduous shrubs & trees)**	**$ 16.26**	**9.68**

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* LABO0132-001 05/01/2008 ANOKA, BENTON, CHISAGO, DAKOTA, HENNEPIN, RAMSEY, SCOTT, SHERBURNE, STEARNS, WASHINGTON & WRIGHT COs

LABORER - UNDEFINED (Asbestos Abatement) $ 28.11 10.57

LABO0563-005 05/01/2009

Laborers:

AREA 1:			**AREA 2:**			AREA 3:			AREA 4:		
GRP 1	$ 27.72	12.01	**GRP 1**	**$ 27.14**	**11.52**	GRP 1	$ 26.10	12.56	GRP 1	$ 23.16	11.37
GRP 2	$ 27.92	12.01	**GRP 2**	**$ 27.34**	**11.52**	GRP 2	$ 26.30	12.56	GRP 2	$ 23.36	11.37
GRP 3	$ 28.07	12.01	**GRP 3**	**$ 27.49**	**11.52**	GRP 3	$ 26.45	12.56	GRP 3	$ 23.51	11.37
GRP 4	$ 28.17	12.01	**GRP 4**	**$ 27.59**	**11.52**	GRP 4	$ 26.55	12.56	GRP 4	$ 23.61	11.37
GRP 5	$ 28.42	12.01	**GRP 5**	**$ 27.84**	**11.52**	GRP 5	$ 26.80	12.56	GRP 5	$ 23.86	11.37
GRP 6	$ 29.72	12.01	**GRP 6**	**$ 29.14**	**11.52**	GRP 6	$ 28.10	12.56	GRP 6	$ 25.16	11.37

AREA 1 (District 1): ANOKA, CHISAGO, DAKOTA, HENNEPIN, RAMSEY, SCOTT, SHERBURNE, WASHINGTON & WRIGHT COs

AREA 2 (District 2A): **ST. LOUIS CO** (south of T 55N):

AREA 3 (District 2B): ST. LOUIS CO (north of T 55N)

AREA 4 (District 3A): BENTON & STEARNS COs

LABORERS CLASSIFICATIONS

GRP 1: Construction; Bituminous Batcherperson (Stationary Plant); Bituminous Worker - Shoveler, Raker, Floater, Squeegee, Utility; Blaster Tender; Brick Tender; Carpenter Tender; Cement Coverperson Batch Truck; Cement Handler - Bulk, Bag; Concrete Batcherperson; Concrete Handler, Caisson, Footings, Columns, Piling, Slabs, etc.; Concrete Longitudinal Float Operator (Manual Bullfloat on Paving); Concrete Shoveler, Tamper & Puddler (Paving); Conduit Layer; Curb Setter; Damp Proofer Below Grade; Demolition of an entire Structural System, excluding remodeling; Drill Runner Tender; Dump Operator (Dirt, Paver, Dumping Batch Truck, etc.); Fabric Installer; Grade Checker; Hydrant & Valve Setter; Hydro Blast or Waterblaster; Joint Filler (Concrete Pavement); Kettleperson (Bituminous or Lead); Labor Wrecking Demolition; Mortar Mixer; Pipe Handler; Power Buggy Operator; Pump Operator(less than 6"); Retaining Wall Installation; Sand Cushion Bedmaker; Slip Lining of Utility Lines; Soil Stabilizer; Sound Barrier & Guard Rail Installation; Squeegeeperson; Stabilizing Batcherperson (Stationary Plant); Temporary Heaters & Blower Tender; Top Person (Sewer, Water or Gas Trench); Flagperson; Traffic Controller (Traffic Barriers) & Transit/Level; Laser Beam (sewer, water, gas) $1.50 above Group 1 rate. Blasting Person (Dynamite or substitute product) $3.00 above Group 1 rate.

GRP 2: Chain Saw; Compaction Equipment (Hand Operated or Remote Control); Concrete Drilling; Concrete Mixer Operator; Concrete Sawer; Concrete Vibrator; Ditch & other work more than 8' below starting level of manual work; Formsetter; Joint Sawer, Mortar; Pipe Fuser/Technician; Pneumatic Tools, Jackhammer, Paving Buster, Chipping Hammer, etc.; Remote Control Demo Machine & Related Accessories (Electric/Hydraulic); Stone Tender/Mason Tender; & Torchperson - Gas, Electric, Thermal or similar device

GRP 3: Brick or Block Paving Setter; Caisson Work; Cofferdam Work

GRP 4: Cement Gun Operator (1 1/2" or over); Driller – Air Track or similar; & Nozzle Operator (Gunite, Sandblasting, Cement); Pipe Rehab (including Cleaning, Relining, Camera).

GRP 5: Bottom person (Sewer, Water, or Gas Trench more than 8 ft below starting level of manual work); Asbestos & Hazardous Waste Tech; Tunnel Laborer; Tunnel Miner; Tunnel Miner Tender; Underground Laborer; & Underpinning

GRP 6: Pipelayer, Tunnel Miner Under Pressure

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* PAIN0061-004 05/01/2010 CHISAGO, DAKOTA, RAMSEY & WASHINGTON Cos Painters: Brush $ 31.54 15.80 Sandblaster; Spray; Swing Stage; Boatswain Chair; Window Jack; Safety Belt; Erected Structural Steel; Bridges; & Application of Epoxy Materials and Materials Containing over 50% Creosote $ 32.29 15.80

			Rate	Fringe
* PAIN0106-007 05/01/2010	**ST. LOUIS CO**			
Painters:	**New:**	**Brush & Roller**	**$ 27.30**	**14.08**
		Spray, Steel, and Bridge	**$ 27.90**	**14.08**
	Repaint:	**Brush & Roller**	**$ 25.80**	**14.08**
		Spray, Steel, and Bridge	**$ 26.40**	**14.08**

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* PAIN0386-007 05/01/2010 ANOKA, HENNEPIN, SCOTT, SHERBURNE (south & east of a line drawn between the town of Santiago in Sherburne County and the town of Clearwater in Wright Co) & WRIGHT Cos Painters: Brush & Roller $ 31.25 16.09 Spray; Steel; Sandblaster; Swing Stage & Epoxy $ 32.00 16.09

PAIN0880-001 05/01/2002 **Sign Painter $ 21.12 2.07+a+b** FOOTNOTES: a) 8 Paid Holidays: New Year's Day; Memorial Day; Independence Day; Labor Day; Thanksgiving Day; the Day After Thanksgiving; the last working Day Before Christmas; & Christmas Day b) Vacation Pay: 3 yrs svc - 2 wks pd vac; 6 yrs svc - 3 wks pd vac; 15 yrs svc - 4 wks pd vac

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PAIN0884-004 06/01/2009 BENTON, SHERBURNE (western one-half, north & west of a line drawn between the city of Santiago in Sherburne Co & the city of Clearwater in Wright Co) & STEARNS Cos Painters: Brush & Roller $ 24.16 13.01 PROJECTS UNDER $8,000: Receive 80% of basic hourly rate. PAINTER'S PREMIUM - $0.75 per hour add't for the following: Spray; Two Component Paints; Epoxies; Sandblasting & Rigging; Work done on Swing Scaffolding, Safety Harness, Window Jacks, Boatswain's Chair, Coverings & Erection of Scaffolding for same; Work on Erected Structural Steel & Abrasive Blasting

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PLAS0633-003 05/01/2009 ANOKA, CHISAGO, DAKOTA, HENNEPIN, RAMSEY, SCOTT, SHERBURNE, WASHINGTON & WRIGHT COs
Cement Mason/Concrete Finisher $ 30.45 16.50

		Rate	Fringe
PLAS0633-019 05/01/2009 **ST. LOUIS CO** (south of T55N)	**Cement Mason/Concrete Finisher**	**$ 29.63**	**15.45**

PLAS0633-023 10/01/2009 ST. LOUIS CO (north of White Face River) Cement Mason/Concrete Finisher $ 24.31 14.34

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* TEAM0160-001 05/01/2010 **TRUCK DRIVER**

AREA 1:			**AREA 2:**			AREA 3:			AREA 4:		
GRP 1	$ 27.00	13.15	**GRP 1**	**$ 26.60**	**13.15**	GRP 1	$ 24.80	13.15	GRP 1	$ 20.67	12.75
GRP 2	$ 26.45	13.15	**GRP 2**	**$ 26.05**	**13.15**	GRP 2	$ 24.25	13.15	GRP 2	$ 20.16	12.75
GRP 3	$ 26.35	13.15	**GRP 3**	**$ 25.95**	**13.15**	GRP 3	$ 24.15	13.15	GRP 3	$ 20.01	12.75
GRP 4	$ 26.10	13.15	**GRP 4**	**$ 25.70**	**13.15**	GRP 4	$ 23.95	13.15	GRP 4	$ 20.01	12.75

AREA DESCRIPTIONS:
AREA 1: ANOKA, CHISAGO (south of T. 34-N), DAKOTA, HENNEPIN, RAMSEY, SCOTT, SHERBURNE, WASHINGTON & WRIGHT COs
AREA 2: ST. LOUIS CO
AREA 3: WINONA CO
AREA 4: BENTON, CHISAGO (north of T. 34-N) & STEARNS COs

TRUCK DRIVER CLASSIFICATIONS
GRP 1 - Boom; Mechanic; Off-Road, including Articulated Dump Truck; Tractor Trailer; Winch Truck
GRP 2 - Tri Axles (including four axles)
GRP 3 - Bituminous Distributor; Bituminous Distributor (one man operation); Tandem Axles & Single Axles
GRP 4 - Bituminous Distributor Spray Operator (Rear and Oiler); Dumpman; Pilot Car; Self-propelled Packer; Slurry Operator; Tank Truck Tender (Gas, Oil, Road Oil & Water); Tractor Operator (Wheel type used for any purpose)
THE FOLLOWING CLASSIFICATIONS SHALL COME UNDER THE APPROPRIATE AXLE RATE WAGE GROUP: "A" Frame; Dry Batch Hauler; Ready-Mix Concrete; Slurry; Tank (Gas, Oil, Road Oil & Water)

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

In the listing above, the "SU" designation means that rates listed under the identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be: * an existing published wage determination * a survey underlying a wage determination * a Wage and Hour Division letter setting forth a position on a wage determination matter * a conformance (additional classification and rate) ruling
On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2. and 3) should be followed.
With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to: Branch of Construction Wage Determinations Wage and Hour Division U.S. Department of Labor 200 Constitution Avenue, N.W. Washington, DC 20210
2) If the answer to the question in 1) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to: Wage and Hour Administrator U.S. Department of Labor 200 Constitution Avenue, N.W. Washington, DC 20210
The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.
3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to: Administrative Review Board U.S. Department of Labor 200 Constitution Avenue, N.W. Washington, DC 20210
4) All decisions by the Administrative Review Board are final.

========== END OF GENERAL DECISION

AMERICAN ENGINEERING TESTING, INC.

CONSULTANTS
• ENVIRONMENTAL
• GEOTECHNICAL
• MATERIALS
• FORENSICS

REPORT OF GEOTECHNICAL EXPLORATION AND REVIEW

Proposed Highland Pump Station Improvements
Duluth, Minnesota

AET #07-04601

Date:

June 10, 2010

Prepared For:

Mr. Mark Wallis, PE
MSA Professional Services
301 W. First Street, Suite 408
Duluth MN 55802

www.amengtest.com

AMERICAN ENGINEERING TESTING, INC.

