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June 18, 2013

NOTICE OF ADDENDUM

ADDENDUM NO. 03

CONTRACT NO. 7101

PROJECT 53W1629: BOOSTER PUMPING STATION 106 RECONSTRUCTION

Revise and amend the contract document(s) for the above project as stated in this addendum, otherwise, the original document shall remain in effect.

A. SPECIFICATIONS

1. DIVISION 11–EQUIPMENT

   a. Page 11211-3, SECTION 11211-CENTRIFUGAL PUMPS, <u>PART 2-PRODUCTS</u>, 2.02 EQUIPMENT, A. Design Requirements

   <u>ADD</u> the following to the end of paragraph 2:

   "No negative tolerance for flow or head shall be permitted at the design point."

   <u>REPLACE</u> "125" with "12.5" in the second sentence of paragraph 5.

   b. Page 11730-5, SECTION 11730- SUBMERSIBLE RESERVOIR MIXING SYSTEM, <u>PART 3-EXECUTION</u>, 3.02 EQUIPMENT INSTALLATION AND COORDINATION

   <u>ADD</u> the following to the end of Paragraph 3.02:

   "C. The location of the mixers in the reservoir bays shall be as recommended by the mixer manufacturer."

2. APPENDICES

   ADD the attached GEOTECHNICAL INVESTIGATION following the SAMPLE DRAWINGS.

B. DRAWINGS

1. SHEET NO. 12 - SITE DETAILS

   REPLACE detail C/5.1 with the attached revised detail C/5.1 on Drawing AD-3.1.

2. SHEET NO. 16–BUILDING SECTIONS

   REPLACE Key Note 24 with the following:

   "12-inch swing check valve."

Please acknowledge this addendum on page E1 of the contract documents and/or in Section E: Bidder's Acknowledgement on Bid Express.

Electronic version of these documents can be found on Bid Express at https://www.bidexpress.com/.

If you are unable to download plan revisions associated with the addendum, please contact the Engineering office at 608-266-4751 receive the material by another route.

6/18/13

Alan L. Larson, PE, BCEE
Principal Engineer

WISCONSIN
ANDY L.
MULLENDORE
E-32542
MADISON
WI
PROFESSIONAL ENGINEER

6/18/2013

Prepared by: STRAND ASSOCIATES, INC.®, 910 West Wingra Drive, Madison, WI 53715

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GEOTECHNICAL INVESTIGATION

(CGC, Inc.)

Construction • Geotechnical
Consulting Engineering/Testing

February 11, 2013 (Revised)
C13017

Mr. Alan Larson, P.E.
Madison Water Utility
119 East Olin Avenue
Madison, WI 53713

Re: Geotechnical Exploration
Booster Pump Station 106
110 Glenway Street
Madison, Wisconsin

Dear Mr. Larson:

Construction • Geotechnical Consultants, Inc. (CGC) has completed the subsurface exploration program for the above-referenced project. The purpose of this program was to evaluate the subsurface conditions within the proposed construction area and to provide geotechnical recommendations regarding site preparation, foundation, floor slab and below-grade wall design/construction. A determination of the site class for seismic design is also included. In addition to the electronic copy we are sending you, we are also forwarding pdf copies of this report to Mr. Adam Wiederholt of Madison Water Utility and Messrs. Scott Herkert and Andy Mullendore of Strand Associates.

PROJECT DESCRIPTION

We understand the project will include demolition of an existing portal and stairway leading down to a valve chamber on the east side of the below-ground reservoir in Reservoir Park on Glenway Street near the intersection with Hillcrest Drive. A new booster pump station will then be constructed measuring about 25 ft by 44 ft in plan dimension. The south and west portion of the structure will be in a trench extending about 10 ft below the main floor level to match up with the elevation of the pipes entering and leaving the reservoir. The floor slab elevation in this portion of the building will therefore roughly match the bottom of the reservoir which is at about EL 184 ft (Madison city datum). The main floor level will likely be at about EL 194 ft (MCD) or 1039.5 ft (USGS datum). The south, west, and north walls will be buried in the slope, with the east face exposed along Glenway Street. We estimate that footing grade will be at about EL 190 (or EL 1035.5 USGS) along the exposed face, but will step down about 7 to 8 ft for the deeper portion of the structure.

We understand the building will be a reinforced concrete structure with masonry veneer on the exposed walls. The flat, reinforced concrete roof will span between exterior bearing walls. Light to moderate structural loads are anticipated.

2921 Perry Street, Madison WI 53713
Telephone: 608/288-4100
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SITE CONDITIONS

The existing reservoir and valve chamber portal date back to about 1925. The reservoir is built about 25 ft below grade and is covered with soil on its top and sides. Plans from the original construction indicate the excavation side slopes for the reservoir were cut at slopes ranging from 1H:3V to 1H:1V. As a result, the excavation for the reservoir in the area near the proposed booster station likely did not extend more than about 10 to 15 ft beyond the outer reservoir wall. However, comparing current grades to original grades indicates that 5 to 14 ft of backfill may have been placed along the west side of the proposed booster station to bury the reservoir. Moving away from the reservoir, existing grades on the east side of the booster station footprint (which is further east of the reservoir and lower in elevation) appear to be close to original grades.

The reservoir is located in a City park with mature trees surrounding the reservoir. The roof of the reservoir is flat, but the terrain on the east side, where the booster pump station is proposed, is very steep at about a 1.7H:1V slope. A quarry stone wall retains part of the slope along Glenway Street.

SUBSURFACE CONDITIONS

Access conditions at the site seriously limited the locations where borings could be performed, as we anticipated and discussed in our proposal. The combination of very steep slopes and both overhead and buried utilities made it practical to attempt only one boring, located as close as possible to the north side of the proposed building footprint. However, even the intended location could not be accessed safely because of icy conditions on the slope; as a result the boring had to be moved further north than planned. Nevertheless, it is our opinion that the soil boring information, when combined with the geologic setting and past project records indicating probable fill depths, should give a fairly representative picture of the anticipated subsurface conditions.

Subsurface conditions on site were explored by drilling one Standard Penetration Test (SPT) soil boring to a depth of 40 ft below existing site grades. As noted above, the location was selected by CGC and adjusted by the drillers due to safety concerns related to the snow and ice-covered slope. The boring was drilled on January 16, 2013 by Badger State Drilling (under subcontract to CGC) using a balloon-tired ATV rotary CME750 drill rig equipped with hollow-stem augers and an automatic SPT hammer. The boring location is shown in plan on the Soil Boring Location Map attached in Appendix B. The ground surface elevation at the boring location was interpolated from the topographic map provided to us and is referenced to USGS datum (subtract 845.6 ft to convert to MCD). The borehole was found to have no water and was therefore backfilled with bentonite upon completion.

The subsurface profile at the boring location can generally be described by the following strata (in descending order):

- About 12 in. of ***topsoil fill***, underlain by
- 5 ft of medium dense, reddish brown ***sand fill***, followed by
- 27.5 ft of medium dense to dense, light brown ***silt***, underlain by
- 7.5 ft of very stiff, brown ***lean clay*** extending to the maximum depth explored.

As discussed previously, based on a comparison of original (prior to the reservoir construction) to existing grades, we estimate that the uppermost 5 to 14 ft of soil along the west side of the proposed building footprint may be backfill placed against the reservoir. The boring is located in an area where about 5 ft of fill was anticipated (and confirmed by the boring), but the fill is expected to be deeper near the proposed pump station.

