

REQUEST FOR QUALIFICATIONS

MICHIGAN DEPARTMENT OF TRANSPORTATION

Grand Region

Design-Build Project

M-20 at Schrader Creek

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Control Section: 54022

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1.0 INTRODUCTION

The Michigan Department of Transportation (MDOT), Grand Region, is requesting Statements of Qualifications (“SOQs”) from entities (“Submitters”) interested in submitting proposals for a road reconstruction and two new bridges on M-20 at Schrader Creek (the “Project”). The Project will be funded with state and federal-aid dollars thereby requiring the Submitters adhere to all pertinent federal, state and local requirements.

1.1 Procurement Process

MDOT will use a two-phase procurement process to select a Design-Build contractor to deliver the Project. This Request for Qualifications (RFQ) is issued as part of the first phase to solicit information, in the form of SOQ’s, that MDOT will evaluate to determine which Submitters are the most highly qualified to successfully deliver the Project. MDOT intends to short-list three, but may short-list up to five, Submitters that submit SOQ’s. In the event that there are less than three Submitters, MDOT may cancel or re-advertise the Project.

In the second phase, MDOT will issue a Request for Proposals (RFP) for the Project to the short-listed Submitters. Only the short-listed Submitters will be eligible to submit technical and price proposals in response to the RFP for the Project. Each short-listed Submitter that submits a proposal in response to the RFP (if any) is referred to herein as a “Proposer.” MDOT will award a contract for the Project, if any, to the Proposer offering the low bid with lane rental, to be determined as described in the RFP.

1.2 Project Goals

The Purpose of this Project is to replace M-20 over Schrader Creek and the south branch of Schrader Creek with two bridges (see Attachment A for project location). Poor soils and minimal allowable wetland impact at the crossings require that the bridges each be approximately 500 feet long. The new bridges will be constructed with 2 feet clear distance from the bottom of the lowest beam to the 100-year floodplain. Design and construction of deep foundations will be impacted by artesian aquifers. Approximately 1300 feet of roadway adjacent to the bridges will be reconstructed to improve vertical alignments. MDOT anticipates that work will be required outside of the regular seasonal limitations specified in the 2003 Standard Specifications for Construction.

M-20 traffic will be detoured during construction of the proposed improvements.

The following goals have been established for the Project:

- a) Safety
 - Provide a safe Project area for the traveling public and workers during execution of the Project
 - Provide a solution consistent with current MDOT, FHWA, and AASHTO practices, guidelines, policies, and standards.
- b) Quality - Provide a high quality product that fits the geology and minimizes future maintenance

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- c) Environmental
 - Limit permanent impacts to wetlands to less than 1/3 acre
 - Minimize temporary impacts to wetlands
 - Restore temporarily impacted wetlands to as good or better than current condition
 - Design and construction must be performed such that the already obtained MDEQ permit can be modified and approved
- d) Mobility - Minimize duration of M-20 closure
- e) Budget - Complete the project within MDOT's established budget
- f) Meet project schedule

1.3 Submitter Information

To allow receipt of any addenda or other information regarding this RFQ, each Submitter is solely responsible for ensuring that MDOT's Project Manager as described in Section 2.3 has its contact person name and e-mail address.

If an entity intends to submit an SOQ as part of a team, the entire team is required to submit a single SOQ as a single Submitter.

General information on MDOT's Design Build program and information regarding this RFQ can be found at the following website: www.michigan.gov/designbuild.

2.0 BACKGROUND INFORMATION; RFQ PROCESS

2.1 Project Description; Scope of Work

The Project is located in Morton Township, Mecosta County on M-20 at Schrader Creek. The Project replaces M-20 over Schrader Creek and the South Branch of Schrader Creek with two bridges. Poor soils and minimal allowable wetland impact at the crossings require that the bridges each be approximately 500 feet long. The new bridges will be constructed with 2 feet clear distance from the bottom of the lowest beam to the 100-year floodplain. Design and construction of deep foundations will be impacted by artesian aquifers. Approximately 1300 feet of roadway adjacent to the bridges will be reconstructed to improve vertical alignments. The aforementioned poor soils and environmental goals must be considered when planning construction methods. Proposed laneage shall match existing.

Project information and data is included in attachments as follows:

- Attachment A – Location Map
- Attachment B – Plan View of M-20 at Schrader Creek and South Branch of Schrader Creek
- Attachment C – Soil Boring Data
- Attachment D – Monitoring Well Data
- Attachment E – Informational and/or Interpretative Engineering Data

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- Attachment F – Preliminary RID
- Attachment G – Form 5100H

The current anticipated design build cost of the Project is estimated to be \$7,700,000. The RFP will establish the project schedule including open to traffic and completion dates.

2.2 Project Schedule

The deadline for submitting RFQ questions and the SOQ due date stated below apply to this RFQ. MDOT also anticipates the following additional Project milestone dates. This schedule is subject to revision by addenda to this RFQ or the RFP requirements.

Phase 1 – Request for Qualifications

Issue RFQ	July 20, 2011
Deadline for submitting RFQ questions	Aug 10, 2011; 4 PM EST
SOQ due date	Aug 17, 2011; 1 PM EST
Evaluation of SOQs	Aug 17 to Aug 31
Anticipated Notification of short-listed Submitters (Proposers)	Aug 31, 2011

Phase 2 – Request for Proposals – **Tentative Schedule (subject to change)**

Issue RFP	Aug 31, 2011
Technical and Price Proposals due	Oct 25 and 26, 2011
Proposer with Low Bid with Lane Rental Announced	Oct 26, 2011
Contract Award	Nov, 2011

2.3 Inquiries and General Information

All questions regarding the Project must be submitted by e-mail to the MDOT Project Manager listed below. Questions shall be received by 4:00 p.m. EST on the date indicated in Section 2.2. All such questions and their answers will be placed on the MDOT website as soon as possible after receipt of the questions. The names of the entity submitting questions will not be disclosed. **The employees and representatives of the Submitter may not contact any MDOT staff (including members of the selection team) other than the MDOT Project Manager, or their designee, to obtain information on the Project. Such contact may result in disqualification.**

Project Manager
Charlie Stein, P.E.
Michigan Department of Transportation, Muskegon TSC
E-mail:steinc@michigan.gov

1. Addenda to the RFQ

If it becomes necessary to revise any part of the RFQ, addenda will be posted on the MDOT

website.

2. News Releases

Any news releases pertaining to this RFQ or the services, study, data or project to which it relates will not be made without prior written MDOT approval, and then only in accordance with the explicit written instructions from MDOT. MDOT reserves the right to revise this RFQ at any time before the SOQ due date. Such revisions, if any, will be announced by addenda to this RFQ.