CONSULTANTS
· ENVIRONMENTAL
· GEOTECHNICAL
· MATERIALS
· FORENSICS

June 10, 2010

Mr. Mark Wallis, PE
MSA Professional Services
301 West First Street, Suite 408
Duluth, MN 55802

Re: Geotechnical Exploration/Review
Proposed Highland Pump Station Improvements
Duluth, Minnesota
AET Project #07-04601

Dear Mr. Wallis,

American Engineering Testing, Inc. (AET) has completed a subsurface exploration and geotechnical engineering review for the above referenced project. We are sending you three copies of our report. Our report documents the exploration/review results and provides our opinions and recommendations to aid you and your design team in planning and construction of the project.

AET appreciates this opportunity to serve you. As your project proceeds, we remain interested in providing additional consulting or testing services. If you have questions about the report, or if we can provide additional services for you, I can be reached at (218) 628-1518 or sleow@amengtest.com.

Sincerely,
American Engineering Testing, Inc.

Sara L. Leow, PE
Geotechnical Engineer

TABLE OF CONTENTS
PROPOSED HIGHLAND PUMP STATION IMPROVEMENTS
AET PROJECT 07-04601
PAGE 1 of 2

TABLE OF CONTENTS
PROPOSED HIGHLAND PUMP STATION IMPROVEMENTS
AET PROJECT 07-04601
PAGE 2 of 2

STANDARD DATA SHEETS

APPENDIX

GEOTECHNICAL EXPLORATION/REVIEW
PROPOSED HIGHLAND PUMP STATION IMPROVEMENTS
DULUTH, MINNESOTA
AET #07-04601

SUMMARY

Purpose

We understand improvements are planned for the Highland Pump Station in Duluth, Minnesota. The purpose of our work on this project is to explore the subsurface conditions in the area of proposed construction and provide geotechnical engineering recommendations for a new water reservoir, SCADA building, and pipeline.

Scope

You authorized AET to perform a total of ten test borings within proposed construction areas to explore the subsurface conditions, and to provide a geotechnical engineering report.

Findings

In general, the test borings indicate a soil profile of existing fill overlying native soils consisting of till. Topsoil was also encountered at the ground surface in one test boring.

Recommendations

These recommendations are in a condensed form for your convenience. It is important that you study our entire report for a more comprehensive explanation of our recommendations.

- Based on a foundation base elevation approximately 12 to 15 feet below the existing ground surface, the proposed elevated water reservoir can be supported on the till using a conventional ring foundation designed for a maximum allowable bearing pressure of 4,000 psf.

- The proposed SCADA building can be supported on a spread footing foundation system designed for a maximum allowable bearing pressure of 3,000 psf when constructed on undisturbed till, or on compacted engineered fill overlying undisturbed till.

- Grading for the new water reservoir and SCADA building should include removing all existing fill and organic soils from the planned foundation areas. Any soft, wet, or disturbed soils in foundation areas should also be removed. If excavations extend below the bottom-of-footing depth, the removal of unsuitable soils should include sufficient excavation oversize to accommodate the lateral distribution of the foundation loads.

- Bottom-of-footing grade for the water reservoir foundation should be re-attained with concrete or engineered fill. Engineered fill placed for support of the water reservoir should be placed in thin lifts and compacted to 98% of the Modified Proctor density (ASTM D1557).

- Engineered fill should also be used to re-attain bottom-of-footing grade for the SCADA building. Engineered fill placed for support of the SCADA building foundation should be placed in thin lifts and compacted to 95% of the Modified Proctor density.

INTRODUCTION

MSA Professional Services (MSA) is providing design services for improvements to the Highland Pump Station in Duluth, Minnesota. You authorized American Engineering Testing, Inc. (AET) to conduct a subsurface exploration and provide geotechnical engineering recommendations for this project. This report presents the field information we obtained at the site and our engineering recommendations.

To protect you, AET, and the public, we authorize use of opinions and recommendations in this report only by you and your project team for this specific project. Contact us if other uses are intended. Even though this report is not intended to provide sufficient information to accurately determine quantities and locations of particular materials, we recommend that your potential contractors be advised of the report availability.

Scope of Services

Our authorized scope of services for this project, outlined in AET Proposal #07-04601, consisted of:

- Arranging for the location of existing public underground utilities through the Gopher State One-Call Service.
- Performing four standard penetration test (SPT) borings in planned water reservoir and SCADA building foundation areas, and six flight auger (FA) borings along the planned water main alignment. The SPT borings were performed in general accordance with ASTM designation D1586.
- Providing a geotechnical report that includes logs of the test borings and our geotechnical recommendations for foundation support for the new water reservoir and SCADA building.

The scope of our work is intended for geotechnical purposes only. This scope is not intended to explore for the presence or extent of chemical contamination at the site.

PROJECT INFORMATION

Proposed Project

We understand MSA is providing design services for improvements to the Highland Pump Station in Duluth, Minnesota. The pump station is located between Arlington Avenue and Basswood Avenue, just north of Olive Street. The pump station presently consists of two existing water reservoirs and a SCADA building at the west end of the site, two large tanks near the central portion of the site, and a pump station building at the east end of the site. You have indicated the existing water towers will be demolished and replaced by a new water reservoir.

We understand the new water reservoir will be a pedestal-spherical reservoir supported by a ring foundation. The tank for the new reservoir will be supported by a 142-foot tall tower having an approximate base diameter of 30 feet. The foundation will extend approximately 10 to 15 feet below existing grade and 13.5 feet below final grade; the top of the foundation wall will be at elevation 1415.5 feet, and the base of the foundation will be at elevation 1402.0 feet. Some fill may be added to achieve final grade surrounding the reservoir base. MSA informed AET that preliminary plans include an allowable bearing pressure of 4,000 pounds per square foot for the water reservoir.

The pump station improvements will also include constructing a new SCADA building and installing a section of water main. The new SCADA building will be constructed south of the existing SCADA building, and will be a one-story structure with a footprint of 25 feet square. The new SCADA building is planned to be supported by a spread footing foundation system. A section of water main will also be constructed between Basswood Avenue and Arlington Avenue.

Project Assumptions

The recommendations contained in this report are based on attaining a factor of safety of at least 3 with respect to localized shear or base failure of the foundations. For the SCADA building, we have assumed allowable foundation settlements of 1 inch total and ½ inch differential are acceptable.

Allowable settlement for the water reservoir will likely be governed by the flexibility of pipe connections. We assume allowable total settlement should be 1 inch or less. Differential settlement in the form of tilt across the reservoir base diameter typically should not exceed 0.001 inches per inch. Therefore, differential settlement across the water reservoir base should be no more than 3/8 inches.

> The presented project information represents our understanding of the proposed construction. This information is an integral part of our engineering review. It is important that you contact us if there are changes from that described so that we can evaluate whether modifications to our recommendations are appropriate.

SITE CONDITIONS

Surface Observations

On the dates of the test borings, the ground surface at the site was observed to gradually increase in elevation to the north and west. The site was mainly covered in grass, with the exception of the area near test boring FA-10-06; FA-10-06 was performed in the paved driveway area for the existing pump station building. The existing water reservoirs and SCADA building had not yet been demolished on the dates of the test borings.

Subsurface Soils/Geology

Logs of the test borings are included in the Appendix. Please refer to the logs for general information concerning soil sampling, soil layering, soil classification, geologic description, and moisture. Relative density or consistency is also noted, which is based on the standard penetration resistance (N-value).

> The boring logs only indicate the subsurface conditions at the sampled locations. Variations often occur between and beyond borings.

The general soil profile indicated by the test borings is existing fill overlying native soils comprised of till. Topsoil was also encountered in test boring SPT-10-02.

The existing fill consists of organic silt, organic sandy silt, organic silt with sand, slightly organic silt, silty sand, and a mixture of silty sand with a little gravel and sandy silt. Glass rubble was also encountered in the existing fill in test boring FA-10-04. The topsoil encountered in test boring SPT-10-02 consists of organic to slightly organic silt with sand.

The till consists of silty sand, silty sand with gravel, and gravelly silty sand. Sandy silty lean clay till was also encountered in FA-10-01. The N-values recorded for the SPT borings indicate the till is mainly medium dense to dense. Apparent cobbles were encountered in the till in test borings SPT-10-01, SPT-10-03, and FA-10-02.

Water Level Measurements

Groundwater was initially encountered in test boring FA-10-04 at a depth of 8.5 feet. After the borehole was left open for approximately 7 hours, groundwater was observed at a depth of 3.7 feet. Groundwater was not encountered in the other test borings prior to abandonment.

The soils at the site are considered slow draining to relatively impermeable, and groundwater many not have had enough time to stabilize in the boreholes prior to abandonment. Water level measurements from the test borings may not be a reliable indication of the static groundwater level in the area. Piezometer(s) would need to be installed to record groundwater fluctuations. A discussion of the water level measurement methods is presented in the SUBSURFACE EXPLORATION section of this report.

> Ground water levels usually fluctuate. Fluctuations occur due to varying seasonal and yearly rainfall and snow melt, as well as other factors.

GEOTECHNICAL CONSIDERATIONS

The following considerations are the basis for the recommendations presented in this report.

Review of Soil Properties

Strength/Stability

The existing fill is considered to have low strength and stability under the proposed structural loads, due to the uncontrolled nature in which it was placed and the presence of organics. The topsoil is also considered to have low strength and stability due to the presence of organics. The till is considered to have high strength and stability for supporting the anticipated structural loads.

Compressibility

The existing fill and topsoil are considered highly compressible beneath the anticipated structural loads. The till is considered to have low compressibility potential.

Frost Susceptibility

The soils encountered at the site are considered highly frost susceptible if within 6 feet of final grade.

Drainage Properties

The soils encountered at the site are judged to have low to very low permeability properties, and are considered slow to very slow draining.

RECOMMENDATIONS

Foundation Recommendations

Water Reservoir

You have indicated the base of the water reservoir foundation will be constructed at an elevation of approximately 1402 feet. The soil encountered at this elevation consists of silty sand till. It is our opinion that a typical ring spread footing foundation bearing directly on these till soils, or on engineered fill overlying these till soils, can be designed for a maximum allowable bearing pressure of 4,000 psf.

It is our judgment that this foundation design will include a factor of safety of greater than 3 against shear or base failure. It is also our judgment that total and differential (tilt) settlements should be less than 1/2 inch and 3/8 inch, respectively.

SCADA Building

It is our judgment that wall loads and column loads for the new SCADA building can be supported by a shallow foundation system consisting of spread footings bearing on undisturbed native soils, or engineered fill placed directly on undisturbed native soils. It is our opinion that strip footings and column footing pads placed on competent till, or engineered fill placed directly on till, can be designed for a maximum allowable soil bearing pressure of 3,000 psf.