Groundwater was not encountered in the boring during or after drilling. Groundwater levels are expected to fluctuate with seasonal variations in precipitation, infiltration, evapotranspiration and other factors but are not likely to be encountered within the expected excavation depths on this project. A more detailed description of the site soil and groundwater conditions is presented on the Soil Boring Logs attached in Appendix B. Particle size distribution test reports on two representative samples for classification purposes are included in Appendix B.

The samples were screened for volatile organics with a photoionization detector (PID meter) by IverTech personnel under subcontract to CGC. Screening results are indicated on the far right column of the boring log. There were no visual indications or odors suggesting the presence of waste materials noted by the drillers or by CGC in the soil samples.

DISCUSSION AND RECOMMENDATIONS

Subject to the limitations discussed below and based on the subsurface exploration, it is our opinion that the site is suitable for the proposed construction and that the structure can be supported by conventional spread footing foundations. Our recommendations for site preparation, foundation, floor slab and below-grade wall design/construction are presented in the following subsections. Additional information regarding the conclusions and recommendations presented in this report is discussed in Appendix C.

1. <u>Site Preparation</u>

We anticipate that the existing structure will be demolished in its entirety, including foundations and floor slabs, where it lies within or close to the proposed building footprint or where substructure elements might interfere with new utility lines. Topsoil, vegetation and tree roots should be stripped to at least 5 ft beyond the proposed construction areas, including areas required for cuts beyond the building footprint. Following demolition and site stripping, excavation to proposed rough grade should proceed. Exposed soils in areas to receive fill (if any) should be recompacted with a vibratory roller, large plate compactor or hoe-pak and checked for soft/yielding areas. If loose, soft or yielding areas are detected, they should be undercut/removed. Grade should be re-established using granular backfill compacted to at least 95% compaction based on modified Proctor methods (ASTM D 1557) or stabilized with breaker rock compacted into the subgrade until no further deflection is evident.

We recommend using granular soils as fill because sand/gravel soils are relatively easy to place and compact. Clay soils are not recommended as structural fill because moisture conditioning will be required to achieve desired compaction levels, which could delay construction progress especially in late fall to early spring. We recommend that fill/backfill be compacted to at least 95% compaction (ASTM D1557) in accordance with our Recommended Compacted Fill Specifications presented in Appendix D. Periodic field density tests should be taken by CGC staff within the fill/backfill to document the adequacy of compactive effort.

2. Foundation Design

In our opinion, the proposed structure can be supported on reinforced concrete spread footing foundations bearing on the native silt soils, and the following parameters should be used for foundation design:

• Maximum net allowable bearing pressure:	4,000 psf
• Minimum foundation widths:	
-- Continuous wall footings:	18 in.
-- Column pad footings:	30 in.
• Minimum footing depths:	
-- Exterior/perimeter footings:	4 ft
-- Interior footings:	no minimum requirement

Undercutting below footing grade will be required if clays with pocket penetrometer readings (an estimate of the unconfined compressive strength of cohesive soil) less than 2.0 ton/sq ft or looser silt or granular soils are observed at or below footing grade. Where undercutting is required, the base of the undercut excavations should be widened beyond the footing edges at least 0.5 ft in each direction for each foot of undercut depth for stress distribution purposes. Grade can be restored using granular fill compacted to 95% compaction (ASTM D 1557) or compacted coarse stone (breaker run, select crushed material or 3-in. dense graded base course, as described in

Appendix D). CGC should be present during footing excavations to check that adequate soil conditions exist or recommend corrective measures, if necessary.

It is important for contractors to recognize that the silt layer which predominates at this site is a suitable bearing stratum in its undisturbed condition but is very susceptible to disturbance when wet. Extra care will be required to protect footing subgrades during wet weather, including possibly covering them with a 3 to 4-in. thick 'mud mat' of lean mix concrete immediately after excavation or stabilizing them with a thin (6 in. ±) layer of coarse stone compacted until deflection ceases. If subgrades become wet after excavation, they will be very easily disturbed under foot traffic alone while setting forms and rebar.

We recommend using a smooth-edged backhoe bucket for footing excavations. Further, moist to dry silt subgrade soils should be recompacted with a vibratory plate compactor or hoe-pak (backhoe mounted compactor), and clay soils should be hand-trimmed or recompacted with a jumping jack to densify soils loosened/disturbed during excavation. Provided the foundation design/construction recommendations discussed above are followed, we estimate that total and differential settlements should not exceed 1.0 and 0.5 in., respectively.

3. Site Class for Seismic Design

In our opinion, the average soil/rock properties in the upper 100 ft of the site (based on SPT blow counts (N-values) greater than 15 blows/foot, on average) can be characterized as a stiff soil profile. This characterization would place the site in Site Class D for seismic design according to the International Building Code (see Table 1613.5.2).

4. Floor Slab

The floor slabs for the proposed structure are expected to be supported on either native silt or sand fill and may be designed using a subgrade modulus of 100 pci. Prior to slab construction, the subgrades should be recompacted to densify soils that may become disturbed or loosened during construction activities. The design subgrade modulus is based on a recompacted subgrade such that non-yielding conditions are developed. Areas which do not proof-roll or recompact satisfactorily should be undercut and replaced with compacted breaker rock or granular fill. To serve as a capillary break, the final 4 in. of soil placed below the slabs should consist of imported well-graded sand or gravel with no more than 5 percent by weight passing a No. 200 U.S. standard sieve. (Note that some structural engineers require a 4 to 6 in. layer of dense-graded base course immediately below the floor slab, in lieu of the capillary break, to improve the subgrade modulus.) To further minimize the potential for moisture migration, a plastic vapor barrier could also be utilized. Fill placed below the floor slabs should be placed as described in the Site Preparation section of this report. The slabs should be structurally separate from the foundations and have construction joints and wire mesh for crack control.

A number of the preceding recommendations would not apply if the building, or a portion of it, is designed as a watertight structure. We can provide modified recommendations if appropriate.

5. Below-Grade Walls

We anticipate that below-grade walls will be laterally restrained by the floor slab and ground level framing. Therefore, *at-rest* lateral earth pressures should be used during design. To minimize the development of such pressures, granular backfill should be placed within 4 to 6 ft of the walls. Unless the structure is designed to be water-tight, we recommend that perimeter drainage systems be installed to intercept potential surface water infiltration and that the granular backfill placed behind the walls be continuously connected to this system. The perimeter drainage system should be sloped to drain to a sump pit. To impede the inflow of surface moisture, the final 2 ft of backfill placed along the below-grade walls should consist of a clayey fill cap or other semi-impermeable material such as asphaltic or concrete pavement. The clay cap or pavement should be graded in a manner which promotes positive drainage away from the walls. Recommended perimeter drain details are attached to this report in Appendix E.

Before placing the wall backfill, the exterior walls should be damp-proofed with a spray-applied or mopped-on rubber or bituminous sealer. Note that the on-site silt soils would not be suitable as "free-draining" backfill, but could be used if a three-dimensional drainage composite layer is installed on the walls. Compaction of the backfill within 3 to 5 ft of the walls should be performed with lightweight compaction equipment. The granular backfill should be compacted to a minimum of 90% compaction based on modified Proctor (ASTM D1557) methods following Appendix D guidelines.