3. Disclosure

Except as otherwise stated, all information in a Submitter's SOQ and any contract resulting from this RFQ are subject to disclosure under the provisions of the "Freedom of Information Act," 1976 Public Act No. 442, as amended, MCL 15.231, et seq.

2.4 Prequalification

The Submitter and their subcontractors must meet the following prequalification requirements:

Design-Builder Prequalification Requirements

- 7500 Fa

Lead Engineering Design Firms Prequalification Requirements

- Geotechnical Engineering Services
- Short and Medium Span Bridges
- Hydraulics
- Road Rehabilitation and Rural Freeways
- Maintaining Traffic Plans and Provisions

Additional design prequalifications will be listed in the Project's Request for Proposal.

2.5 Major Participants

As used herein, the term "Major Participant" means any of the following entities: all general partners or joint venture members of the Submitter; all individuals, persons, proprietorships, partnerships, limited liability partnerships, corporations, professional corporations, limited liability companies, business associations, or other legal entity however organized, holding (directly or indirectly) a 20% or greater interest in the Submitter; any subcontractor(s) that will perform work valued at 20% or more of the overall contract amount; the lead engineering/design firm(s); and each engineering/design sub-consultant that will perform 20% or more of the design work.

2.6 MDOT Consultant/Technical Support

MDOT has retained consultants to provide guidance in preparing and evaluating the RFP and advice on related contractual and technical matters for this and other design build projects. The following consultants are not eligible to participate on any submitter's team: HNTB Michigan Inc,

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Parsons Brinckerhoff Michigan Inc., URS Corporation Great Lakes, Wilcox Professional Services LLC.

2.7 Conflicts of Interest

The Proposer shall accept responsibility for being aware of the requirements of 23 Code of Federal Regulations (CFR) 636.116 and include a full disclosure of all potential organizational conflicts of interest in the Proposal.

The Submitter shall complete Form 5100D (Forms can be found at this website: <http://mdotwas1.mdot.state.mi.us/public/webforms/index.cfm>) certifying that they have read and understand MDOT's policy regarding conflict of interest and the CFR and that each Major Participant has done the same. The Submitter shall certify that they and each Major Participant has no conflict of interest with the Project. If there is a conflict with the Project, then the Submitter needs to describe the conflict.

The Submitter agrees that, if after award, an organizational conflict of interest is discovered, the Submitter must make an immediate and full written disclosure to MDOT that includes a description of the action that the Submitter has taken or proposes to take to avoid or mitigate such conflicts. If an organizational conflict of interest is determined to exist, MDOT may, at its discretion, cancel the design-build contract for the Project. If the Submitter was aware of an organizational conflict of interest prior to the award of the contract and did not disclose the conflict to MDOT, MDOT may terminate the contract for default.

MDOT may disqualify a Submitter if any of its Major Participants belong to more than one Submitter organization.

2.8 Changes to Organizational Structure

All changes in Key Personnel from a Submitters SOQ to the Submitters proposal in response to the RFP must be approved by MDOT in writing by submitting Form 5100G. Changes in Key Personnel must be approved by MDOT prior to submitting a proposal in response to the RFP. MDOT may revoke an awarded contract if any Key Personnel or Major Participant identified in the SOQ is removed, replaced or added without MDOT's prior written approval. To qualify for MDOT approval, the written request must document that the proposed removal, replacement or addition will be equal to or better than the Key Personnel or Major Participant provided in the SOQ. MDOT will use the criteria specified in this RFQ to evaluate all requests. Form 5100G RFQ must be submitted to MDOT's Project Manager as identified in Section 2.3 (Forms can be found at this website: <http://mdotwas1.mdot.state.mi.us/public/webforms/index.cfm>).

2.9 Equal Employment Opportunity

The Submitter will be required to follow both State of Michigan and Federal Equal Employment Opportunity (EEO) policies.

2.10 Disadvantaged Business Enterprises

It is the policy of MDOT that Disadvantaged Business Enterprises (DBEs), as defined in 49 CFR Part 26, and other small businesses shall have the maximum feasible opportunity to participate in

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contracts financed in whole or in part with public funds. Consistent with this policy, MDOT will not allow any person or business to be excluded from participation in, denied the benefits of, or otherwise be discriminated against in connection with the award and performance of any U.S. Department of Transportation (DOT)-assisted contract because of sex, race, religion, or national origin. MDOT has established a DBE program in accordance with regulations of the DOT, 49 CFR Part 26. In this regard, the Submitter will take all necessary and reasonable steps in accordance with 49 CFR Part 26 to ensure that DBEs have the maximum opportunity to compete for and perform the contract. Additional DBE requirements will be set forth in the RFP.

MDOT anticipates that the Project will have a DBE goal of 3%.

3.0 CONTENT OF STATEMENT OF QUALIFICATIONS

This section describes specific information that must be included in the SOQ. SOQs must follow the outline of this Section 3.0. Submitters shall provide brief, concise information that addresses the requirements of the Project consistent with the evaluation criteria described in this RFQ.

3.1 Introduction (Pass/Fail)

Provide a letter stating the business name, address, business type (e.g., corporation, partnership, joint venture) and roles of the Submitter and each known Major Participant. Identify one contact person and his or her address, telephone and fax numbers, and e-mail address. This person shall be the single point of contact on behalf of the Submitter organization, responsible for correspondence to and from the organization and MDOT. MDOT will send all Project-related communications to this contact person. Authorized representatives of the Submitter organization must sign the letter. If the Submitter is a joint venture, the joint venture members must sign the letter. If the Submitter is not yet a legal entity, the known Major Participants must sign the letter. The letter must certify the truth and correctness of the contents of the SOQ. This information will be used to identify the Submitter and its designated contact, and will be reviewed on a pass/fail basis only and not as part of the qualitative assessment of the SOQ.