Strip footings should have a minimum width of 20 inches and column pad footings should have a minimum dimension of 3 feet. Perimeter footings supporting heated structures, and all footings supporting unheated structures, should extend at least 72 inches below final grade for frost protection. Interior column footings for heated structures should be embedded at least 12 inches below the bottom of the floor slab. A structure is considered heated if the indoor temperature is maintained above 40 degrees Fahrenheit year-round.

It is our judgment that this foundation design will include a factor of safety of greater than 3 against shear or base failure. It is also our judgment that total and differential building settlement should be less than 1 inch and ½ inch, respectively.

Foundation Support

Excavation

All existing fill, topsoil, soils containing organics, and elements of the existing structures should be removed from the water reservoir and building footprint areas. Any disturbed, wet, or soft soils should also be removed from foundation areas. If excavation of unsuitable material extends below the bottom-of-footing grade, the excavation of unsuitable material should extend out laterally at least 1 foot from the outside edge of footings for every foot of new fill placed below the base of the

footings (i.e. 1H:1V excavation oversize). This excavation oversize is to be measured at the base of the excavation, not at the surface.

The actual required depth of excavations may be different than indicated by the test borings. Suitable excavation depths should be reviewed by a geotechnical engineer or engineering technician performing full-time observation and testing during site preparation.

Filling/Compaction for Foundation Support – Water Reservoir

If over-excavation is needed below the water reservoir foundation base, grades can be re-established with engineered fill. Engineered fill should be a non-organic, granular material void of cobbles, boulders, and placed in thin lifts and compacted to 98% of the Modified Proctor density (ASTM D1557). Grades could also be re-established with additional foundation concrete.

Excavated on-site soils void of organics, boulders, and debris can be used as engineered fill if these soils have a moisture content suitable for meeting compaction requirements. Moisture conditioning will likely be required to obtain sufficient compaction for excavated soils used as engineered fill. Conditioning of silty and clayey soils to reduce soil moisture can be difficult under the climatic conditions typical for the Duluth area, and in some cases it is not possible.

A layer of gravel can be used to provide a stable working surface at the excavation bottom, if needed. The gravel should consist of 1" to 2" crushed stone placed on a geotextile fabric to keep the crushed stone separate from underlying native soils. After the gravel working surface is no longer required, the gravel layer should also be covered with geotextile fabric to prevent fill soils from migrating into the crushed stone layer.

Filling/Compaction for Foundation Support – SCADA Building

Fill placed to attain foundation grades for the SCADA building should consist of engineered fill. The engineered fill should be a non-organic, granular material void of cobbles, boulders, and debris.

Engineered fill placed for foundation support should be placed in thin loose lifts and compacted to at least 95% of the maximum Modified Proctor dry density. Please refer to the attached standard data sheets entitled "Excavation and Refilling for Structural Support" for general information regarding excavation and fill placement for foundation support.

Water Reservoir Backfill

You have indicated the interior portion of the water reservoir ring foundation will be filled to support a floor slab or gravel layer. For a floor slab, the interior area of the foundation will need to be backfilled with compacted engineer fill, unless the floor will be a structurally supported slab. If the space within the interior of the ring foundation will not be heated, the soils used in the upper 6-foot zone of backfill should be limited to sandy soils with 100% material passing the #4 sieve and having less than 7% by weight passing the #200 sieve. We recommend the backfill soils below interior slabs be uniformly compacted in thin lifts to a minimum of 95% of the Modified Proctor density.

If a valve vault or other below grade space is constructed within the ring foundation and backfill is placed against the walls, lateral loads will need to be resisted. For information concerning lateral pressures, soil types, and drainage considerations for this case, we refer you to the attached standard sheet entitled "Basement/Retaining Wall Backfill and Water Control."

Inorganic excavated soils can be used as exterior backfill around foundation elements and foundation stem walls. Moisture conditioning of these soils may be needed to attain compaction. Organic soils can be placed in the upper 1 foot of backfill in green areas, but should not be considered for lateral resistance. Exterior backfill should compacted in thin lifts to a minimum of 90% of the Modified Proctor density.

We recommend the lateral earth pressure of the foundation be developed with an equivalent fluid density of 50 lbs/ft^3. The at-rest condition should govern for lateral pressures; deformation of the foundation cannot be allowed to develop a passive resistance.

Floor Slab Support

Excavation of unsuitable soils from the SCADA building area, as previously recommended, will also prepare this area for floor slab support. If the floor slab is constructed over the existing fill, there is a potential for cracking to occur in the slab. The risk of cracking can be reduced by removing the existing fill from floor slab areas.

The SCADA building floor slab should be constructed on a layer of clean sand fill having less than 5% material by weight passing the #200 sieve size, and 100% material passing the #4 sieve. The clean sand layer should have a thickness of at least 6 inches to provide a capillary break for moisture. If the building is to be unheated, an increased thickness of clean sand fill will reduce the risk of frost heave in the floor slab area. Engineered fill supporting the floor slab should be compacted to a minimum of 90% of Modified Proctor density. This includes utility and foundation trench backfill in floor slab areas.

If moisture sensitive floor coverings are used, a polyethylene vapor membrane can provide added moisture protection beneath the floor slab. For standard recommendations pertaining to moisture and vapor protection of the building floor slab, we refer you to the attached standard sheet entitled "Floor Slab Moisture/Vapor Protection."

Sidewalks and Doorway Aprons

All topsoil and soils containing organics should be removed from any sidewalk and doorway apron construction areas. Sidewalks and aprons will likely be aligned over silty soils that are highly frost susceptible. To reduce the potential for frost heaving, we recommend sidewalk and apron sections have a sand base thickness ranging from 2 feet to 3 feet. The sand should have 100% material passing the #4 sieve and having less than 7% by weight passing the #200 sieve. Fill placed below sidewalks should be uniformly compacted in thin lifts to a minimum of 90% of the Modified Proctor density.

Site Drainage

We recommend that site grades be established that promote positive drainage of surface water away from the water reservoir and SCADA building. The building should be equipped with a sufficient collection system that collects precipitation from the roof and directs it away from the building and water reservoir.

Utility Construction

Excavation

We recommend the new water main be supported by inorganic, undisturbed native soils or engineered fill overlying inorganic native soils. Cobbles and/or boulders may be encountered during trench excavation, and should be removed from the trench base as necessary to help prevent point loading along the pipeline. Any soft or wet soils at the bottom of the pipeline trench should also be removed.

Support Fill

Bedding material should be used to level the bottom of the trench for installing the water main. Bedding material and engineered fill placed for pipeline support and/or trench backfill should consist of an inorganic, non-frozen, granular material void of boulders, cobbles, and debris. As discussed previously, if excavated soils are to be used as engineered fill, moisture conditioning may be required. Engineered fill for water main support should be placed in thin loose lifts and compacted to 95% of the Standard Proctor density (ASTM D698).

Frost Considerations

The water main pipeline, and any other utilities that can freeze, should be provided with a minimum of 7 feet of soil cover for protection from frost. If the pipeline is to be placed at shallower depths, insulation should be placed over the pipeline for frost protection.

Backfill

In pavement areas, the critical subgrade zone is considered the zone within three vertical feet of the pavement surface. Trench backfill within the critical subgrade zone should be compacted to 100% of the Standard Proctor density, and below the critical subgrade zone can be compacted to 95% of the Standard Proctor density. In green areas, the trench backfill should be compacted to 90% of the Standard proctor density, or compacted per the Mn/DOT Quality Compaction Method (Mn/DOT Specification 2105.3F2) to avoid depressions at the surface of the backfilled trench. Standard data sheets entitled "Standard Recommendations for Utility Trench Backfilling" and "Bedding/Foundation Support of Buried Pipe" are also attached to this report. These standard sheets provide recommendations for backfill materials and placement.

CONSTRUCTION CONSIDERATIONS

Potential Difficulties

Cobbles and Boulders

Apparent cobbles were encountered in three of the test borings. Cobbles and boulders are common in till soils and may be encountered in foundation and water main excavations at the site. The presence of cobbles and boulders can cause difficult conditions for excavating in foundation and utility areas.

Runoff Water in Excavation

The silty soils encountered in the borings are likely to perch water during periods of wet weather. To allow observation of the excavation bottom, reduce the potential for soil disturbance, and to facilitate filling operations, we recommend that all free-standing water within excavations be removed prior to proceeding with construction.

Soil Disturbance

The soils encountered in the test borings are highly susceptible to disturbance and weakening when exposed to construction equipment and/or foot traffic, especially when moist or saturated. If soils do

become disturbed, they should be carefully excavated and be replaced with compacted, engineered fill.

Cold Weather Construction

If construction occurs during freezing temperatures, there are certain precautions that should be considered for placement of fill and backfilling around structures. We refer you to the attached sheet entitled "Freezing Weather Effects on Building Construction" for information regarding cold weather precautions.

Excavation Sidesloping

If unretained, excavations should maintain sideslopes in accordance with OSHA Regulations (Standards 29 CFR), Part 1926, Subpart P, "Excavations" (can be found on www.osha.gov). Even with the required OSHA sloping, water can potentially induce side slope erosion which could require slope maintenance.

Observation and Testing

The recommendations in this report are based on the subsurface conditions found at our test boring locations. Since the soil conditions can be expected to vary away from the soil boring locations, we recommend on-site observations by a geotechnical engineer, or the engineer's representative, during construction to evaluate the effect of these potential changes.

We recommend that all foundation excavations be observed by a geotechnical engineer immediately prior to placing engineered fill and concrete. The soils at the site are susceptible to disturbance from moisture or construction traffic, and should be protected until a final observation can be made immediately prior to placing engineered fill or concrete. Soil density testing should also be performed on all fill placed at the site to document that project recommendations or specifications for compaction and moisture have been satisfied. Where fill material type is important, sieve analysis tests should be performed to document the actual fill meets the recommended gradation criteria.

SUBSURFACE EXPLORATION

General

Our subsurface exploration program included performing 4 SPT borings and six FA borings at the site on May 7 and 10, 2010. The test boring locations and elevations, as provided by MSA, are shown on Figure 1 in the Appendix.

Drilling Methods

The standard penetration test borings were advanced using 3¼-inch inside diameter hollow stem augers. Flight auger borings were performed using 6 inch diameter flight augers. The boreholes were backfilled in compliance with Minnesota Department of Health regulations.

Sampling Methods

Split-Spoon Samples (SS)

Standard Penetration (split-spoon) samples were collected in general accordance with ASTM D1586. This method consists of driving a 2" O.D. split-barrel sampler into the in-situ soil with a 140-pound hammer dropped from a height of 30". The sampler is driven a total of 18" into the soil. After an initial set of 6 inches, the number of hammer blows to drive the sampler the final 12 inches is known as the Standard Penetration resistance or N-value.

Hand Samples

Hand samples were collected from the flights of the auger for FA borings.

Sampling Limitations

Unless actually observed in a sample, contacts between soil layers are estimated based on the spacing of samples and the action of drilling tools. Cobbles, boulders, and other large objects generally cannot be recovered from test borings, and they may be present in the ground even if they are not noted on the boring logs.

Classification Methods

Soil classifications shown on the boring logs are generally based on the Unified Soil Classification System (USCS). The USCS is described in ASTM D2487 and D2488. Where laboratory classification tests (sieve analysis or Atterberg Limits) have been performed, classifications per ASTM D2487 are possible. Otherwise, soil classifications shown on the boring logs are visual-manual judgments. We have attached charts in the Appendix illustrating the USCS, the descriptive terminology, and the symbols used on the boring logs.