Walls constructed in accordance with the above recommendations may be designed for an *at-rest* equivalent fluid pressure of 55 psf per foot of depth. An equivalent fluid pressure of 200 psf per foot of depth can be used for calculating passive resistance. This value includes a factor of safety of 2.0 to reduce lateral deflection. The below-grade wall design should also take into account surcharge effects which could be applied during or after construction. Exterior retaining walls (if any) which are free to rotate slightly will be subjected to *active* lateral earth pressures and may be designed for an *active* equivalent fluid pressure of 35 psf per foot of depth.

CONSTRUCTION CONSIDERATIONS

Due to variations in weather, construction methods and other factors, specific construction problems are difficult to predict. Soil related difficulties which could be encountered on the site are discussed below:

Due to the potentially sensitive nature of the on-site soils, we recommend that final site grading activities be completed during dry weather, if possible. Construction traffic should be avoided on prepared subgrades to minimize potential disturbance.

- Contingencies in the project budget for subgrade stabilization with breaker run stone in footing and floor slab areas should be increased if the project schedule requires that work proceed during adverse weather conditions.

- Earthwork construction during the early spring or late fall could be complicated as a result of wet weather and freezing temperatures. During cold weather, exposed subgrades should be protected from freezing before and after footing construction. Fill should never be placed while frozen or on frozen ground.

- Excavations extending greater than 4 ft in depth below the existing ground surface should be sloped or braced in accordance with current OSHA standards. Siltier sand layers are likely to be categorized as OSHA Type B soils (1H:1V slopes), while sands with less silt may fall in the Type C category (1.5H:1V). The excavation side slopes should be determined by a "competent person" during excavation. If temporary earth retention is required, this system should be designed by a registered professional engineer.

- Based on observations made during the field exploration, groundwater infiltration into footing excavations is not expected to be a problem. However, water accumulating at the base of excavations as a result of precipitation or seepage should be controlled and quickly removed using pumps operating from filtered sump pits.

- When excavating adjacent to the existing reservoir, take care to avoid undermining its base slab.

RECOMMENDED CONSTRUCTION MONITORING

The quality of the foundation and floor slab subgrades will be largely determined by the level of care exercised during site development. To check that earthwork and foundation construction proceeds in accordance with our recommendations, the following operations should be monitored by CGC:

- Topsoil stripping/subgrade proof-rolling within the construction areas;
- Fill/backfill placement and compaction;
- Foundation excavation/subgrade preparation; and
- Concrete placement.

* * * * *

It has been a pleasure to serve you on this project. If you have any questions or need additional consultation, please contact us.

Sincerely,

CGC, Inc.

William W. Wuellner, P.E.
Senior Geotechnical Engineer

David A. Staab/www

David A. Staab, P.E., LEED AP
Consulting Professional

Encl: Appendix A - Field Exploration
Appendix B - Soil Boring Location Plan
Logs of Test Boring (1)
Log of Test Boring-General Notes
Unified Soil Classification System
Particle Size Distribution Test Reports
Appendix C - Document Qualifications
Appendix D - Recommended Compacted Fill Specifications
Appendix E - Perimeter Drain Details

cc: Adam Wiederholt, Madison Water Utility (via email)
Scott Herkert and Andy Mullendore, Strand Associates (via email)

APPENDIX A

FIELD EXPLORATION

APPENDIX A

FIELD EXPLORATION

Subsurface conditions on site were explored by drilling one Standard Penetration Test (SPT) soil boring to a depth of 40 ft below existing site grades. The location was selected by CGC and adjusted by the drillers due to safety concerns related to the snow and ice-covered slope. The boring was drilled on January 16, 2013 by Badger State Drilling (under subcontract to CGC) using a balloon-tired ATV rotary drill rig equipped with hollow-stem augers and an automatic SPT hammer. The boring location is shown in plan on the Soil Boring Location Map attached in Appendix B. The ground surface elevation at the boring location was interpolated from the topographic map provided to us and is referenced to USGS datum (subtract 845.6 ft to convert to MCD). The borehole was found to have no water and was therefore backfilled upon completion.

In each boring, soil samples were obtained at 2.5 foot intervals to a depth of 10 ft and at 5 ft intervals thereafter. The soil samples were obtained in general accordance with specifications for standard penetration testing, ASTM D 1586. The specific procedures used for drilling and sampling are described below.

1. Boring Procedures between Samples

   The boring is extended downward, between samples, by a hollow-stem auger.

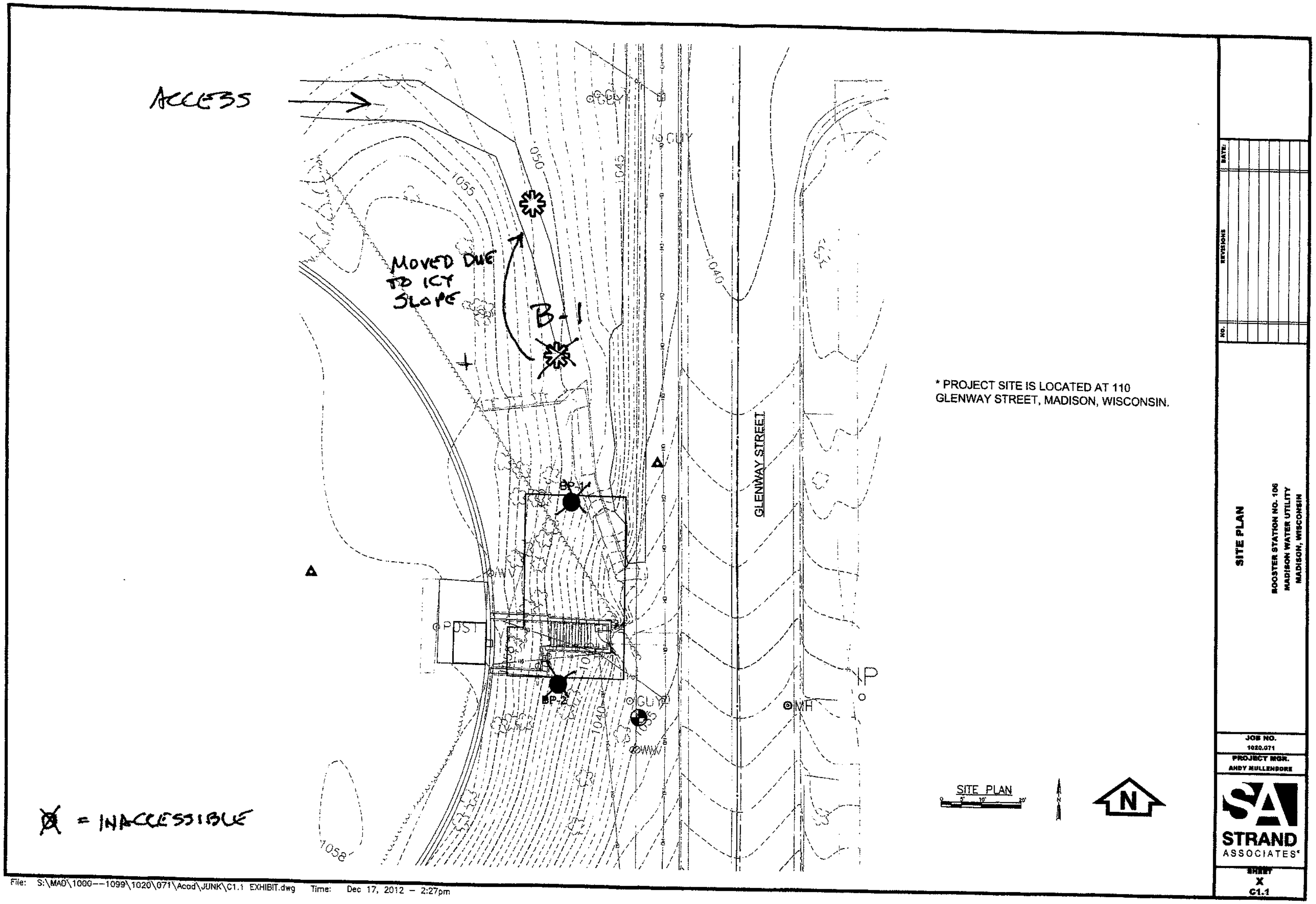
2. Standard Penetration Test and Split-Barrel Sampling of Soils
   (ASTM Designation: D 1586)