3.2 Understanding of Project (25 points)

Based on preliminary information available at the time of the RFQ, provide a synopsis demonstrating the Submitter's understanding of the physical description of the Project, probable impacts of the Project, and potential issues affecting the Project. Demonstrate an understanding of the Project goals discussed in Section 1.2 as the following is specifically addressed:

- a. Understanding of Project scope
- b. Understanding of geotechnical conditions at this site
 - i. The Submitter shall provide information that will show how the proposed team's capabilities and geotechnical approach are suitable for the resolution of the geotechnical complexities of this project. Describe how the design and construction team members will deliver a quality product using traditional or innovative methods.
- c. Understanding of the design requirements needed for the Project
- d. Understanding of temporary and permanent environmental impacts and an understanding on how those impacts can be minimized

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- i. The Submitter shall describe how the proposed design and construction will impact the Project site. This project will avoid wetland mitigation, which means limiting permanent wetland impacts to less than 1/3 acre. Another goal is to minimize the temporary and permanent impacts to the surrounding wetlands and creek. The scoring will be greatest to those Submitters who minimize these impacts. This includes maintaining creek flow with minimal impacts and sedimentation, minimizing temporary wetland impacts caused by construction access or sedimentation, and minimizing permanent impacts including restoration of impacted wetlands and treatment of stormwater run-off prior to entering wetland. Describe how the design and construction team members will do these using traditional or innovative methods.
- e. Understanding of construction and construction access in wetlands and on poor soils
- f. Understanding of construction in artesian site conditions.
- g. Understanding of mobility and safety concerns
- h. Potential Project innovations

3.3 Qualifications of Team (30 Points)

Provide the qualifications of the Submitters team that includes both construction firm and design firm personnel. The information should address the following:

- a. Management and staff experience, capabilities and functions on projects of similar scope and with similar environmental and geotechnical conditions.
- b. Effective project management structure and interaction with MDOT or other entities
- c. Effective utilization of personnel and experience of team members working together
- d. Experience with expedited schedules and timely completion on comparable projects
- e. Experience with on-budget completion of comparable projects
- f. Experience with integrating design and construction activities
- g. Company experience and qualifications that are relevant to the Project scope

3.3.1 Organization of Project Team

Describe the roles of all Key Personnel, Major Participants and identified subcontractors. Include what percent of the named role that the entity is expected to provide.

Provide an organizational chart(s) showing the flow of the “chain of command” with lines identifying participants who are responsible for major functions to be performed and their reporting relationships, in managing, designing and building the Project. The chart(s) must show the functional structure of the organization down to the design discipline leader or construction superintendent level and must identify Key Personnel by name. Identify the Submitter and all known Major Participants in the chart(s).

Submitters may be unable to identify all Major Participants or other subcontractors who are providing construction services (design services meeting the prequalification requirements listed in Section 2.4 must be provided). If a Submitter is unable to provide the name of the construction Major Participants or other subcontractors, they should include a plan of how they will obtain the firm including what qualifications they would expect the firm to provide.

3.3.2 Project Team Communication

The Submitter shall provide information that will show how the Submitter communicates during the execution of the Project. MDOT’s desire is to have a strong single point of contact who controls the project during all phases, including planning, design, and construction. Scoring will be greatest to those Submitters who provide a clear and concise communication plan that incorporates and integrates all components of the Submitters team (i.e. primary designers, subconsultant designers, construction managers, construction field personnel, construction office personnel, material testing personnel, etc.) and inserts MDOT personnel and other appropriate stakeholders (i.e. local residents and businesses, public agencies) within that communication plan (i.e. process for design and construction submittals to MDOT, MDOT involvement in quality checkpoints during design and construction, incorporating MDOT review of design changes during construction, public information plan, etc.).

3.3.3 Staff Service Experience

3.3.3.1 Resumes of Key Personnel

Resumes of Key Personnel shall be provided as Appendix A – Resumes of Key Personnel to the SOQ. Resumes of Key Personnel shall be limited to two pages each and will not be counted towards the overall SOQ page limit. If an individual fills more than one position, only one resume is required. The listing below describes the minimum key personnel for the Project (“Key Personnel”), others may be added by the Submitter. Submitters may propose alternate plans to staff and manage the Project. SOQ’s with alternate staffing plans are required to have details of the key staff and their roles and responsibilities in a manner similar to the requirements listed below, including their responsibility on the project and their authority over the design and/or construction operations.

Key Personnel

- a. Submitter’s Project Manager
- b. Project Superintendent
- c. Construction Quality Control Manager
- d. Design Manager
- e. Design Lead Geotechnical Engineer
- f. Design Lead Structures Engineer
- g. Design Lead Hydraulic Engineer
- h. Design Lead Road Engineer

Include the following items on each resume:

- a. Relevant licensing and registration.
- b. Years of experience performing similar work.
- c. Actual work examples on similar projects, including projects, project dates, duties performed and their percentage of time on the project.

3.3.3.2 Minimum Qualifications of Key Personnel

Key Personnel will be evaluated, in part, based on the extent they meet and/or exceed minimum qualifications including, but not limited to, relevant education, training, certification, and experience. The following provides minimum qualifications of the Key Personnel assigned to the Project. Any certifications required to meet the requirements of the RFQ shall be in place by the time the first notice to proceed is issued. Key Personnel, except as noted, may perform Work in more than one position in the organization.

a. Submitter's Project Manager

The Submitter's Project Manager is expected to have significant experience managing the construction of highway and/or bridge reconstruction projects. MDOT prefers that the Submitter's Project Manager also has experience with foundation construction in challenging geotechnical conditions. MDOT prefers that the Submitter's Project Manager has experience performing construction in wetlands (and minimizing impacts to wetlands) and constructing on sites with soils containing minimal strength such as peat, fibrous material, and clay marl.

Submitter's Project Manager will be responsible for the overall design, construction, quality management and contract administration for the Project and will:

- (i) Have full responsibility for the prosecution of the Work,
- (ii) Act as agent and be a single point of contact in all matters on behalf of Submitter,
- (iii) Be available (or the Approved designee will be available) at all times that Work is performed, and
- (iv) Have authority to bind Submitter on all matters relating to the Project.

b) Project Superintendent

The Project Superintendent is expected to have recent experience in highway and/or bridge construction and testing. MDOT prefers that the Submitter's Project Superintendent also has experience with foundation construction in challenging geotechnical conditions. MDOT prefers that the Submitter's Project Superintendent has experience performing construction in wetlands (and minimizing impacts to wetlands) and constructing on sites with soils containing minimal strength such as peat, fibrous material, and clay marl.

The Project Superintendent, or the Approved designee, must be on site during all construction activities. The Project Superintendent must work under the direct supervision of Submitter's Project Manager.

c) Construction Quality Control Manager

The Construction Quality Control Manager is expected to have significant recent experience overseeing the inspection and materials testing on major highway and/or bridge construction projects.

The Construction Quality Control Manager must work under the direct supervision of Submitter's Project Manager. It must be the responsibility of the Construction Quality Control Manager to manage the Submitter's assigned Quality Control functions and will:

- (i) Not be assigned any other duties or responsibilities on the Project.

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- (ii) Visit the site weekly and report on that visit to the MDOT Project Manager.
- (iii) Be available whenever any construction activities are being performed.
- (iv) Have the authority to stop any and all work that does not meet the standards, specifications or criteria established for the Project.

d) Design Manager

The Design Manager is expected to have significant experience in managing the design of bridge and/or geotechnical foundation projects and must be a licensed professional engineer in the State of Michigan now or by the award of the project. The Design Manager is expected to have significant experience in the design of structures and foundations where challenging geotechnical conditions are present. The Design Manager is expected to have significant experience working on projects requiring MDEQ permits for construction within streams, wetlands, and floodplains.