The boring logs include judgments of the geologic depositional origin. This judgment is primarily based on observation of the soil samples, which can be limited. Observations of the surrounding topography, vegetation and development can sometimes aid this judgment.

Water Level Observations

The water level measurements are shown at the bottom of the boring logs. The following information appears under "Water Level Measurements" on the logs:

- Date and Time of measurement
- Sampled Depth: lowest depth of soil sampling at the time of measurement
- Casing Depth: depth to bottom of casing or hollow-stem auger at time of measurement
- Cave-in Depth: depth at which measuring tape stops in the borehole
- Water Level: depth in the borehole where free water is encountered
- Drilling Fluid Level: same as Water Level, except that the liquid in the borehole is drilling fluid

The true location of the water table at the boring locations may be different than the water levels measured in the boreholes. This is possible because there are several factors that can affect the water level measurements in the borehole. Some of these factors include: permeability of each soil layer in profile, presence of perched water, amount of time between water level readings, presence of drilling fluid, weather conditions, and use of borehole casing.

Sample Storage

We will retain representative samples of the soils recovered from the borings for a period of 30 days. The samples will then be discarded unless you notify us otherwise.

LIMITATIONS

The data derived through the exploration program have been used to develop our opinions about the subsurface conditions at your site. However, because no exploration program can reveal totally what is in the subsurface, conditions between borings and between samples and at other times, may differ from conditions described in this report. The exploration we conducted identified subsurface conditions only at those points where we took samples or observed ground water conditions. Depending on the sampling methods and sampling frequency, every soil layer may not be observed, and some materials or layers which are present in the ground may not be noted on the boring logs.

If conditions encountered during construction differ from those indicated by our borings, it may be necessary to alter our conclusions and recommendations, or to modify construction procedures, and the cost of construction may be affected.

The extent and detail of information about the subsurface condition are directly related to the scope of the exploration. It should be understood, therefore, that information can be obtained by means of additional exploration.

STANDARD OF CARE

Our services for your project have been conducted to those standards considered normal for services of this type at this time and location. Other than this, no warranty, express or implied, is intended.

SIGNATURES

We have appreciated the opportunity to provide our services for this project. If you have questions regarding this report, or if we may provide additional assistance, please contact us.

Report Prepared by:
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I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am duly Licensed Professional Engineer under the laws of the State of Minnesota.

Sara L. Leow

Date 6/10/10 **License # 47103**

EXCAVATION AND REFILLING FOR STRUCTURAL SUPPORT

EXCAVATION

Excavations for structural support at soil boring locations should be taken to depths recommended in the geotechnical report. Since conditions can vary, recommended excavation depths between and beyond the boring locations should be evaluated by geotechnical field personnel. If ground water is present, the excavation should be dewatered to avoid the risk of unobservable poor soils being left in-place. Excavation base soils may become disturbed due to construction traffic, ground water or other reasons. Such soils should be subcut to underlying undisturbed soils. Where the excavation base slopes steeper than 4:1, the excavation bottom should be benched across the slope parallel to the excavation contour.

Soil stresses under footings spread out with depth. Therefore, the excavation bottom and subsequent fill system should be laterally oversized beyond footing edges to support the footing stresses. A lateral oversize equal to the depth of fill below the footing (i.e., 1:1 oversize) is usually recommended. The lateral oversize is usually increased to 1.5:1 where compressible organic soils are exposed on the excavation sides. Variations in oversize requirements may be recommended in the geotechnical report or can be evaluated by the geotechnical field personnel.

Unless the excavation is retained, the backslopes should be maintained in accordance with OSHA Regulations (Standards - 29 CFR), Part 1926, Subpart P, "Excavations" (found on www.osha.gov). Even with the required OSHA sloping, ground water can induce sideslope raveling or running which could require that flatter slopes or other approaches be used.

FILLING

Filling should proceed only after the excavation bottom has been approved by the geotechnical engineer/technician. Approved fill material should be uniformly compacted in thin lifts to the compaction levels specified in the geotechnical report. The lift thickness should be thin enough to achieve specified compaction through the full lift thickness with the compaction equipment utilized. Typical thicknesses are 6" to 9" for clays and 12" to 18" for sands. Fine grained soils are moisture sensitive and are often wet (water content exceeds the "optimum moisture content" defined by a Proctor test). In this case, the soils should be scarified and dried to achieve a water content suitable for compaction. This drying process can be time consuming, labor intensive, and requires favorable weather.

Select fill material may be needed where the excavation bottom is sensitive to disturbance or where standing water is present. Sands (SP) which are medium to coarse grained are preferred, and can be compacted in thicker lift thicknesses than finer grained soils.

Filling operations for structural support should be closely monitored for fill type and compaction by a geotechnical technician. Monitoring should be on a full-time basis in cases where vertical fill placement is rapid; during freezing weather conditions; where ground water is present; or where sensitive bottom conditions are present.

EXCAVATION/REFILLING DURING FREEZING TEMPERATURES

Soils that freeze will heave and lose density. Upon thawing, these soils will not regain their original strength and density. The extent of heave and density loss depends on the soil type and moisture condition; and is most pronounced in clays and silts. Foundations, slabs, and other improvements should be protected from frost intrusion during freezing weather. For earthwork during freezing weather, the areas to be filled should be stripped of frozen soil, snow and ice prior to new fill placement. In addition, new fill should not be allowed to freeze during or after placement. For this reason, it may be preferable to do earthwork operations in small plan areas so grade can be quickly attained instead of large areas where much frost stripping may be needed.

BASEMENT/RETAINING WALL BACKFILL AND WATER CONTROL

DRAINAGE

Below grade basements should include a perimeter backfill drainage system on the exterior side of the wall. The exception may be where basements lie within free draining sands where water will not perch in the backfill. Drainage systems should consist of perforated or slotted PVC drainage pipes located at the bottom of the backfill trench, lower than the interior floor grade. The drain pipe should be surrounded by properly graded filter rock. A filter fabric should then envelope the filter rock. The drain pipe should be connected to a suitable means of disposal, such as a sump basket or a gravity outfall. A storm sewer gravity outfall would be preferred over exterior daylighting, as the latter may freeze during winter. For non-building, exterior retaining walls, weep holes at the base of the wall can be substituted for a drain pipe.

BACKFILLING

Prior to backfilling, damp/water proofing should be applied on perimeter basement walls. The backfill materials placed against basement walls will exert lateral loadings. To reduce this loading by allowing for drainage, we recommend using free draining sands for backfill. The zone of sand backfill should extend outward from the wall at least 2', and then upward and outward from the wall at a 30° or greater angle from vertical. As a minimum, the sands should contain no greater than 12% by weight passing the #200 sieve, which would include (SP) and (SP-SM) soils. The sand backfill should be placed in lifts and compacted with portable compaction equipment. This compaction should be to the specified levels if slabs or pavements are placed above. Where slab/pavements are not above, we recommend capping the sand backfill with a layer of clayey soil to minimize surface water infiltration. Positive surface drainage away from the building should also be maintained. If surface capping or positive surface drainage cannot be maintained, then the trench should be filled with more permeable soils, such as the Fine Filter or Coarse Filter Aggregates defined in Mn/DOT Specification 3149. You should recognize that if the backfill soils are not properly compacted, settlements may occur which may affect surface drainage away from the building.

Backfilling with silty or clayey soil is possible but not preferred. These soils can build-up water which increases lateral pressures and results in wet wall conditions and possible water infiltration into the basement. If you elect to place silty or clayey soils as backfill, we recommend you place a prefabricated drainage composite against the wall which is hydraulically connected to a drainage pipe at the base of the backfill trench. High plasticity clays should be avoided as backfill due to their swelling potential.

LATERAL PRESSURES

Lateral earth pressures on below grade walls vary, depending on backfill soil classification, backfill compaction and slope of the backfill surface. Static or dynamic surcharge loads near the wall will also increase lateral wall pressure. For design, we recommend the following ultimate lateral earth pressure values (given in equivalent fluid pressure values) for a drained soil compacted to 95% of the Standard Proctor density and a level ground surface.

	Equivalent Fluid Density	
Soil Type	**Active (pcf)**	**At-Rest (pcf)**
Sands (SP or SP-SM)	35	50
Silty Sands (SM)	45	65
Fine Grained Soils (SC, CL or ML)	70	90

Basement walls are normally restrained at the top which restricts movement. In this case, the design lateral pressures should be the Aat-rest@ pressure situation. Retaining walls which are free to rotate or deflect should be designed using the active case. Lateral earth pressures will be significantly higher than that shown if the backfill soils are not drained and become saturated.

FLOOR SLAB MOISTURE/VAPOR PROTECTION

Floor slab design relative to moisture/vapor protection should consider the type and location of two elements, a granular layer and a vapor membrane (vapor retarder, water resistant barrier or vapor barrier). In the following sections, the pros and cons of the possible options regarding these elements will be presented, such that you and your specifier can make an engineering decision based on the benefits and costs of the choices.

GRANULAR LAYER

In American Concrete Institute (ACI) 302.1-96, a "base material" is recommended, rather than the conventional cleaner "sand cushion" material. The manual maintains that clean sand (common "cushion" sand) is difficult to compact and maintain until concrete placement is complete. ACI recommends a clean, fine graded material (with at least 10% to 30% of particles passing a #100 sieve) which is not contaminated with clay, silt or organic material. We refer you to ACI 302.1-96 for additional details regarding the requirements for the base material.

In cases where potential static water levels or significant perched water sources appear near or above the floor slab, an underfloor drainage system may be needed wherein a draintile system is placed within a thicker clean sand or gravel layer. Such a system should be properly engineered depending on subgrade soil types and rate/head of water inflow.

VAPOR MEMBRANE

The need for a vapor membrane depends on whether the floor slab will have a vapor sensitive covering, will have vapor sensitive items stored on the slab, or if the space above the slab will be a humidity controlled area. If the project does not have this vapor sensitivity or moisture control need, placement of a vapor membrane may not be necessary. Your decision will then relate to whether to use the ACI base material or a conventional sand cushion layer. However, if any of the above sensitivity issues apply, placement of a vapor membrane is recommended. Some floor covering systems (adhesives and flooring materials) require a vapor membrane to maintain a specified maximum slab moisture content as a condition of their warranty.

VAPOR MEMBRANE/GRANULAR LAYER PLACEMENT

A number of issues should be considered when deciding whether to place the vapor membrane above or below the granular layer. The benefits of placing the slab on a granular layer, with the vapor membrane placed **below** the granular layer, include **reduction** of the following:

- Slab curling during the curing and drying process.
- Time of bleeding, which allows for quicker finishing.
- Vapor membrane puncturing.
- Surface blistering or delamination caused by an extended bleeding period.
- Cracking caused by plastic or drying shrinkage.

The benefits of placing the vapor membrane **over** the granular layer include the following:

- The moisture emission rate is achieved faster.
- Eliminates a potential water reservoir within the granular layer above the membrane.
- Provides a "slip surface", thereby reducing slab restraint and the associated random cracking.