   This method consists of driving a 2-inch outside diameter split-barrel sampler using a 140-pound weight falling freely through a distance of 30 inches. The sampler is first seated 6 inches into the material to be sampled and then driven 12 inches. The number of blows required to drive the sampler the final 12 inches is recorded on the log of borings and is known as the Standard Penetration Resistance.

During the field exploration, the driller visually classified the soil and prepared a field log. Upon completion of drilling, the borings were backfilled with bentonite (where required) to satisfy WDNR regulations and the soil samples were delivered to our laboratory for visual classification and laboratory testing. The samples were screened for volatile organics with a photoionization detector (PID meter) by IverTech personnel under subcontract to CGC. Screening results are indicated on the far right column of the boring log. Water level observations were made in each boring during and after drilling and are shown at the bottom of each boring log. The soils were then visually classified by a geotechnical engineer using the Unified Soil Classification System. The final logs prepared by the engineer and a description of the Unified Soil Classification System are presented in Appendix B.

APPENDIX B

SOIL BORING LOCATION MAP
LOG OF TEST BORINGS (1)
LOG OF TEST BORING - GENERAL NOTES
UNIFIED SOIL CLASSIFICATION SYSTEM
PARTICLE SIZE DISTRIBUTION TEST REPORTS (2)



File: S:\MAD\1000--1099\1020\071\Acad\JUNK\C1.1 EXHIBIT.dwg Time: Dec 17, 2012 - 2:27pm

Legend

⊕ Denotes Soil Boring Location and Number

Scale: As Shown

Notes
1. Base map provided by Strand Associates.
2. Soil boring performed by Badger State Drilling in January, 2013.
3. Boring location is approximate.

Date: 1/24/13

Job No. C13017

CGC, Inc.

SOIL BORING LOCATION MAP
Booster Pump Station 106
110 Glenway Street
Madison, Wisconsin

CGC Inc.

LOG OF TEST BORING

Project: Booster Pump Station 106
110 Glenway Street
Location: Madison, Wisconsin

Boring No. 1
Surface Elevation (ft) 1052.0
Job No. C13017
Sheet 1 of 1

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE / VISUAL CLASSIFICATION and Remarks / SOIL PROPERTIES

No.	Type	Rec (in.)	Moist	N	Depth (ft)	Visual Classification and Remarks	qu (qa) (tsf)	W	LL	PL	LI
						12 in. Dark Brown Clayey/Silty TOPSOIL FILL (OL)					
1		18	M	11							0
						FILL: Medium Dense, Reddish Brown Fine Sand, Some Silt, Little Gravel, Scattered Clay Pockets (SM)					
2		18	M	13	5						1
3		16	M	10		Medium Dense to Dense, Tan SILT, Little Sand, Occasional Fine Sand Seams/Lenses (ML)					0
4		18	M	22	10						2
5		18	M	28	15	Increasing Sand Content with Depth					1
6		18	M	36	20						0
7		18	M	34	25						1
8		18	M	20	30						0
9		18	M	25	35	Very Stiff, Light Brown/Gray Lean CLAY (CL)	(2.5-3.5)				0
10		18	M	20	40		(2.5-3.25)				0
					45	End of Boring at 40 ft Backfilled with Bentonite Chips					

WATER LEVEL OBSERVATIONS

While Drilling ∇ NW   Upon Completion of Drilling NW
Time After Drilling
Depth to Water ▼
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 1/16/13 End 1/16/13
Driller BSD Chief KD Rig CME-750
Logger GM Editor AJB
Drill Method 2.25" HSA; Autohammer

CGC, Inc.

LOG OF TEST BORING

General Notes

DESCRIPTIVE SOIL CLASSIFICATION

Grain Size Terminology

Soil Fraction	Particle Size	U.S. Standard Sieve Size
Boulders	Larger than 12"	Larger than 12"
Cobbles	3" to 12"	3" to 12"
Gravel: Coarse	¾" to 3"	¾" to 3"
Fine	4.76 mm to ¾"	#4 to ¾"
Sand: Coarse	2.00 mm to 4.76 mm	#10 to #4
Medium	0.42 to mm to 2.00 mm	#40 to #10
Fine	0.074 mm to 0.42 mm	#200 to #40
Silt	0.005 mm to 0.074 mm	Smaller than #200
Clay	Smaller than 0.005 mm	Smaller than #200

Plasticity characteristics differentiate between silt and clay.

General Terminology

Physical Characteristics
Color, moisture, grain shape, fineness, etc.
Major Constituents
Clay, silt, sand, gravel
Structure
Laminated, varved, fibrous, stratified, cemented, fissured, etc.
Geologic Origin
Glacial, alluvial, eolian, residual, etc.

Relative Density

Term	"N" Value
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	Over 50

Relative Proportions Of Cohesionless Soils

Proportional Term	Defining Range by Percentage of Weight
Trace	0% - 5%
Little	5% - 12%
Some	12% - 35%
And	35% - 50%

Consistency

Term	q_u-tons/sq. ft
Very Soft	0.0 to 0.25
Soft	0.25 to 0.50
Medium	0.50 to 1.0
Stiff	1.0 to 2.0
Very Stiff	2.0 to 4.0
Hard	Over 4.0

Organic Content by Combustion Method

Soil Description	Loss on Ignition
Non Organic	Less than 4%
Organic Silt/Clay	4 – 12%
Sedimentary Peat	12% - 50%
Fibrous and Woody Peat	More than 50%

Plasticity

Term	Plastic Index
None to Slight	0 - 4
Slight	5 - 7
Medium	8 - 22
High to Very High	Over 22

The penetration resistance, N, is the summation of the number of blows required to effect two successive 6" penetrations of the 2" split-barrel sampler. The sampler is driven with a 140 lb. weight falling 30" and is seated to a depth of 6" before commencing the standard penetration test.