The Design Manager will be responsible for ensuring that the overall Project design is completed and design criteria requirements are met. The Design Manager will:

- (i) Be available whenever design activities are being performed.
- (ii) Work under the direct supervision of Submitter's Project Manager.

e) Design Lead Geotechnical Engineer

The Design Lead Geotechnical Engineer must be experienced with design in challenging geotechnical conditions similar to those found on this Project. The Design Lead Geotechnical Engineer is expected to have experience with design of structure foundations when poor soil conditions, low soil strength, and artesian conditions are present. The Design Lead Geotechnical Engineer must be a registered professional engineer in the State of Michigan now or by the award of the project.

f) Design Lead Structures Engineer

The Design Lead Structures Engineer must be experienced in structures design of the size and type required for the Project and must be a registered professional engineer in the State of Michigan now or by the award of the project.

g) Design Lead Hydraulic Engineer

The Design Lead Hydraulic Engineer must be experienced in hydraulics design of the type required for the Project and must be a registered professional engineer in the State of Michigan now or by the award of the project.

h) Design Lead Road Engineer

The Design Lead Road Engineer must be experienced in roadway design related to roadway reconstruction projects that include bridges, including associated approach work and must be a registered professional engineer in the State of Michigan now or by the award of the project.

3.4 Submitter Experience (30 points)

Describe at least two but a maximum of four projects the Submitter has completed or participated in (if the Submitter is not yet existing or is newly formed, please explain) and at least two but a maximum of four projects each listed Major Participant has managed, designed and/or constructed.

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For projects in which several of the proposed Major Participants were involved, the Submitter may provide a single project description. Highlight experience relevant to the Project the Submitter/Major Participants have gained in the last 5-10 years. Cite projects with levels of scope comparable to that anticipated for the Project, specifically design and construction of road and bridge facilities in areas with challenging geotechnical conditions and within wetlands. Also consider citing projects where construction duration is minimized, design schedules were kept, and original design and construction budgets were not increased. Describe the experiences that could apply to this Project. The experience of the Submitter will account for 15 or more of the points out of the 30 points available in this category. The experience of the Major Participants will account for a maximum of 15 points out of the 30 points available in this category. If some Major Participants are unknown at the time SOQ's are submitted, the Submitter's plan (see Section 3.3.1) for obtaining the firm for this area of work will be considered.

Each project description should include the following information:

- a. Name of the project and either the owner's contract number or state project number;
- b. Owner's construction engineer, design engineer, and geotechnical engineer and their current telephone number;
- c. Dates of design, construction, and project management;
- d. Description of the work or services provided and percentage of the overall project actually performed;
- e. Description of scheduled completion deadlines and actual completion dates;
- f. Original design or construction budget and final design or construction cost.

MDOT may elect to use the information provided above as a reference check.

3.5 Past Performance of Designers (10 Points)

MDOT's objective in evaluating Past Performance is to incorporate quality of past performance of the Submitter's design firm(s) into the overall technical score. Past performance of the design firm(s) will be determined based on the Service Vendor Evaluation System at MDOT. If performance evaluations have not been performed, the selection team will contact previous clients and base scoring on feedback received. Past performance for the Submitter's construction company is reflected in the level the firm can bid and will not be part of this score.

3.6 Location (5 points)

MDOT's scoring of location provides additional points for work that is performed within Michigan. Both the Submitter's construction and design firms' location of effort will be taken into account equally (2.5 points total for each). Scoring will depend on percent of work performed in Michigan as follows:

- a. 95 - 100% 5 points
- b. 80 - 94% 4 points
- c. 50 - 79% 3 points
- d. 25 - 49% 2 points

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- e. 10 - 24% 1 point
- f. Less than 10% 0 points

3.7 Legal and Financial (Pass/Fail)

The information required in response to Section 3.7 shall be submitted as Appendix B – Legal and Financial. Information provided in response to these sections will not count towards the overall page limitation defined in Section 5.2. Information required by this section will be evaluated on a pass/fail basis.

3.7.1 Acknowledgment of Clarifications and Addenda

Identify all addenda provided by date and version.

3.7.2 Organizational Conflicts of Interest

Identify all relevant facts relating to past, present or planned interest(s) of the Submitter’s team (including the Submitter, Major Participants, proposed consultants, contractors and subcontractors, and their respective chief executives, directors and key project personnel) which may result, or could be viewed as, an organizational conflict of interest in connection with this RFQ.

Disclose: (a) any current contractual relationships with MDOT (by identifying the MDOT contract number and project manager); (b) present or planned contractual or employment relationships with any current MDOT employee; and (c) any other circumstances that might be considered to create a financial interest in the contract for the Project by any current MDOT employee if the Submitter is awarded the contract. The foregoing is provided by way of example, and shall not constitute a limitation on the disclosure obligations.

For any fact, relationship or circumstance disclosed in response to this Section 3.7.2 identify steps that have been or will be taken to avoid, neutralize or mitigate any organizational conflicts of interest.

In cases where Major Participants on different Submitter teams belong to the same parent company, each Submitter must describe how the participants would avoid conflicts of interest through the qualification and proposal phases of the Project.

The required information for Organizational Conflicts of Interest shall be submitted with the 5100I RFQ Conflict of Interest Form. Information provided in response to this section will not count towards the overall page limitation defined in Section 5.2.

3.7.3 Legal Structure

If the Submitter organization has already been formed, provide complete copies of the organizational documents that allow, or would allow by the time of contract award, the Submitter and Major Participants to conduct business in the State of Michigan. If the Submitter organization has not yet been formed, provide a brief description of the proposed legal structure or draft copies of the underlying agreements.

3.7.4 Financial Viability

The Submitter must supply form 1300 EZ with their SOQ to show they will bid on the project when it is advertised. Form 1300 EZ will be required to be resubmitted again before letting.

4.0 EVALUATION PROCESS

4.1 SOQ Evaluation

MDOT will initially review the SOQs for responsiveness to the requirements of this RFQ. The information in the SOQ will then be measured against the evaluation criteria described in Section 3. Submitter's SOQ response shall be complete based on the RFQ requirements. A non-responsive or partially non-responsive SOQ missing required information may result in a "fail".