If a membrane is to be used in conjunction with a granular layer, the approach recommended depends on slab usage and the construction schedule. The vapor membrane should be placed above the granular layer when:

- Vapor sensitive floor covering systems are used or vapor sensitive items will be directly placed on the slab.
- The area will be humidity controlled, but the slab will be placed before the building is enclosed and sealed from rain.
- Required by a floor covering manufacturer's system warranty.

The vapor membrane should be placed below the granular layer when:

- Used in humidity controlled areas (without vapor sensitive coverings/stored items), with the roof membrane in place, and the building enclosed to the point where precipitation will not intrude into the slab area. Consideration should be given to slight sloping of the membrane to edges where draintile or other disposal methods can alleviate potential water sources, such as pipe or roof leaks, foundation wall damp proofing failure, fire sprinkler system activation, etc.

There may be cases where membrane placement may have a detrimental effect on the subgrade support system (e.g., expansive soils). In these cases, your decision will need to weigh the cost of subgrade options and the performance risks.

STANDARD RECOMMENDATIONS FOR UTILITY TRENCH BACKFILLING

GENERAL

Clayey and silty soils are often difficult to compact, as they may be naturally wet or may become wet due to ground water or surface/rain water during construction. Soils will need to be placed within a certain range of water (moisture) content to attain desired compaction levels. Moisture conditioning to within this range can be time consuming, labor intensive, and requires favorable weather.

The degree of compaction and the soil type used for backfill within open cut utility trenches depends on the function of the overlying land surface. Details are as follows:

ROADWAYS

Where trenches are located below roadways, we recommend using inorganic fill and compacting these soils per Mn/DOT Specification 2105.3F1 (Specified Density Method). This specification requires 100% of the Standard Proctor density in the upper one meter subgrade zone, and 95% below this. Note that this specification includes moisture content range requirements which are important for proper subgrade stability.

Where available soils are wet or of poor quality, it may be possible to use the "Quality Compaction Method" (Mn/DOT Specification 2105.3F2) for soils below the upper one meter subgrade zone if you can tolerate some subsidence. However, a high level of stability is still important within the upper subgrade zone and recommend that the "Specified Density Method" be used in this upper subgrade area. We caution that if backfill soils in the lower trench area are significantly unstable, it may be difficult or even impossible to properly compact soils within the upper one meter subgrade zone. In this case, placing a geotextile fabric directly over the unstable soils can aid in offsetting the instability.

STRUCTURAL AREAS

If fill is placed beneath or within the significant zone of influence of a structure (typically a 1:1 lateral oversize zone), the soil type and minimum compaction level will need to be evaluated on an individual basis. Because trenches result in variable fill depths over a short lateral distance, higher than normal compaction levels and/or more favorable (sandy) soil fill types may be needed. If this situation exists, it is important that special geotechnical engineering review be performed.

NON-STRUCTURAL AREAS

In grass/ditch areas, backfill soils should be placed in reasonable lift thicknesses and compacted to a minimum of 90% of the Standard Proctor density (ASTM:D698) and/or per the Mn/DOT "Quality Compaction Method." If lower compaction levels are attained, more noticeable subsidence at the surface can occur. Steep or high slopes require special consideration.

BEDDING/FOUNDATION SUPPORT OF BURIED PIPE

GENERAL

This page addresses soil bedding and foundation support of rigid pipe, such as reinforced concrete, and flexible pipe, such as steel and plastic. This does not address selection of pipe based on loads and allowable deflections, but rather addresses the geotechnical/soil aspects of uniform pipe support. Bedding/foundation support needs relate to local conditions directly beneath and to the sides of the pipe zone, which may be influenced by soft in-situ ground conditions or by soil disturbance due to soil sensitivity or ground water. Bedding relates to granular materials placed directly beneath the bottom of the pipe (usually 4" to 6" thick), which is intended to provide increased support uniformity. We refer to foundation soils as thicker layers of sands and/or gravels (beneath the bedding zone) intended to provide increased foundation strength support, usually needed due to soft, unstable and/or waterbearing conditions.

GRANULAR BEDDING

With circular pipes, high local loads (approaching point loads) develop if pipes are placed on hard surfaces. Load distribution is improved by placing granular bedding materials beneath the pipe, which are either shaped to match the pipe bottom or are placed without compaction to allow "settling in." The bedding should be placed in such a manner that the pipe will be at the proper elevation and slope when the pipe is laid on the bedding. Common bedding material is defined in Mn/DOT Specification 3149.2F, Granular Bedding. Published documents recommend rigid pipes having a diameter of 12" to 54" be placed on a bedding thickness of 4", which increases to 6" of bedding for pipe diameters ranging from 54" to 72". Beyond a 72" diameter, the bedding thickness can be equal to the pipe outside diameter divided by 12. Typically, the need for bedding under small diameter pipes (less than 12") depends on the pipe designer's specific needs, although in obvious point loads situations (bedrock, cobbles, significant coarse gravel content), bedding is recommended. Note that bedding should also account for larger diameter bells at joints.

FOUNDATION FILL

Positive uniform strength is usually compromised in soft or unstable trench bottom conditions. In this case, deeper subcuts and foundation fill placement is needed beneath the pipe. In moderate instability conditions, improvement can likely be accomplished with a thicker bedding layer. However, in more significant instability situations, particularly where ground water is present, coarser materials may be needed to provide a stronger foundation. Thicker gravel layers can also be a favorable media from which to dewater. The following materials would be appropriate for stability improvement, with the coarser materials being appropriate for higher instability/ground water cases.

- Fine Filter Aggregate – Mn/DOT Specification 3149.2J
- Coarse Filter Aggregate –Mn/DOT Specification 3149.2H

When using a coarser material which includes significant void space, we highly recommend enveloping the entire gravel layer within a geotextile fabric. The gravel material includes open void space, and the fabric acts as a separator which minimizes the intrusion of fines into the open void space. If an additional granular bedding sand is used above foundation gravel, the fabric would also prevent downward infiltration of bedding sand into the rock void space.

Although it is preferred to not highly compact thin granular bedding zones directly beneath the pipe center, it is desirable to compact the foundation materials to prevent more significant pipe settlement. We recommend foundation fill be compacted to a minimum of 95% of the Standard Proctor density (ASTM:D698). It is not possible to test coarse rock fill, although this material should still be well compacted/ tamped.

Often, pipes entering structures such as catch basins, lift stations, etc., enter the structure at a higher elevation than the structure bottom, and are therefore placed on the structure backfill. Fill beneath these pipes should be considered foundation fill. Depending on the flexibility of the connection design, it may be necessary to increase the minimum compaction level to reduce differential settlements, particularly with thicker fills.

SIDE FILL SUPPORT

If the pipe designer requires support from the side fill, granular bedding should also be placed along the sides of the pipe. In poor soil conditions, the sand fill may need to be placed laterally up to two pipe diameters on both sides of the pipe. With rigid pipe, compacted sand placement up to the spring line (within the haunch area) is usually sufficient. With flexible pipe, side fill should be placed and compacted at least to the top of the pipe. For positive support, it is very important to properly compact the sands within the haunch area.

FREEZING WEATHER EFFECTS ON BUILDING CONSTRUCTION

GENERAL

Because water expands upon freezing and soils contain water, soils which are allowed to freeze will heave and lose density. Upon thawing, these soils will not regain their original strength and density. The extent of heave and density/ strength loss depends on the soil type and moisture condition. Heave is greater in soils with higher percentages of fines (silts/clays). High silt content soils are most susceptible, due to their high capillary rise potential which can create ice lenses. Fine grained soils generally heave about 1/4" to 3/8" for each foot of frost penetration. This can translate to 1" to 2" of total frost heave. This total amount can be significantly greater if ice lensing occurs.

DESIGN CONSIDERATIONS

Clayey and silty soils can be used as perimeter backfill, although the effect of their poor drainage and frost properties should be considered. Basement areas will have special drainage and lateral load requirements which are not discussed here. Frost heave may be critical in doorway areas. Stoops or sidewalks adjacent to doorways could be designed as structural slabs supported on frost footings with void spaces below. With this design, movements may then occur between the structural slab and the adjacent on-grade slabs. Non-frost susceptible sands (with less than 12% passing a #200 sieve) can be used below such areas. Depending on the function of surrounding areas, the sand layer may need a thickness transition away from the area where movement is critical. With sand placement over slower draining soils, subsurface drainage would be needed for the sand layer. High density extruded insulation could be used within the sand to reduce frost penetration, thereby reducing the sand thickness needed. We caution that insulation placed near the surface can increase the potential for ice glazing of the surface.

The possible effects of adfreezing should be considered if clayey or silty soils are used as backfill. Adfreezing occurs when backfill adheres to rough surfaced foundation walls and lifts the wall as it freezes and heaves. This occurrence is most common with masonry block walls, unheated or poorly heated building situations and clay backfill. The potential is also increased where backfill soils are poorly compacted and become saturated. The risk of adfreezing can be decreased by placing a low friction separating layer between the wall and backfill.

Adfreezing can occur on exterior piers (such as deck, fence or other similar pier footings), even if a smooth surface is provided. This is more likely in poor drainage situations where soils become saturated. Additional footing embedment and/or widened footings below the frost zones (which include tensile reinforcement) can be used to resist uplift forces. Specific designs would require individual analysis.