SYMBOLS

Drilling and Sampling

CS – Continuous Sampling
RC – Rock Coring: Size AW, BW, NW, 2"W
RQD – Rock Quality Designation
RB – Rock Bit/Roller Bit
FT – Fish Tail
DC – Drove Casing
C – Casing: Size 2 ½", NW, 4", HW
CW – Clear Water
DM – Drilling Mud
HSA – Hollow Stem Auger
FA – Flight Auger
HA – Hand Auger
COA – Clean-Out Auger
SS - 2" Dia. Split-Barrel Sample
2ST – 2" Dia. Thin-Walled Tube Sample
3ST – 3" Dia. Thin-Walled Tube Sample
PT – 3" Dia. Piston Tube Sample
AS – Auger Sample
WS – Wash Sample
PTS – Peat Sample
PS – Pitcher Sample
NR – No Recovery
S – Sounding
PMT – Borehole Pressuremeter Test
VS – Vane Shear Test
WPT – Water Pressure Test

Laboratory Tests

q_a – Penetrometer Reading, tons/sq ft
q_a – Unconfined Strength, tons/sq ft
W – Moisture Content, %
LL – Liquid Limit, %
PL – Plastic Limit, %
SL – Shrinkage Limit, %
LI – Loss on Ignition
D – Dry Unit Weight, lbs/cu ft
pH – Measure of Soil Alkalinity or Acidity
FS – Free Swell, %

Water Level Measurement

▽ - Water Level at Time Shown
NW – No Water Encountered
WD – While Drilling
BCR – Before Casing Removal
ACR – After Casing Removal
CW – Cave and Wet
CM – Caved and Moist

Note: Water level measurements shown on the boring logs represent conditions at the time indicated and may not reflect static levels, especially in cohesive soils.

CGC, Inc.

Madison - Milwaukee

UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS
(more than 50% of material is larger than No. 200 sieve size.)

	Clean Gravels (Less than 5% fines)	
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
	GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)	
	GM	Silty gravels, gravel-sand-silt mixtures
	GC	Clayey gravels, gravel-sand-clay mixtures
	Clean Sands (Less than 5% fines)	
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	SW	Well-graded sands, gravelly sands, little or no fines
	SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	
	SM	Silty sands, sand-silt mixtures
	SC	Clayey sands, sand-clay mixtures

FINE-GRAINED SOILS
(50% or more of material is smaller than No. 200 sieve size.)

SILTS AND CLAYS Liquid limit less than 50%	ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
	OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
	CH	Inorganic clays of high plasticity, fat clays
	OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS	PT	Peat and other highly organic soils

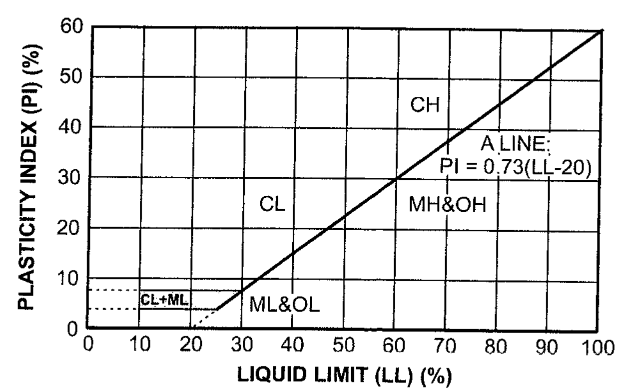
LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for GW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
SC	Atterberg limits above "A" line with P.I. greater than 7	

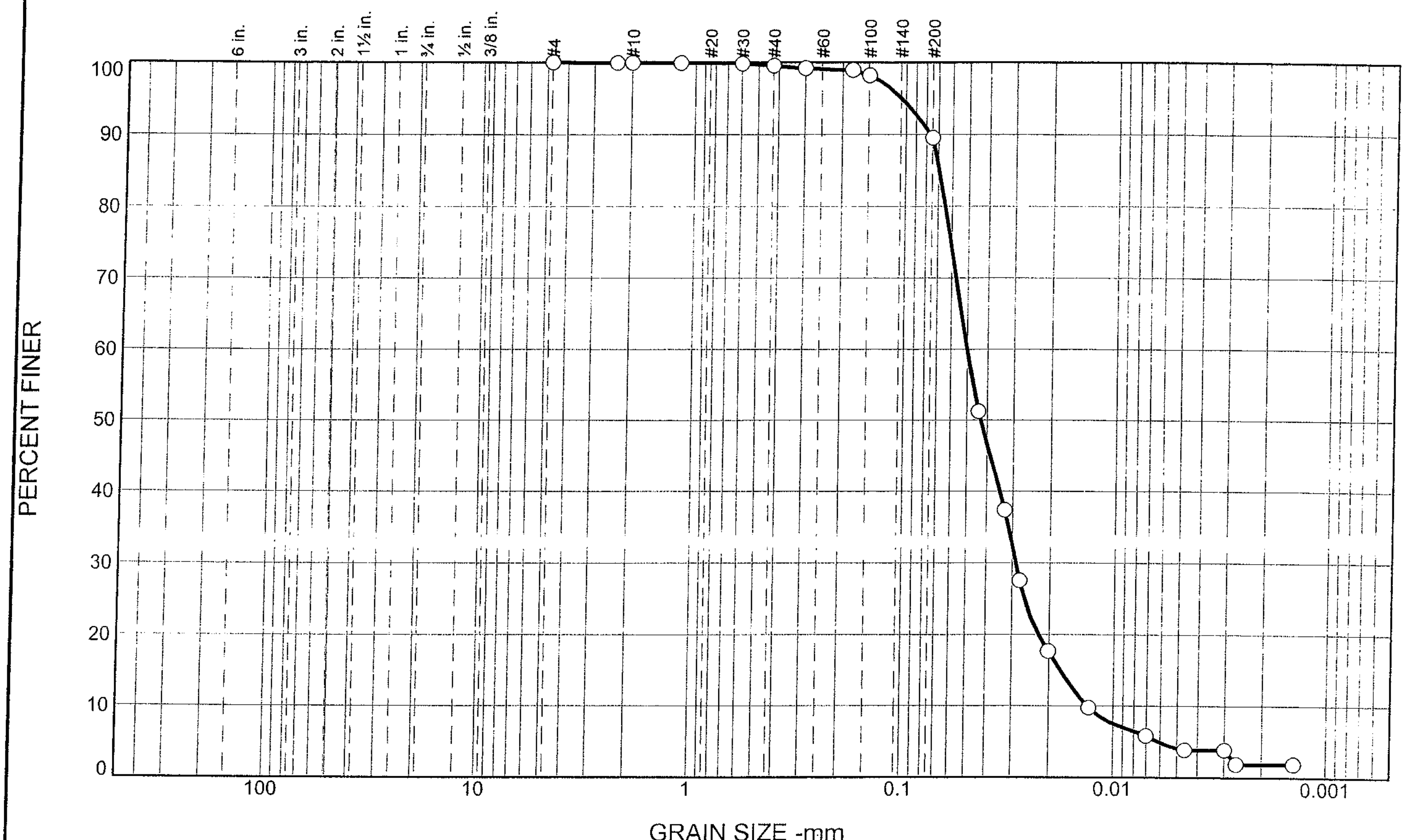
Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent .... GW, GP, SW, SP
More than 12 percent .... GM, GC, SM, SC
5 to 12 percent .... Borderline cases requiring dual symbols

PLASTICITY CHART



Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.5	10.0	85.4	4.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#8	100.0		
#10	100.0		
#16	99.9		
#30	99.8		
#40	99.5		
#50	99.2		
#80	98.9		
#100	98.2		
#200	89.5		