4.2 SOQ Scoring

MDOT will evaluate all responsive SOQs and measure each Submitter's response against the project goals and evaluation criteria set forth in this RFQ, resulting in a numerical score for each SOQ. The scoring will be distributed as described in Section 3 and summarized below:

- a. Understanding of Project (25 Points):
- b. Qualifications of Team (30 Points):
- c. Submitter Experience (30 Points)
- d. Past Performance of Designers (10 Points)
- e. Location (5 Points)

4.3 Determining Short-listed Submitters

MDOT will total the scores for each responsive SOQ and prepare a ranked list of Submitters. MDOT intends to short list three of the most highly qualified Submitters.

MDOT reserves the right, in its sole discretion, to cancel this RFQ, issue a new RFQ, reject any or all SOQs, seek or obtain data from any source that has the potential to improve the understanding and evaluation of the responses to this RFQ, seek and receive clarifications to an SOQ and waive any deficiencies, irregularities or technicalities in considering and evaluating the SOQs.

This RFQ does not commit MDOT to enter into a contract or proceed with the procurement of the Project. MDOT assumes no obligations, responsibilities and liabilities, fiscal or otherwise, to reimburse all or part of the costs incurred by the parties responding to this RFQ. All such costs shall be borne solely by each Submitter.

4.4 Notification of Short Listing

All scores will be posted on MDOT's website in conjunction with the posting of the short list. No submitter names will be provided; however, each Submitter will receive their individual score sheet

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from MDOT via facsimile or e-mail within three working days of the scores and selection results being posted.

4.5 Debriefing

Feedback may be provided via face to face meeting, phone or email at the discretion of the Project Manager however, it will not be provided until after the award of the contract.

5.0 SOQ SUBMITTAL REQUIREMENTS

The following section describes requirements that all Submitters must satisfy in submitting SOQs. Failure of any Submitter to submit their SOQ as required in this RFQ may result in rejection of its SOQ.

5.1 Due Date, Time and Location

Submitter to deliver all required SOQ copies as specified in Form 5100H RFQ. Form 5100H RFQ is included as Attachment G.

MDOT will not accept SOQs by facsimile or electronic transmission. Any SOQ that fails to meet the deadline or delivery requirement will be rejected without opening, consideration or evaluation.

5.2 Format

All SOQ's must comply with the following:

- a. The SOQ must not exceed 15 single-sided pages. The 15 page limit does not include key personnel resumes (Appendix A – Resumes of Key Personnel), required 5100 forms, 1300EZ forms, and the required legal information (Appendix B – Legal and Financial) defined in Section 3.7. In the 1300EZ form the references to “Bidder” shall mean “Submitter”.
- b. Pages shall be 8 ½ inches by 11 inches.
- c. Font must be a minimum of 12 point.
- d. All pages must be numbered continuously throughout and in the format of “Page 1 of _”, including resumes, 5100 forms, 1300 EZ forms, and legal understanding.
- e. Submittals shall be stapled in the upper left hand corner and shall be completely recyclable. (E.g. no binders, plastic, spiral binding, etc.)
- f. Graphics are allowed within established page limits.

6.0 PROCUREMENT PHASE 2

This Section 6.0 is provided for informational purposes only so that each Submitter has information that describes the second phase of the Project procurement process, including a summary of certain anticipated RFP requirements. MDOT reserves the right to make changes to the following, and the

MICHIGAN DEPARTMENT OF TRANSPORTATION – GRAND REGION

short-listed Submitters must only rely on the actual RFP when and if it is issued. This Section 6.0 does not contain requirements related to the SOQ.

6.1 Request for Proposals

The Submitters remaining on the short list following Phase 1 of the procurement process will be eligible to move to Phase 2 and receive an RFP. While MDOT may make the RFP available to the public for informational purposes, only short-listed submitters will be allowed to submit a response to the RFP.

6.2 RFP Structure

The RFP will be structured as follows:

- a. Instructions to Proposers
- b. Contract Documents
 - i. Book 1 (Contract Terms and Conditions)
 - ii. Book 2 (Project Requirements)
 - iii. Book 3 (Standards)
- c. Reference Information Documents (RID)

6.3 Proposal Evaluations

MDOT has determined that award of the Project will be based on a weighted bid to obtain the most qualified and cost effective Proposer to deliver the Project. The bid is weighted by a combination of price and M-20 full or partial closure duration.

6.4 Stipends

MDOT will pay a \$18,000 stipend for the responsive proposals submitted by Proposers (short-listed Submitter). A stipend will not be paid to the successful Proposer.

No stipends will be paid for submitting SOQs.

In consideration for paying the stipend, MDOT may use any ideas or information contained in the proposals in connection with any contract awarded for the Project or in connection with a subsequent procurement, without any obligation to pay any additional compensation to the unsuccessful short-listed Proposers.