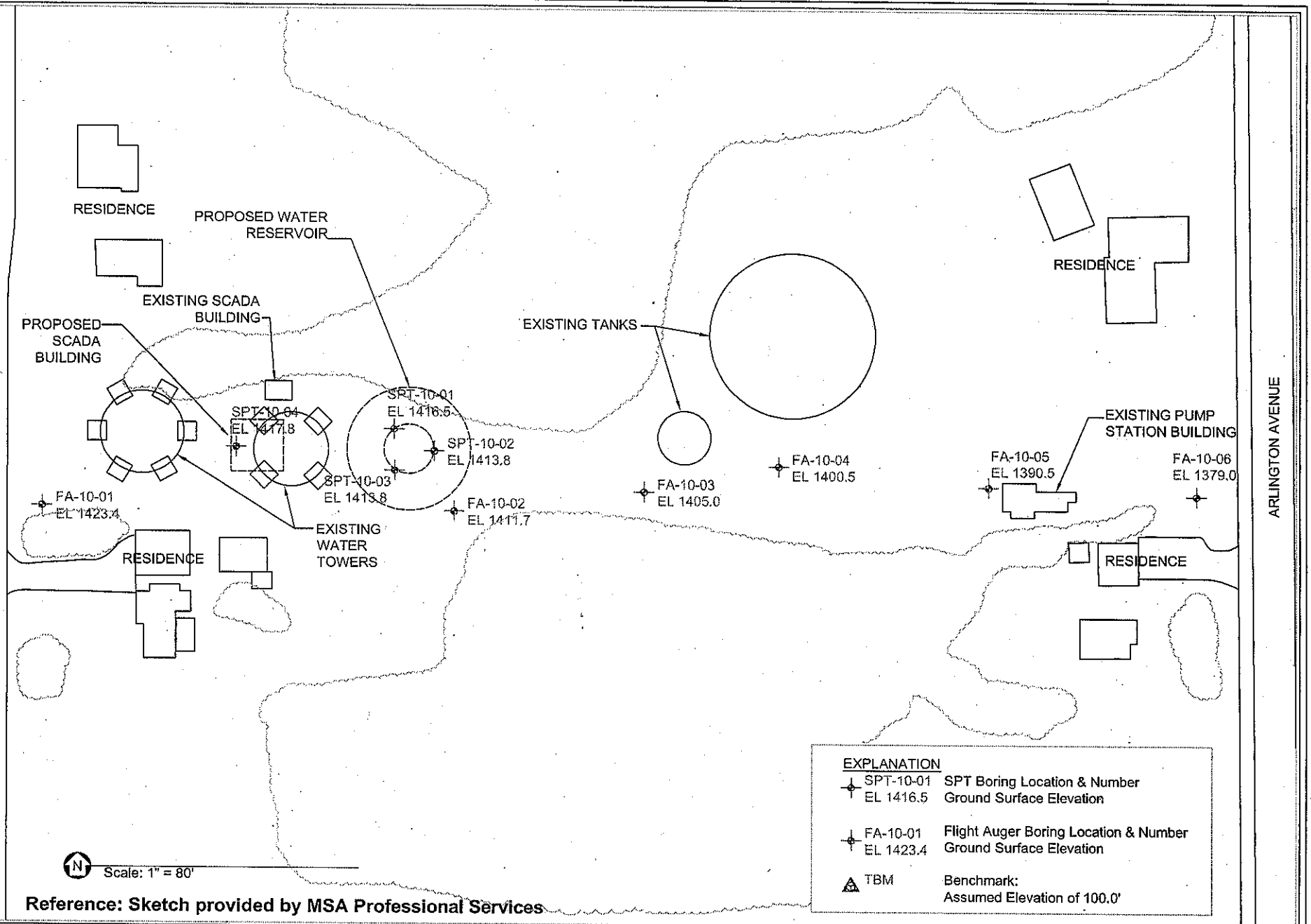
CONSTRUCTION CONSIDERATIONS

Foundations, slabs and other improvements which may be affected by frost movements should be insulated from frost penetration during freezing weather. If filling takes place during freezing weather, all frozen soils, snow and ice should be stripped from areas to be filled prior to new fill placement. The new fill should not be allowed to freeze during transit, placement or compaction. This should be considered in the project scheduling, budgeting and quantity estimating. It is usually beneficial to perform cold weather earthwork operations in small areas where grade can be attained quickly rather than working larger areas where a greater amount of frost stripping may be needed. If slab subgrade areas freeze, we recommend the subgrade be thawed prior to floor slab placement. The frost action may also require reworking and recompaction of the thawed subgrade.

Appendix

Figure 1 – Approximate Test Boring Locations
Logs of Test Borings
Boring Log Notes
Unified Soil Classification System
Geologic Terminology

www.amengtest.com
AMERICAN ENGINEERING TESTING, INC.
P.O. BOX 16008; DULUTH, MINNESOTA 55816



Reference: Sketch provided by MSA Professional Services

FIGURE NO.	PROJECT NO. 07-04601 ALTERED BY: DWA CHECKED BY: SLL DATE: 06/08/10	APPROXIMATE BORING LOCATIONS	HIGHLAND PUMP STATION Duluth, Minnesota

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SUBSURFACE TEST BORING LOG

AET JOB NO: **07-04601** LOG OF BORING NO. **SPT-10-01 (p. 1 of 1)**

PROJECT: **Highland Pump Station Improvements; Duluth, MN**

DEPTH IN FEET	SURFACE ELEVATION: 1416.5 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DD	LL	PL	%-#200
1	FILL, organic sandy silt with roots, dark brown			M	SU						
2	FILL, silty sand, a little gravel, brown										
3		FILL	10	M	SS	4					
4	FILL, silty sand with gravel, trace roots, brown										
5			26	M	SS	14					
6	SILTY SAND, a little gravel, brown, moist,										
7	medium dense (SM)										
8			17	M	SS	5					
9											
10			23	M	SS	9					
11											
12	SILTY SAND WITH GRAVEL, apparent cobbles, brown, moist, dense to medium dense										
13	(SM)		34	M	SS	10					
14											
15		TILL	50/0.1'	M	SS	1					
16											
17											
18											
19											
20			28		SS	0					
21											
22											
23											
24	SILTY SAND WITH GRAVEL, dark brown,										
25	moist, dense (SM)		42	M	SS	10					
26	**END OF BORING AT 26.0 FEET** Borehole backfilled with auger cuttings										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS						
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-24½' 3.25" HSA	5/7/10	10:25	26.0	24.5	24.5	---	None
BORING COMPLETED: 5/7/10							
DR: LA LG: TDD Rig: 51							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/06

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE TEST BORING LOG

AET JOB NO: **07-04601** LOG OF BORING NO. **SPT-10-02 (p. 1 of 1)**

PROJECT: **Highland Pump Station Improvements; Duluth, MN**

DEPTH IN FEET	SURFACE ELEVATION: 1413.8 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DD	LL	PL	%-#200
1	ORGANIC TO SLIGHTLY ORGANIC SILT WITH SAND AND ROOTS, dark brown (OL)	TOPSOIL		M	SU						
2	SILTY SAND, a little gravel, brown, moist, dense (SM)										
3			34	M	SS	3					
4											
5			26		SS	0					
6	SILTY SAND WITH GRAVEL, brown, moist, medium dense (SM)										
7											
8			28	M	SS	8					
9											
10	SILTY SAND, a little gravel, brown, moist, medium dense (SM)		28	M	SS	13					
11											
12	SILTY SAND WITH GRAVEL, brown to dark brown, dense to very dense (SM)	TILL									
13			35	M	SS	9					
14											
15			51	M	SS	17					
16											
17											
18											
19											
20			11/0.5' 41/0.5' 50/0.4'	M	SS	15					
21											
22											
23											
24											
25			21/0.5' 32/0.5' 50/0.4'	M	SS	12					
26	**END OF BORING AT 26.0 FEET** Borehole backfilled with auger cuttings										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS						
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-24½' 3.25" HSA	5/7/10	12:45	26.0	24.5	24.5	---	None
BORING COMPLETED: 5/7/10							
DR: LA LG: TDD Rig: 51							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/06

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE TEST BORING LOG

AET JOB NO: **07-04601** LOG OF BORING NO. **SPT-10-03 (p. 1 of 1)**

PROJECT: **Highland Pump Station Improvements; Duluth, MN**

SURFACE ELEVATION: **1413.8**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DD	LL	PL	%-#200
1	FILL, organic silt with roots, dark brown	FILL		M	SU						
2	FILL, organic to slightly organic silt with sand, trace roots, dark brown										
3	SILTY SAND WITH GRAVEL, brown, moist, loose to dense (SM)		9	M	SS	14					
4											
5			31	M	SS	13					
6											
7			25	M	SS	8					
8											
9											
10			26	M	SS	10					
11											
12	GRAVELLY SILTY SAND, brown, moist, dense (SM)	TILL	41	M	SS	8					
13											
14	SILTY SAND WITH GRAVEL, apparent cobbles, dark brown, moist, medium dense to dense (SM)										
15			27	M	SS	2					
16											
17											
18											
19											
20			32	M	SS	10					
21											
22											
23											
24											
	END OF BORING AT 24.6 FEET Borehole backfilled with auger cuttings *Boring offset 3 feet south of staked location due to utility line*		50/0.1'	M	SS	1					

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-24½' 3.25" HSA	**5/10/10**	**14:55**	**24.6**	**24.5**	**24.6**	—	**None**	
BORING COMPLETED: **5/10/10**								
DR: **LA** LG: **TDD** Rig: **51**								

06/06

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE TEST BORING LOG

AET JOB NO: **07-04601** LOG OF BORING NO. **SPT-10-04 (p. 1 of 1)**

PROJECT: **Highland Pump Station Improvements; Duluth, MN**

DEPTH IN FEET	SURFACE ELEVATION: 1417.8 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DD	LL	PL	%-#200
1	FILL, organic to slightly organic silt with roots, dark brown to brown	FILL		M	SU						
2	FILL, silty sand, a little gravel, brown										
3			8	M	SS	14					
4											
5	SILTY SAND, a little gravel, brown, moist with wet lenses, medium dense, lens of wet sand at about 7' (SM)	TILL	30	M	SS	18					
6											
7											
8			15	M/W	SS	16					
9											
10			19	M/W	SS	16					
11											
12	SILTY SAND WITH GRAVEL, brown, moist, medium dense (SM)										
13			18	M	SS	16					
14											
15			18	M	SS	17					
16	**END OF BORING AT 16.0 FEET** Borehole backfilled with auger cuttings										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS						
0-14½' 3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
	5/10/10	**16:15**	**16.0**	**14.5**	**14.5**	**---**	**None**
BORING COMPLETED: **5/10/10**							
DR: **LA** LG: **TDD** Rig: **51**							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/06

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE TEST BORING LOG

AET JOB NO: **07-04601** LOG OF BORING NO. **FA-10-01 (p. 1 of 1)**

PROJECT: **Highland Pump Station Improvements; Duluth, MN**

SURFACE ELEVATION: **1423.4**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DD	LL	PL	%-#200
1	FILL, sand with silt and gravel, brown	FILL		M							
2	FILL, organic sandy silt with roots and gravel, dark brown			M							
3	FILL, a mixture of silty sand, a little gravel, and sandy silt, brown and light brown										
4	SANDY SILTY LEAN CLAY, a little gravel, brown, moist (CL)			M							
5	SILTY SAND, a little gravel, brown, moist (SM)	TILL									
6											
7				M							
8											
9											
10	**END OF BORING AT 10.0 FEET** Borehole backfilled with auger cuttings										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS						
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-10' 6" FA	**5/10/10**		**10.0**	**None**		**---**	**None**
BORING COMPLETED: **5/10/10**							
DR: **LA** LG: **TDD** Rig: **51**							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/06

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE TEST BORING LOG

AET JOB NO: **07-04601** LOG OF BORING NO. **FA-10-02 (p. 1 of 1)**

PROJECT: **Highland Pump Station Improvements; Duluth, MN**

DEPTH IN FEET	SURFACE ELEVATION: 1411.7 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DD	LL	PL	%-#200
1	FILL, organic sandy silt with roots, dark brown	FILL		M							
	FILL, sand with silt and gravel, brown										
2	SANDY SILT, a little gravel, brown, moist (ML)										
3				M							
4											
5	SILTY SAND, a little gravel, apparent cobbles, brown, moist (SM)	TILL									
6											
7				M							
8											
9											
10	**END OF BORING AT 10.0 FEET** Borehole backfilled with auger cuttings *Boring offset 10 feet southwest of staked location due to utility line*										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS						
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-10' 6" FA	**5/10/10**		**10.0**	**None**		**—**	**None**
BORING COMPLETED: **5/10/10**							
DR: **LA** LG: **TDD** Rig: **51**							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/06