* (no specification provided)

Material Description

Light Brown Silt, Little Sand, Trace Clay

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.0770 D_{85}= 0.0696 D_{60}= 0.0502
D_{50}= 0.0430 D_{30}= 0.0289 D_{15}= 0.0177
D_{10}= 0.0133 C_u= 3.78 C_c= 1.25

Classification

USCS= ML AASHTO=

Remarks

Natural Moisture = 8.7%

Sample Number: B1 S3

Date: 1/30/13

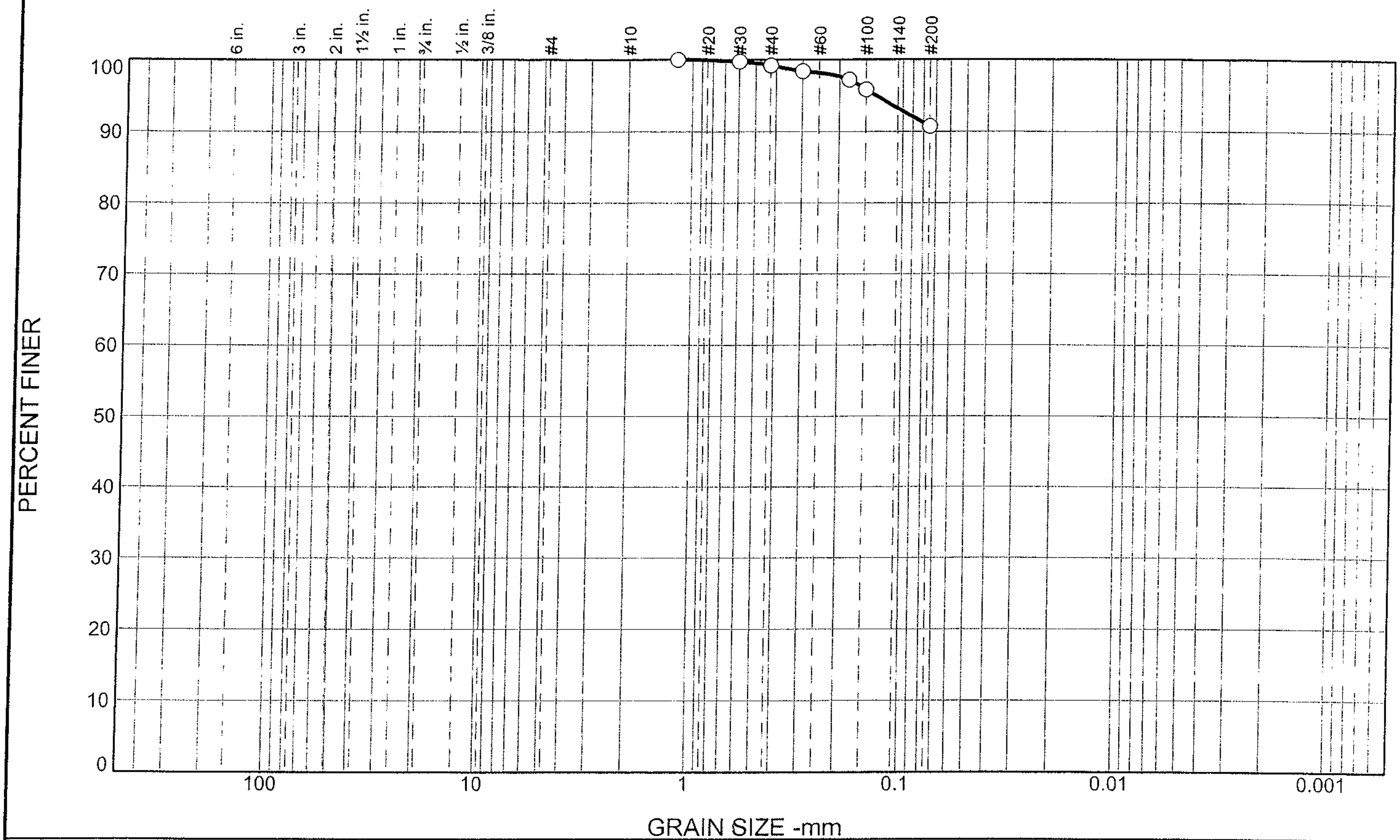
CGC, Inc.

Client: Madison Water Utility
Project: Booster Pump Station 106

Project No: C13017 **Figure**

Tested By: KJS **Checked By:** DAS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.8	8.5	90.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#16	100.0		
#30	99.7		
#40	99.2		
#50	98.4		
#80	97.2		
#100	95.9		
#200	90.7		

* (no specification provided)

Material Description

Light Brown Silt, Little Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO=

Remarks

Natural Moisture = 7.9%

Sample Number: B1 S6

Date: 1/30/13

CGC, Inc.

Client: Madison Water Utility
Project: Booster Pump Station 106

Project No: C13017 **Figure**

Tested By: KJS **Checked By:** DAS

APPENDIX C

DOCUMENT QUALIFICATIONS

APPENDIX C
DOCUMENT QUALIFICATIONS

I. GENERAL RECOMMENDATIONS/LIMITATIONS

CGC, Inc. should be provided the opportunity for a general review of the final design and specifications to confirm that earthwork and foundation requirements have been properly interpreted in the design and specifications. CGC should be retained to provide soil engineering services during excavation and subgrade preparation. This will allow us to observe that construction proceeds in compliance with the design concepts, specifications and recommendations, and also will allow design changes to be made in the event that subsurface conditions differ from those anticipated prior to the start of construction. CGC does not assume responsibility for compliance with the recommendations in this report unless we are retained to provide construction testing and observation services.

This report has been prepared in accordance with generally accepted soil and foundation engineering practices and no other warranties are expressed or implied. The opinions and recommendations submitted in this report are based on interpretation of the subsurface information revealed by the test borings indicated on the location plan. The report does not reflect potential variations in subsurface conditions between or beyond these borings. Therefore, variations in soil conditions can be expected between the boring locations and fluctuations of groundwater levels may occur with time. The nature and extent of the variations may not become evident until construction.

II. IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. *No one except you* should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one - not even you* - should apply the report for any purpose or project except the one originally contemplated.

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, *do not rely on a geotechnical engineering report* that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or project ownership.

As a general rule, , *always* inform your geotechnical engineer of project changes - even minor ones - and request an assessment of their impact. *CGC cannot accept responsibility or liability for problems that occur because our reports do not consider developments of which we were not Informed.*

SUBSURFACE CONDITIONS CAN CHANGE

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

MOST GEOTECHNICAL FINDINGS ARE PROFESSIONAL OPINION

Site exploration identifies subsurface conditions only at those points where surface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgement to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ - sometimes significantly - from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A REPORT'S RECOMMENDATIONS ARE NOT FINAL

Do not over-rely on the construction recommendations included in your report. *Those recommendations are not final*, because geotechnical engineers develop them principally from judgement and opinion, geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *CGC cannot assume responsibility or liability for the report's recommendations if we do not perform construction observation.*

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having CGC participate in prebid and preconstruction conferences, and by providing construction observation.

DO NOT REDRAW THE ENGINEER'S LOGS

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

GIVE CONTRACTORS A COMPLETE REPORT AND GUIDANCE

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

READ RESPONSIBILITY PROVISIONS CLOSELY

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce such risks, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineer's responsibilities begin and end, to help others recognize their own responsibilities and risks. Read these provisions closely. Ask questions. Your geotechnical engineer should respond fully and frankly.