Attachment A

Location Map

DATE: 06/22/10

LAST CORRECTION BY: TRW

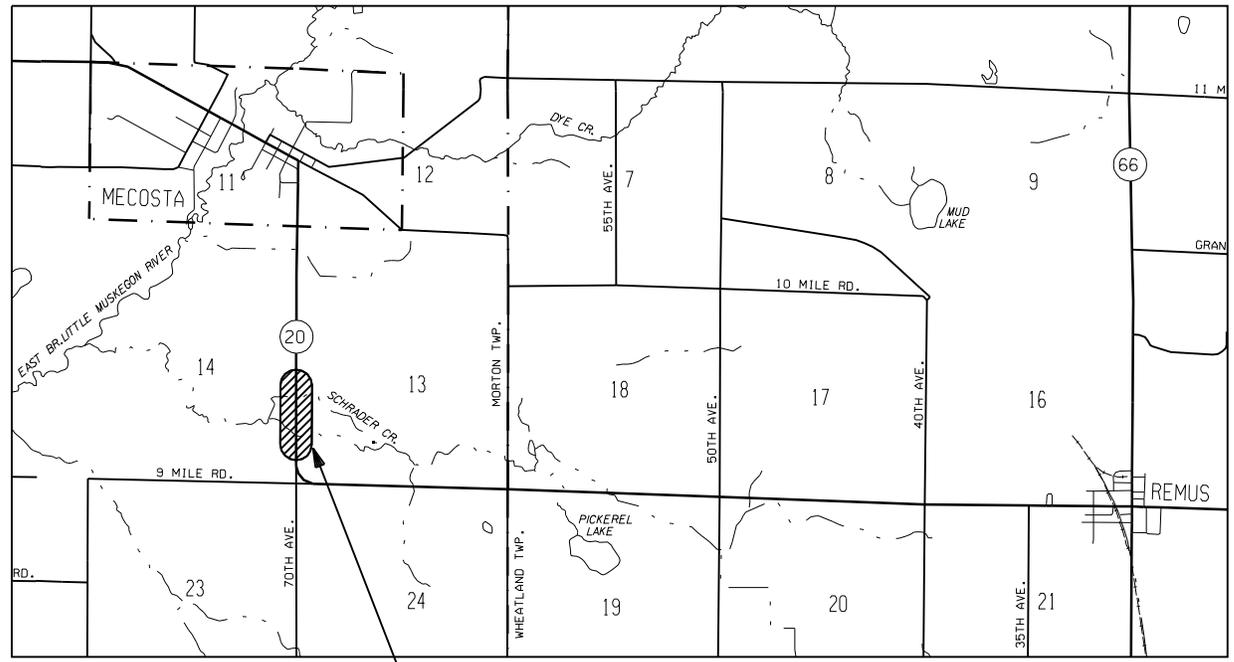
FILE NAME: LOCATION MAP.DGN

M-20 AT SCHRADER CREEK

CONTROL SECTION 54022
JOB NUMBER 73737

M-20
MECOSTA COUNTY
MORTON TOWNSHIP

R8W, T15N



PROPOSED PROJECT AREA

URS
Surface Transportation
Grand Rapids, Southfield,
Traverse City

MDOT
Michigan Department of Transportation

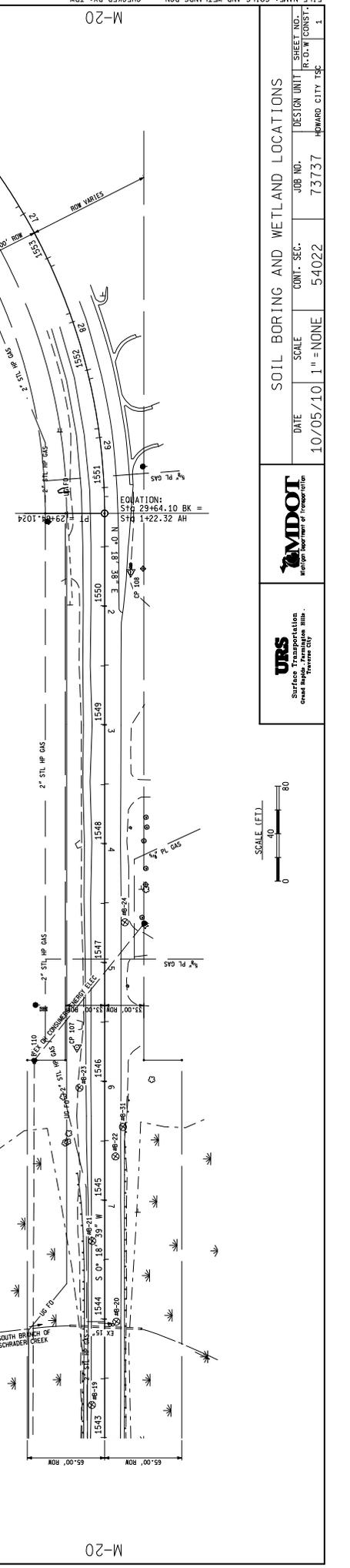
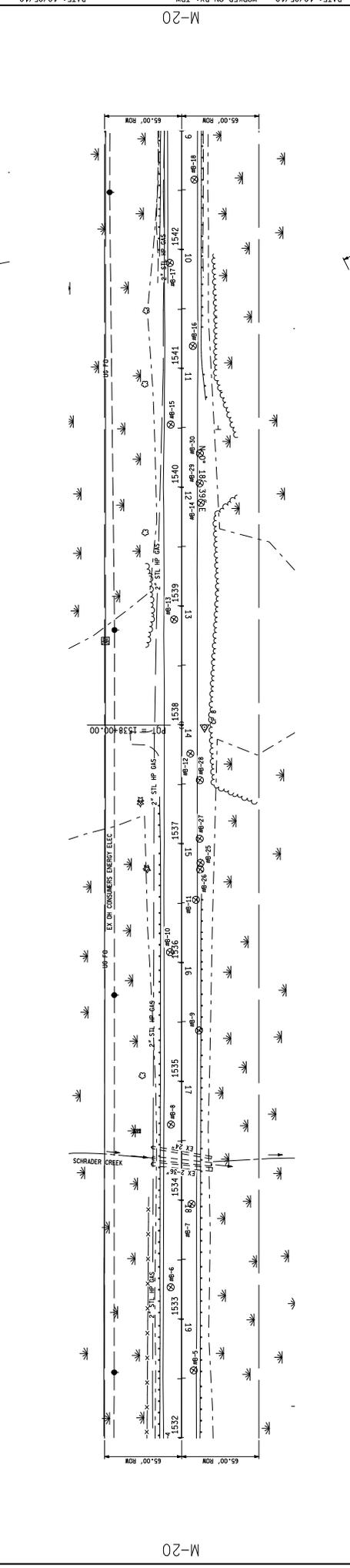
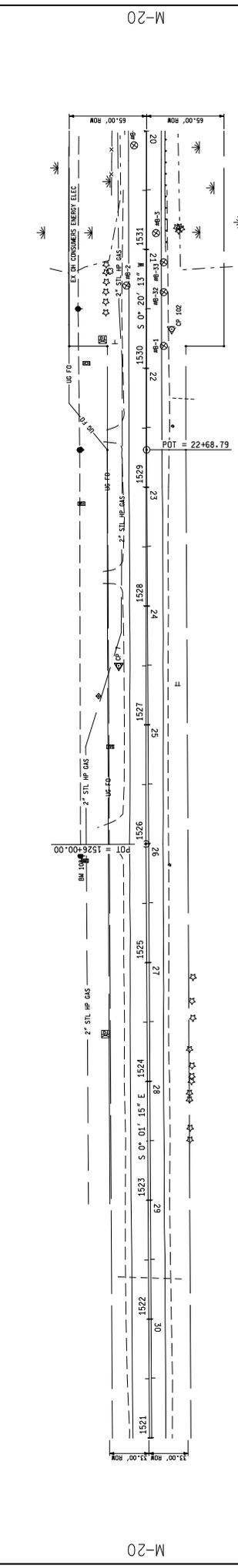
LOCATION MAP

DATE 06/22/10	SCALE 1"=NONE	CONT. SEC. 54022	JOB NO. 73737	SHEET NO. 1
------------------	------------------	---------------------	------------------	----------------

Attachment B

Plan View of M-20 at Schrader Creek and South Branch of Schrader Creek

NO.	DATE	BY	REVISION
1			FINAL R.O.W.



FINAL R.O.W.

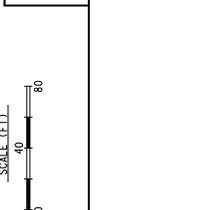
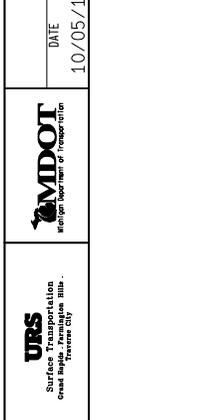
M-20

M-20

M-20

DATE	SCALE	CONT. SEC.	JOB NO.	DESIGN UNIT	SHEET NO.
10/05/10	1" = NONE	54022	73737	HOWARD CITY TSC	R.O.W. CONST.