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE TEST BORING LOG

AET JOB NO: **07-04601** LOG OF BORING NO. **FA-10-03 (p. 1 of 1)**

PROJECT: **Highland Pump Station Improvements; Duluth, MN**

DEPTH IN FEET	SURFACE ELEVATION: 1405.0 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DD	LL	PL	%-#200
1	FILL, organic silt with sand and roots, dark brown	FILL		M							
2	FILL, slightly organic sandy silt, a little gravel, brown										
3	FILL, silty sand, a little gravel, brown, moist (SM)			M							
4											
5	SILTY SAND, a little gravel, brown, moist with wet lenses (SM)	TILL									
6											
7				M							
8											
9											
10	**END OF BORING AT 10.0 FEET** Borehole backfilled with auger cuttings										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS						
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-10' 6" FA	**5/10/10**		**10.0**	**None**		---	**None**
BORING COMPLETED: **5/10/10**							
DR: **LA** LG: **TDD** Rig: **51**							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/06

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE TEST BORING LOG

AET JOB NO: **07-04601** LOG OF BORING NO. **FA-10-04 (p. 1 of 1)**

PROJECT: **Highland Pump Station Improvements; Duluth, MN**

SURFACE ELEVATION: **1400.5**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS: WC	DD	LL	PL	%-#200
1	FILL, organic sandy silt with roots										
2	FILL, a mixture of sandy silt, a little gravel, silty sand, and rubble (glass), brown	FILL		M							
3											
4											
5											
6	SILTY SAND, a little gravel, brown, moist to wet (SM)										
7											
8				M/W							
9											
10		TILL									
11	SILTY SAND WITH GRAVEL, brown, wet (SM)										
12											
13				W							
14											
15											
	END OF BORING AT 15.0 FEET Borehole backfilled with auger cuttings										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS						
0-15' 6" FA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
	5/10/10	**8:50**	**15.0**	**None**	**9.0**	**—**	**8.5**
	5/10/10	**16:20**	**15.0**	**None**	**9.0**	**—**	**3.7**
BORING COMPLETED: **5/10/10**							
DR: **LA** LG: **TDD** Rig: **51**							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/06

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE TEST BORING LOG

AET JOB NO: **07-04601** LOG OF BORING NO. **FA-10-05 (p. 1 of 1)**

PROJECT: **Highland Pump Station Improvements; Duluth, MN**

DEPTH IN FEET	SURFACE ELEVATION: 1390.5 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DD	LL	PL	%-#200
1	FILL, organic silty sand with roots, dark brown										
	FILL, silty sand with gravel, brown	FILL									
2	SILTY SAND WITH GRAVEL, brown, moist with wet lenses (SM)			M/W							
3											
4											
5	SILTY SAND, a little gravel, brown, moist with wet lenses (SM)										
6		TILL									
7				M/W							
8											
9											
10	**END OF BORING AT 10.0 FEET** Borehole backfilled with auger cuttings										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS						
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-10' 6" FA	**5/10/10**		**10.0**	**None**		**---**	**None**
BORING COMPLETED: **5/10/10**							
DR: **LA** LG: **TDD** Rig: **51**							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/06

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE TEST BORING LOG

AET JOB NO: **07-04601** LOG OF BORING NO. **FA-10-06 (p. 1 of 1)**

PROJECT: **Highland Pump Station Improvements; Duluth, MN**

DEPTH IN FEET	SURFACE ELEVATION: 1379.0 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DD	LL	PL	%-#200
1	Bituminous Pavement - 1¾" thickness	PAVEMENT									
2	FILL, silty sand with gravel, brown	FILL		M							
3	SILTY SAND, a little gravel, brown, moist (SM)			M							
4											
5	SILTY SAND, a little gravel, brown, moist with wet lenses (SM)	TILL									
6											
7				M/W							
8											
9											
10	**END OF BORING AT 10.0 FEET** Borehole backfilled with auger cuttings										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS						
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-10' 6" FA	5/10/10		10.0	None		---	None
BORING COMPLETED: 5/10/10							
DR: LA LG: TDD Rig: 51							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

06/06

BORING LOG NOTES

DRILLING AND SAMPLING SYMBOLS

Symbol	Definition
B,H,N:	Size of flush-joint casing
CA:	Crew Assistant (initials)
CAS:	Pipe casing, number indicates nominal diameter in inches
CC:	Crew Chief (initials)
COT:	Clean-out tube
DC:	Drive casing; number indicates diameter in inches
DM:	Drilling mud or bentonite slurry
DR:	Driller (initials)
DS:	Disturbed sample from auger flights
FA:	Flight auger; number indicates outside diameter in inches
HA:	Hand auger; number indicates outside diameter
HSA:	Hollow stem auger; number indicates inside diameter in inches
LG:	Field logger (initials)
MC:	Column used to describe moisture condition of samples and for the ground water level symbols
N (BPF):	Standard penetration resistance (N-value) in blows per foot (see notes)
NQ:	NQ wireline core barrel
PQ:	PQ wireline core barrel
RD:	Rotary drilling with fluid and roller or drag bit
REC:	In split-spoon (see notes) and thin-walled tube sampling, the recovered length (in inches) of sample. In rock coring, the length of core recovered (expressed as percent of the total core run). Zero indicates no sample recovered.
REV:	Revert drilling fluid
SS:	Standard split-spoon sampler (steel; 1⅜" is inside diameter; 2" outside diameter); unless indicated otherwise
SU	Spin-up sample from hollow stem auger
TW:	Thin-walled tube; number indicates inside diameter in inches
WASH:	Sample of material obtained by screening returning rotary drilling fluid or by which has collected inside the borehole after "falling" through drilling fluid
WH:	Sampler advanced by static weight of drill rod and 140-pound hammer
WR:	Sampler advanced by static weight of drill rod
94mm:	94 millimeter wireline core barrel
▼:	Water level measured in borehole prior to abandonment
▽:	Interim water level measurement or estimated water level based on sample appearance

TEST SYMBOLS

Symbol	Definition
CONS:	One-dimensional consolidation test
DEN:	Dry density, pcf
DST:	Direct shear test
E:	Pressuremeter Modulus, tsf
HYD:	Hydrometer analysis
LL:	Liquid Limit, %
LP:	Pressuremeter Limit Pressure, tsf
OC:	Organic Content, %
PERM:	Coefficient of permeability (K) test; F - Field; L - Laboratory
PL:	Plastic Limit, %
q_p:	Pocket Penetrometer strength, tsf (approximate)
q_c:	Static cone bearing pressure, tsf
q_u:	Unconfined compressive strength, psf
R:	Electrical Resistivity, ohm-cms
RQD:	Rock Quality Designation of Rock Core, in percent (aggregate length of core pieces 4" or more in length as a percent of total core run)
SA:	Sieve analysis
TRX:	Triaxial compression test
VSR:	Vane shear strength, remoulded (field), psf
VSU:	Vane shear strength, undisturbed (field), psf
WC:	Water content, as percent of dry weight
%-200:	Percent of material finer than #200 sieve

STANDARD PENETRATION TEST NOTES

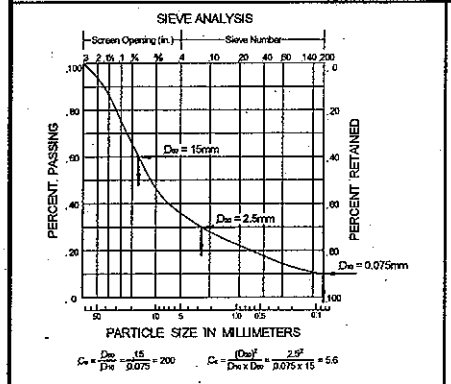
The standard penetration test consists of driving the sampler with a 140 pound hammer and counting the number of blows applied in each of three 6" increments of penetration. If the sampler is driven less than 18" (usually in highly resistant material), permitted in ASTM:D1586, the blows for each complete 6" increment and for each partial increment is on the boring log. For partial increments, the number of blows is shown to the nearest 0.1' below the slash.

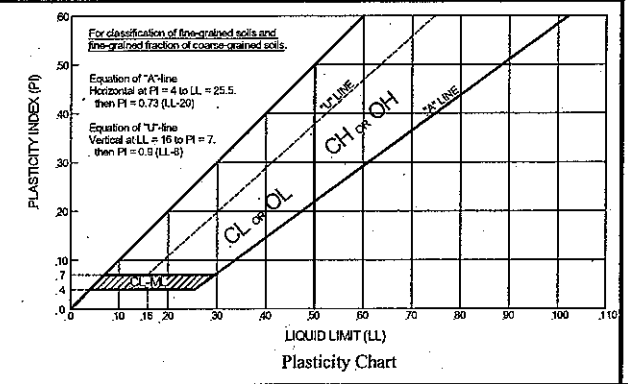
The length of sample recovered, as shown on the "REC" column, may be greater than the distance indicated in the N column. The disparity is because the N-value is recorded below the initial 6" set (unless partial penetration defined in ASTM:D1586 is encountered) whereas the length of sample recovered is for the entire sampler drive (which may even extend more than 18").

UNIFIED SOIL CLASSIFICATION SYSTEM
ASTM Designations: D 2487, D2488

AMERICAN ENGINEERING TESTING, INC.

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification: Group Symbol	Soil Classification: Group Name[B]
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$[E]	GW	Well graded gravel[F]
			$Cu < 4$ and/or $1 > Cc > 3$[E]	GP	Poorly graded gravel[F]
		Gravels with Fines more than 12% fines[C]	Fines classify as ML or MH	GM	Silty gravel[F,G,H]
			Fines classify as CL or CH	GC	Clayey gravel[F,G,H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$[E]	SW	Well-graded sand[I]
			$Cu < 6$ and $1 > Cc > 3$[E]	SP	Poorly-graded sand[I]
		Sands with Fines more than 12% fines[D]	Fines classify as ML or MH	SM	Silty sand[G,H,I]
			Fines classify as CL or CH	SC	Clayey sand[G,H,I]
Fine-Grained Soils 50% or more passes the No. 200 sieve (see Plasticity Chart below)	Silts and Clays Liquid limit less than 50	inorganic	PI>7 and plots on or above "A" line[J]	CL	Lean clay[K,L,M]
			PI<4 or plots below "A" line[J]	ML	Silt[K,L,M]
		organic	Liquid limit–oven dried / Liquid limit – not dried < 0.75	OL	Organic clay[K,L,M,N] / Organic silt[K,L,M,O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay[K,L,M]
			PI plots below "A" line	MH	Elastic silt[K,L,M]
		organic	Liquid limit–oven dried / Liquid limit – not dried < 0.75	OH	Organic clay[K,L,M,P] / Organic silt[K,L,M,Q]
Highly organic soil			Primarily organic matter, dark in color, and organic in odor	PT	Peat[R]





Plasticity Chart

Notes

[A]Based on the material passing the 3-in (75-mm) sieve.

[B]If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C]Gravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay

[D]Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay

[E]$Cu = D_{60} / D_{10}$, $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F]If soil contains ≥15% sand, add "with sand" to group name.

[G]If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H]If fines are organic, add "with organic fines" to group name.

[I]If soil contains ≥15% gravel, add "with gravel" to group name.

[J]If Atterberg limits plot is hatched area, soils is a CL-ML silty clay.