GEOENVIRONMENTAL CONCERNS ARE NOT COVERED

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

OBTAIN PROFESSIONAL ASSISTANCE TO DEAL WITH MOLD

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

RELY ON YOUR GEOTECHNICAL ENGINEER FOR ADDITIONAL ASSISTANCE

Membership in ASFE exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with CGC, a member of ASFE, for more information.

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ASFE/The Best People on Earth
881 Colesville Road, Suite G 106
Silver Spring, MD 20910

APPENDIX D

RECOMMENDED COMPACTED FILL SPECIFICATIONS

APPENDIX D

CGC, INC.

RECOMMENDED COMPACTED FILL SPECIFICATIONS

General Fill Materials

Proposed fill shall contain no vegetation, roots, topsoil, peat, ash, wood or any other non-soil material which by decomposition might cause settlement. Also, fill shall never be placed while frozen or on frozen surfaces. Rock, stone or broken concrete greater than 6 in. in the largest dimension shall not be placed within 10 ft of the building area. Fill used greater than 10 ft beyond the building limits shall not contain rock, boulders or concrete pieces greater than a 2 sq ft area and shall not be placed within the final 2 ft of finish subgrade or in designated utility construction areas. Fill containing rock, boulders or concrete pieces should include sufficient finer material to fill voids among the larger fragments.

Special Fill Materials

In certain cases, special fill materials may be required for specific purposes, such as stabilizing subgrades, backfilling undercut excavations or filling behind retaining walls. For reference, WisDOT gradation specifications for various types of granular fill are attached in Table 1.

Placement Method

The approved fill shall be placed, spread and leveled in layers generally not exceeding 10 in. in thickness before compaction. The fill shall be placed at a moisture content capable of achieving the desired compaction level. For clay soils or granular soils containing an appreciable amount of cohesive fines, moisture conditioning will likely be required.

It is the Contractor's responsibility to provide all necessary compaction equipment and other grading equipment that may be required to attain the specified compaction. Hand-guided vibratory or tamping compactors will be required whenever fill is placed adjacent to walls, footings, columns or in confined areas.

Compaction Specifications

Maximum dry density and optimum moisture content of the fill soil shall be determined in accordance with modified Proctor methods (ASTM D1557). The recommended field compaction as a percentage of the maximum dry density is shown in Table 2. Note that these compaction guidelines would generally not apply to coarse gravel/stone fill. Instead, a method specification would apply (e.g., compact in thin lifts with a vibratory compactor until no further consolidation is evident).

Testing Procedures

Representative samples of proposed fill shall be submitted to CGC, Inc. for optimum moisture-maximum density determination (ASTM D1557) prior to the start of fill placement. The sample size should be approximately 50 lb.

CGC, Inc. shall be retained to perform field density tests to determine the level of compaction being achieved in the fill. The tests shall generally be conducted on each lift at the beginning of fill placement and at a frequency mutually agreed upon by the project team for the remainder of the project.

Table 1
Gradation of Special Fill Materials

Material	WisDOT Section 311	WisDOT Section 312	WisDOT Section 305			WisDOT Section 209		WisDOT Section 210
	Breaker Run	Select Crushed Material	3-in. Dense Graded Base	1 1/4-in. Dense Graded Base	3/4-in. Dense Graded Base	Grade 1 Granular Backfill	Grade 2 Granular Backfill	Structure Backfill
Sieve Size	Percent Passing by Weight							
6 in.	100							
5 in.		90-100						
3 in.			90-100					100
1 1/2 in.		20-50	60-85					
1 1/4 in.				95-100				
1 in.					100			
3/4 in.			40-65	70-93	95-100			
3/8 in.				42-80	50-90			
No. 4			15-40	25-63	35-70	100 (2)	100 (2)	25-100
No. 10		0-10	10-30	16-48	15-55	75 (2)		
No. 40			5-20	8-28	10-35	15 (2)	30 (2)	
No. 200			2-12	2-12	5-15	8 (2)	15 (2)	15 (2)

Notes:
1. Reference: Wisconsin Department of Transportation *Standard Specifications for Highway and Structure Construction.*
2. Percentage applies to the material passing the No. 4 sieve, not the entire sample.
3. Per WisDOT specifications, both breaker run and select crushed material can include concrete that is 'substantially free of steel, building materials and other deleterious material'.

Table 2
Compaction Guidelines

Area	Percent Compaction (1)	
	Clay/Silt	Sand/Gravel
Within 10 ft of building lines		
Footing bearing soils	93 - 95	95
Under floors, steps and walks		
- Lightly loaded floor slab	90	90
- Heavily loaded floor slab and thicker fill zones	92	95
Beyond 10 ft of building lines		
Under walks and pavements		
- Less than 2 ft below subgrade	92	95
- Greater than 2 ft below subgrade	90	90
Landscaping	85	90

Notes:
1. Based on Modified Proctor Dry Density (ASTM D 1557)

APPENDIX E

TYPICAL PERIMETER DRAIN DETAILS

General Notes

1. This system's primary function is to intercept infiltrating surface water. These Alternates are not appropriate for use in situations of high groundwater (i.e., cases where the water table approaches floor slab elevation).

2. Grade surface cap to slope away from structure.

3. Exterior surface of walls below grade should be damp-proofed.

4. A plastic vapor barrier should be installed below the slab.

5. Recommended types of drain pipes:

Specification	Description
ASTM D2729	Polyvinyl Chloride (PVC) Drain Pipe
ASTM F405	Corrugated Polyethylene Drain Pipe
ASTM D2852	Styrene-Rubber Plastic Drain Pipe
AASHTO M136	Corrugated Metal Underdrain Pipe

6. Minimum slope of drain pipes should be 2 in. per 100 lin ft.

7. Place drain pipe below basement floor level and orient the perforations toward the bottom.

8. Clean-outs should be provided to service the pipe.

9. Collected field water should be discharged to a sump, storm sewer or drainage field.

10. The geotextile for Alternative Nos. 2 and 3 may be eliminated if filter requirements are satisfied between the wall and pipe backfill, as well as between backfill materials and natural soils.

11. Pipe backfill materials should satisfy filter requirements for the slot width or hole diameter of the perforated pipe.

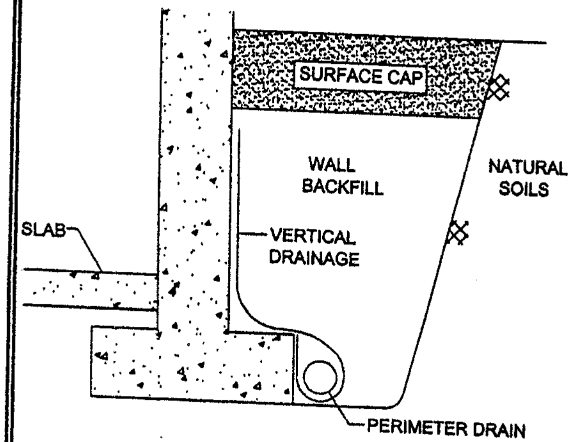
12. Care should be taken during backfilling not to damage the integrity of the system. For compaction requirements, refer to geotechnical report.