SOIL BORING AND WETLAND LOCATIONS



Attachment C

Soil Boring Data

Soil Boring Logs by Wilcox

General Notes by Wilcox

Lab Testing Data by Wilcox

Lab Testing Data by Fibertec (PH/Chloride/Sulfate Tests)

Lab Testing Data by Geotesting Express (Resistivity Tests)

Test Holes by MDOT

Swamp Soundings by MDOT

DISCLAIMER

The documents in this attachment are being provided as a courtesy to its users. They may contain interpretative information and should be considered informational only.



SOIL BORING LOG

One Madison Ave
 Cadillac, MI 49601
 231-775-7755
 231-775-3135 fax

CLIENT & PROJECT: URS, M-20 over Schrader Creek

BORING NO.: B-1

Page 1 of 1

BORING LOCATION: N: 768161, E: 12895914, Sta 1530+19, Offset 15.7 Rt.

METHOD OF DRILLING: 3.25" HSA, Auto Hammer

GROUND ELEVATION: 975.1

NOTES:

DATE DRILLED: 6-14-10

JOB NUMBER: 22621.00005

DRILLER/HELPER: Bob Clark/Ray Farve

DRILL RIG: Diedrich D-90, ATV

LOGGED BY: Bob Clark/Mike Carpenter

TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
975.0	0	(0.0, 1.0) AGGREGATE						
		(1.0, 6.5) Very Loose to Loose, Light Brown, Moist, fine to medium SAND; Trace Silt and fine Gravel		1SS 2.5-4 ft 4-2-2 (4) 40%				
970.0	5			2SS 5-6.5 ft 7-3-3 (6)				

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: NE
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings

*LL = Liquid Limit - PI = Plasticity Index
 *St = Hand Torvane Shear Strength
 *Qp = Pocket Penetrometer
 *Qu = Unconfined Compression Machine



SOIL BORING LOG

One Madison Ave
 Cadillac, MI 49601
 231-775-7755
 231-775-3135 fax

CLIENT & PROJECT: URS, M-20 over Schrader Creek

BORING NO.: B-2

Page 1 of 1

BORING LOCATION: N: 768110, E: 12895945, Sta 1530+70, Offset 15.5 Lt.

METHOD OF DRILLING: 3.25" HSA, Auto Hammer

GROUND ELEVATION: 972.8

NOTES:

DATE DRILLED: 6-25-10

JOB NUMBER: 22621.00005

DRILLER/HELPER: Bob Clark/Ray Farve

DRILL RIG: Diedrich D-90, ATV

LOGGED BY: Bob Clark

TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
	0	(0.0, 0.4) AGGREGATE						
970.0	0.4	(0.4, 4.0) Very Loose, Mixed Browns, Moist, SILTY fine SAND; Trace fine to medium Gravel (FILL)		1SS 2.5-4 ft 8-2-1 (3) 90%				
	5	(4.0, 7.0) Loose, Brown, Moist, SILTY fine SAND		2SS 5-6.5 ft 5-3-6 (9) 0%				
965.0	7.0	(7.0, 21.5) Very Loose to Medium Dense, Brown, Wet, fine to medium SAND with Silt		3SS 7.5-9 ft 7-5-4 (9) 75%				
	10			4SS 10-11.5 ft 2-2-2 (4) 40%				
960.0	12.5			5SS 12.5-14 ft 3-2-2 (4) 75%				
	15			6SS 15-16.5 ft 6-2-1 (3) 50%				
955.0	17.5			7SS 17.5-19 ft 9-7-4 (11) 40%				
	20			8SS 20-21.5 ft 10-8-3 (11) 60%				

GROUNDWATER OBSERVATIONS

∅ DURING DRILLING: 7 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings

*LL = Liquid Limit - PI = Plasticity Index
 *St = Hand Torvane Shear Strength
 *Qp = Pocket Penetrometer
 *Qu = Unconfined Compression Machine



SOIL BORING LOG

One Madison Ave
 Cadillac, MI 49601
 231-775-7755
 231-775-3135 fax

CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-3 Page 1 of 4
BORING LOCATION: N: 768066, E: 12895920, Sta 1531+14, Offset 9.3 Rt.
METHOD OF DRILLING: 3.25" HSA to 20', 2-15/16" Mud Rotary to 100'
GROUND ELEVATION: 971.8
NOTES: Installed Silt Fence

DATE DRILLED: 6-1 & 6-2, 2010
JOB NUMBER: 22621.00005
DRILLER/HELPER: Bob Clark/Ray Farve
DRILL RIG: Diedrich D-90, ATV
LOGGED BY: CDJ
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
970.0	0.0 - 0.5	ASPHALT (6")						
	0.5 - 1.0	Brown, Moist GRAVEL (FILL)						
	1.0 - 4.0	Very loose, Brown, Moist, fine to medium SAND (FILL)		1SS 2.5-4 ft 0%				
	4.0 - 5.5	Very loose, Gray, Moist to Wet, fine to coarse SAND; trace of gravel (Fill)		2SS 5-6.5 ft 2-2/12" 75%	269.9			
	5.5 - 10.8	Soft, Black, Wet Amorphous PEAT, Occasional Sand Lenses		3SS 7.5-9 ft 2-1-2 (3) 90%	27.7			
	10.8 - 22.0	Loose to Medium Dense, Brownish Gray to Brown, Wet, fine to medium SAND		4SS 10-11.5 ft 1-5-5 (10) 100%				
				5SS 12.5-14 ft 7-9-7 (16) 100%				
				6SS 15-16.5 ft 9-6-4 (10) 40%				
				7SS 19-20.5 ft 9-6-4 (10) 75%				
	22.0 - 35.0	Stiff to Very Stiff, Brownish Gray, Moist CLAY		8SS			Qp=1.5-2.0	

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 5.5 ft.
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

*LL = Liquid Limit - PI = Plasticity Index
 *St = Hand Torvane Shear Strength
 *Qp = Pocket Penetrometer
 *Qu = Unconfined Compression Machine



SOIL BORING LOG

One Madison Ave
 Cadillac, MI 49601
 231-775-7755
 231-775-3135 fax

CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-3 Page 2 of 4
BORING LOCATION: N: 768066, E: 12895920, Sta 1531+14, Offset 9.3 Rt.
METHOD OF DRILLING: 3.25" HSA to 20', 2-15/16" Mud Rotary to 100'
GROUND ELEVATION: 971.8
NOTES: Installed Silt Fence