[K]If soil contains 15 to 29% plus No. 200 add "with sand" or "with gravel", whichever is predominant.

[L]If soil contains ≥30% plus No. 200, predominantly sand, add "sandy" to group name.

[M]If soil contains ≥30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N]PI≥4 and plots on or above "A" line.

[O]PI<4 or plots below "A" line.

[P]PI plots on or above "A" line.

[Q]PI plots below "A" line.

[R]Fiber Content description shown below.

ADDITIONAL TERMINOLOGY NOTES USED BY AET FOR SOIL IDENTIFICATION AND DESCRIPTION

Grain Size

Term	Particle Size
Boulders	Over 12"
Cobbles	3" to 12"
Gravel	#4 sieve to 3"
Sand	#200 to #4 sieve
Fines (silt & clay)	Pass #200 sieve

Gravel Percentages

Term	Percent
A Little Gravel	3% - 14%
With Gravel	15% - 29%
Gravelly	30% - 50%

Consistency of Plastic Soils

Term	N-Value, BPF
Very Soft	less than 2
Soft	2 - 4
Firm	5 - 8
Stiff	9 - 15
Very Stiff	16 - 30
Hard	Greater than 30

Relative Density of Non-Plastic Soils

Term	N-Value, BPF
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	Greater than 50

Moisture/Frost Condition (MC Column)

D (Dry): Absense of moisture, dusty, dry to touch.

M (Moist): Damp, although free water not visible. Soil may still have a high water content (over "optimum").

W (Wet/ Waterbearing): Free water visible intended to describe non-plastic soils. Waterbearing usually relates to sands and sand with silt.

F (Frozen): Soil frozen

Layering Notes

Laminations: Layers less than ½" thick of differing material or color.

Lenses: Pockets or layers greater than ½" thick of differing material or color.

Fiber Content of Peat

Term	Fiber Content (Visual Estimate)
Fibric Peat:	Greater than 67%
Hemic Peat:	33 – 67%
Sapric Peat:	Less than 33%

Organic/Roots Description (if no lab tests)

Soils are described as *organic*, if soil is not peat and is judged to have sufficient organic fines content to influence the soil properties. *Slightly organic* used for borderline cases.

With roots: Judged to have sufficient quantity of roots to influence the soil properties.

Trace roots: Small roots present, but not judged to be in sufficient quantity to significantly affect soil properties.

GEOLOGIC TERMINOLOGY (SOILS)

General categories of geologic deposits used, descriptive information and common soil types is as follows:

FILL (F): Soils, rock and/or waste products placed or disturbed by man rather than through geologic processes. Mixed soils are usually easy to identify. Uniform material is more difficult, and signs such as small inclusions, underlying topsoil, topography or knowledge of below grade improvements (e.g., basement backfill, utility trenches, etc.) may be needed to properly judge. When mixed condition is stratified horizontally, the soil may be a weathered natural soil rather than fill.

TOPSOIL (TS): Upper darker colored layer formed by weathering of inorganic soil and accumulation of organic material. Usually black, dark brown, dark gray or dark grayish brown. Often transitions from darker to lighter color.

SLOPEWASH (SW): Organic and/or inorganic materials (sometimes interlayered) washed from slopes and redeposited. Usually stratified. Will be located in depressed areas where they can be washed in from slopes. When topsoil layers are thick in depressed areas, there is a good chance the soil is slopewash.

SWAMP DEPOSITS (SD): Highly organic material (peats and organic clays) which are formed through accumulation of organic material under water. **Peat, Organic clay**

COARSE ALLUVIUM (CA): Sandy (and gravelly). Stratified. Deposited from fast moving waters in streams and rivers. Includes glacial outwash. **Sand, Sand with silt, Silty sand, Gravels**

FINE ALLUVIUM (FA): Clayey and/or silty. Stratified. Deposited from slow moving waters in streams, rivers, lakes and ponds. Includes glacial outwash. **Lean clay, Fat clay, Silty clay, Silt, Sandy silt**

MIXED ALLUVIUM (MA): Combination of Fine and Coarse Alluvium. **Clayey sand, Sandy lean clay,** interlayered **CA/FA**

LACUSTRINE (LAC): Fine grained lake bed deposits (lakes may or may not still be in existence). Usually in very flat topography. **Fat clay, Lean clay, Silty clay, Silt**

LOESS (LOESS): Uniform, non-stratified, silty material (or very fine sand) which is deposited by wind. Can include significant clay content, and grain contacts may be cemented by clay or calcareous (limestone/chalky) material. **Silt, Sandy silt, Silty clay, Lean clay**

TILL (T): Normally contains a wide range of grain sizes, from boulders through clay. Usually non-stratified (not sorted through water action). Deposited directly from glaciers. **Silty sand, Clayey sand, Sandy lean clay,** usually contains **gravel**

WEATHERED TILL (WT): Tills which have been altered by exposure to the action of frost, water, or chemicals. Often softer than underlying soils. May be stratified with varying colors/soil types due to filling in or other changes in frost lensed zones.

COLLUVIUM (COL): Dominantly gravel, boulders and rock slabs, sometimes intermixed or layered with soils. Deposited from gravity flow down hills or cliffs.

HIGHLAND STATION PROCESS INSTRUMENTATION EQUIPMENT WIRING SCHEDULE

TAG NUMBER	DEVICE DESCRIPTION	FIRST SIGNAL/CONTROL HOMERUN			SECOND SIGNAL/CONTROL HOMERUN			POWER HOMERUN				INSTALLATION DETAIL	NOTES
		DESTINATION	WIRING TYPE	WIRING	DESTINATION	WIRING TYPE	WIRING	CIRCUIT	VOLTAGE	CKT. BKR.	WIRING		
LE-1-1-1	ARLINGTON RESERVOIR LEVEL SENSOR	LIT-1-1-1	MFG SIGNAL CABLE	M1								26 90 07	1
LIT-1-1-1	ARLINGTON RESERVOIR LEVEL TRANSMITTER	LCP-A	24VDC ANALOG SIGNAL	A1				LA (13)	120/1Ø	20A/1P	2#12 & #12G	26 99 01	1
PIT-2-1-1	EXISTING SUCTION PRESSURE TRANSMITTER	LCP-A	24VDC ANALOG SIGNAL	A1								26 90 04	5,6
PSL-2-1-1	SUCTION LOW PRESSURE SWITCH	LCP-A	120VAC DISCRETE SIGNAL	D2								26 90 04	1
PI-2-1-1	SUCTION PRESSURE GAUGE											26 90 04	1,7
TSH-3-1-1	PUMP NO.1 MOTOR HIGH TEMEPRATURE SENSOR	MCC-A	120VAC DISCRETE SIGNAL	D2									3
TSH-3-1-2	PUMP NO.2 MOTOR HIGH TEMPERATURE SENSOR	MCC-A	120VAC DISCRETE SIGNAL	D2									3
FCV-3-2-1	PUMP NO.1 DISCHARGE CONTROL VALVE	MCC-A	120VAC DISCRETE SIGNAL	D12									3
FCV-3-2-2	PUMP NO.2 DISCHARGE CONTROL VALVE	MCC-A	120VAC DISCRETE SIGNAL	D12									3,6
FV-3-3-1	PUMP NO.1 BACK-UP DISCHARGE CONTROL VALVE	MCC-A	120VAC DISCRETE SIGNAL	D8				MCC-A	480/3Ø	20A/3P	3#12 & #12G		5
FV-3-3-2	PUMP NO.2 BACK-UP DISCHARGE CONTROL VALVE	MCC-A	120VAC DISCRETE SIGNAL	D8				MCC-A	480/3Ø	20A/3P	3#12 & #12G		5
FCV-3-3-3	SURGE RELIEF VALVE	LCP-A	120VAC DISCRETE SIGNAL	D2									3
FE-4-1-1	DISCHARGE FLOW METER	FIT-4-1-1	MFG SIGNAL CABLE	M1								26 91 51	4
FIT-4-1-1	DISCHARGE FLOW TRANSMITTER	LCP-A	24VDC ANALOG SIGNAL	A1	LCP-A	120VAC DISCRETE SIGNAL	D2	LA (14)	120/1Ø	20A/1P	2#12 & #12G	26 99 01	1
PIT-4-2-1	DISCHARGE PRESSURE TRANSMITTER	LCP-A	24VDC ANALOG SIGNAL	A1								26 90 04	5,6
PI-4-2-1	DISCHARGE PRESSURE GAUGE											26 90 04	1,7
JS-5-1-1	MCC-A POWER FAIL RELAY	LCP-A	120VAC DISCRETE SIGNAL	D2									1
TSL/H-6-1-1	ELECTRICAL ROOM HIGH/LOW TEMPERATURE SENSOR	LCP-A	120VAC DISCRETE SIGNAL	D4								26 99 01	1
XS-6-2-1	ELECTRICAL ROOM HEAT DETECTOR	LCP-A	120VAC DISCRETE SIGNAL	D4									1,2
XS-7-1-1	PUMP STATION ENTRY DETECTION DOOR SWITCH	LCP-A	120VAC DISCRETE SIGNAL	D4								26 70 01	1
LCP-A	SCADA SYSTEM CONTROL PANEL	MCC-A	120VAC DISCRETE SIGNAL	D32	MCC-A	ETHERNET COMM.	C2	LA (12)	120/1Ø	20A/1P	2#12 & #12G	26 98 03	1,9
LCP-C	TEMPORARY BYPASS PUMP CONTROL PANEL	LCP-A	120VAC DISCRETE SIGNAL	D16									1,10

NOTES:

1. EQUIPMENT PROVIDED AND INSTALLED UNDER DIVISION 26.
2. PROVIDE 120V HEAT DETECTOR, SIMPLEX OR EQUIVALENT.
3. EQUIPMENT PROVIDED AND INSTALLED UNDER ANOTHER DIVISION, ELECTRICAL WORK PROVIDED UNDER DIVISION 26.
4. EQUIPMENT INSTALLED UNDER ANOTHER DIVISION BUT PROVIDED UNDER DIVISION 26, ELECTRICAL WORK PROVIDED UNDER DIVISION 26.
5. EXISTING EQUIPMENT TO BE REMOVED AND RE-USED, REMOVE EXISTING ELECTRICAL AND PROVIDE NEW ELECTRICAL AS INDICATED.
6. EQUIPMENT SHALL BE TEMPORARILY INSTALLED AND WIRED AS PART OF THE TEMPORARY BYPASS PUMP CONTROL SYSTEM.
7. DEVICE DOES NOT REQUIRE WIRING.
8. FUTURE EQUIPMENT FOR REFERENCE ONLY, NO WORK REQUIRED UNDER THIS CONTRACT.
9. TEMPORARILY INSTALL CONTROL PANEL AS PART OF THE TEMPORARY BYPASS PUMP CONTROL SYSTEM. SEE PLANS FOR ADDITIONAL DETAILS.
10. PANEL SHALL BE PROVIDED AND INSTALLED AS PART OF THE TEMPORARY BYPASS PUMP CONTROL SYSTEM. PANEL SHALL BE TURNED OVER TO THE CITY AFTER COMPLETION OF WORK FOR USE ELSEWHERE, REFER TO PLANS FOR ADDITIONAL DETAILS.