13. Pipe, geotextile, and geocomposite should be installed according to manufacturer specifications.

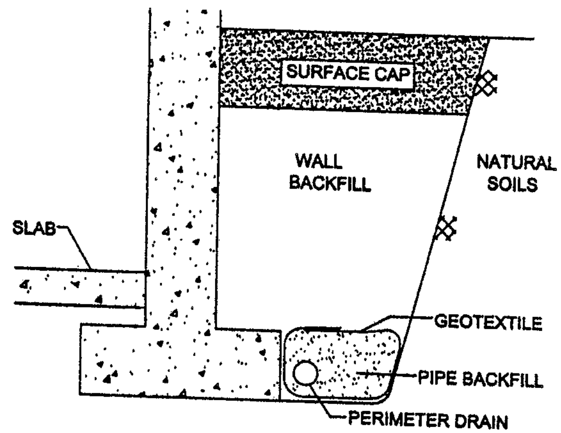
CGC, Inc.

Typical Perimeter Drain Detail

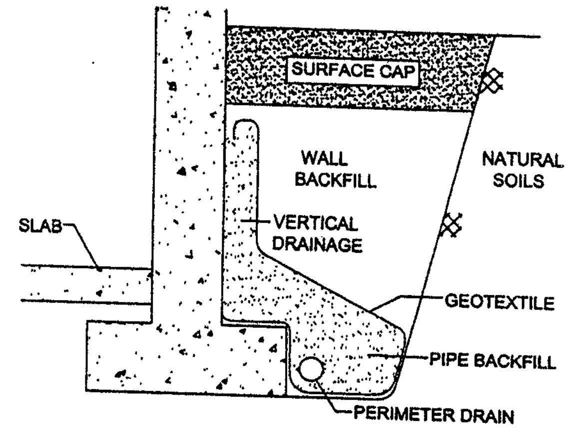
General Notes



ALTERNATE NO. 1



ALTERNATE NO. 2



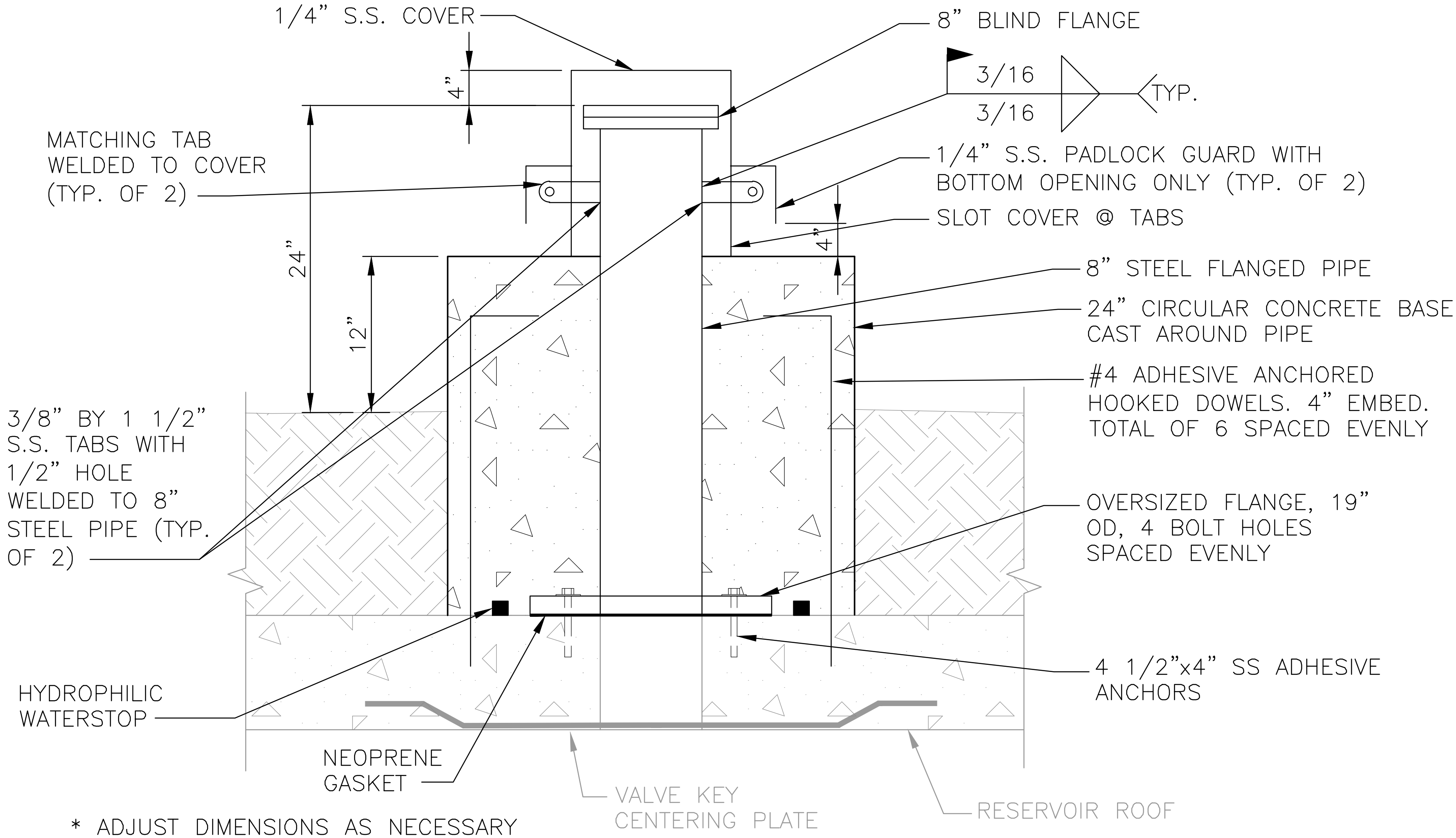
ALTERNATE NO. 3

DRAINAGE SYSTEM COMPONENTS

Component	Alternate No. 1	Alternate No. 2	Alternate No. 3
Surface Cap	1 to 2 ft. of clayey soils. Minimum 1 ft. thick if overlain by pavement	Refer to Alternate No. 1	Refer to Alternate No. 1
Vertical Drainage	3-dimesional drainage geocomposite hydraulically connected to perimeter drain.	Relatively Free-draining granular soils with P200 (% fines) $\leq$12%.	MinImum 6-in. wide zone of free-draining granualr soils with P200 $\leq$5% hydraulically connected to perimeter drain. Provide geotextile as required (see note 10).
Perimeter Drain	Perforated pipe encapsulated in geocomposite.	Perforated pipe surrounded by free-draining granular pipe backfill with P200$\leq$5%. Provide geotextile as required (See Note 10).	Refer to Alternate No. 2
Wall Backfill	Excavation spoils or imported materials (granular soils preferred).	Relatively Free-draining granular soils with P200$\leq$12%.	Refer to Alternate No. 1

CGC, Inc.

Typical Perimeter Drain Detail



* ADJUST DIMENSIONS AS NECESSARY FOR EYEBOLTS PROVIDED.

VALVE ACCESS DETAIL

BOOSTER PUMPING STATION 106 RECONSTRUCTION
110 GLENWAY STREET
MADISON WATER UTILITY
MADISON, WISCONSIN

Madison Water Utility
Quality and Reliability since 1882

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