DATE DRILLED: 6-1 & 6-2, 2010
JOB NUMBER: 22621.00005
DRILLER/HELPER: Bob Clark/Ray Farve
DRILL RIG: Diedrich D-90, ATV
LOGGED BY: CDJ
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
945.0				25-26.5 ft 3-3-4 (7) 100%				
	30			1ST 30-32 ft 100%	20.1	133.8	Qu=2.88	
940.0								
	35	(35.0, 41.0) Loose, Brown, Wet, fine to medium SAND; Occasional Clay Lenses		9SS 35-36.5 ft 3-3-4 (7) 100%				
935.0								
	40	(40.7, 41.0) Silt Lens		10SS 40-41.5 ft 5-3-5 (8) 75%	22.5			
930.0		(41.0, 53.0) Medium Dense, Brown, Wet, fine to coarse GRAVEL						
	45			11SS 45-46.5 ft 13-12-7 (19) 60%				
925.0								
	50			12SS 50-51.5 ft 8-10-9 (19) 65%				
920.0								

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 5.5 ft.
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

*LL = Liquid Limit - PI = Plasticity Index
 *St = Hand Torvane Shear Strength
 *Qp = Pocket Penetrometer
 *Qu = Unconfined Compression Machine



SOIL BORING LOG

One Madison Ave
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 231-775-3135 fax

CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-3 Page 3 of 4
BORING LOCATION: N: 768066, E: 12895920, Sta 1531+14, Offset 9.3 Rt.
METHOD OF DRILLING: 3.25" HSA to 20', 2-15/16" Mud Rotary to 100'
GROUND ELEVATION: 971.8
NOTES: Installed Silt Fence

DATE DRILLED: 6-1 & 6-2, 2010
JOB NUMBER: 22621.00005
DRILLER/HELPER: Bob Clark/Ray Farve
DRILL RIG: Diedrich D-90, ATV
LOGGED BY: CDJ
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
915.0	55	(53.0, 71.0) Dense to Medium Dense, Brown, Wet, fine to medium SAND	Yellow dotted pattern	13SS 55-56.5 ft 15-18-20 (38) 100%				
910.0	60			14SS 60-61.5 ft 9-9-14 (23) 50%				
905.0	65			15SS 65-66.5 ft 3-5-9 (14) 75%				
900.0	70	(71.0, 73.5) Medium Stiff, Brown Moist CLAY	Green diagonal lines	16SS 70-71.5 ft 10-3-2 (5) 20%	22.4		Qp=5	
895.0	75	(73.5, 87.0) Medium Dense, Brown, Wet, fine to coarse SAND; Occasional Clay Lenses	Yellow dotted pattern	17SS 75-76.5 ft 10-10-6 (16) 0%				

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 5.5 ft.
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

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 *Qp = Pocket Penetrometer
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One Madison Ave
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 231-775-7755
 231-775-3135 fax

CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-3 Page 4 of 4
BORING LOCATION: N: 768066, E: 12895920, Sta 1531+14, Offset 9.3 Rt.
METHOD OF DRILLING: 3.25" HSA to 20', 2-15/16" Mud Rotary to 100'
GROUND ELEVATION: 971.8
NOTES: Installed Silt Fence

DATE DRILLED: 6-1 & 6-2, 2010
JOB NUMBER: 22621.00005
DRILLER/HELPER: Bob Clark/Ray Farve
DRILL RIG: Diedrich D-90, ATV
LOGGED BY: CDJ
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
890.0			•••••	18SS 80-81.5 ft 14-7-6 (13) 75%				
85			•••••	19SS 85-86.5 ft 7-6-13 (19) 100%	19.7			
885.0		(87.0, 91.5) Very Hard, Grayish Brown, Moist CLAY	//			140.6	Qu=6.68	
90		Boring Terminated due to Drilling Refusal	■	20SS 90-91.5 ft. 15-15-26 (41) 100%	14.3		Qp=4.5+	

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 5.5 ft.
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

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 *St = Hand Torvane Shear Strength
 *Qp = Pocket Penetrometer
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SOIL BORING LOG

One Madison Ave
 Cadillac, MI 49601
 231-775-7755
 231-775-3135 fax

CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-4 Page 1 of 4
BORING LOCATION: N: 767992, E: 12895938, Sta 1531+88, Offset 8.9 Lt.
METHOD OF DRILLING: 4.25" HSA. 3-7/8" Mud Rotary, Auto Hammer
GROUND ELEVATION: 969.5
NOTES: Installed Silt Fence

DATE DRILLED: 6-23-10 to -24-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: Bob Clark/Ray Farve
DRILL RIG: Diedrich D-90, ATV
LOGGED BY: Bob Clark and MAC
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
969.5	0	(0.0, 1.1) ASPHALT (13")			49.6			
	1.1	(1.1, 1.8) Brown, Moist, fine to medium SAND (FILL)						
	1.8	(1.8, 3.0) Brown, Moist CLAY with Sand (FILL)						
965.0	5	(3.0, 7.0) Loose, Brown, Wet, SILTY SAND (FILL)		1SS 5-6.5 ft 2-2-3 (5) 20%				
	7.0	(7.0, 14.5) Very Soft, Dark Brown, Wet PEAT						
960.0	10			2SS 10-11.5 ft 2-1-0 (1) 0%				
	12.5			3SS 12.5-14 ft 1-0-0 (0) 0%				
955.0	15	(14.5, 25.5) Very Soft, Light Gray, Moist MARL		4SS 15-16.5 ft 1-0-0 (0) 100%	81.1			
950.0	20			5SS 20-21.5 ft 1-0-0 (0) 100%	86.4			
945.0	25	(25.5, 48.5) Loose to Medium Dense, Brown, Wet, fine to		6SS 25-26.5 ft 3-4-7 (11)				

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 3 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

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GROUND ELEVATION: 969.5
NOTES: Installed Silt Fence

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DRILL RIG: Diedrich D-90, ATV
LOGGED BY: Bob Clark and MAC
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
940.0	30	medium SAND; Trace fine Gravel		100%				
		Driller Reports Gravel Lens at 32 ft						
935.0	35			7SS 30-31.5 ft 3-3-5 (8) 10%				
				8SS 35-36.5 ft 8-8-7 (15) 65%				
930.0	40			9SS 40-41.5 ft 5-5-6 (11) 65%				
				10SS 45-46.5 ft 4-7-7 (14) 100%				
925.0	45							
920.0	50	(48.5, 52.0) Stiff, Light Gray, Moist CLAY		11SS 50-51.5 ft 3-5-8 (13)	23.7		Qp=1.7	

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 3 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

*LL = Liquid Limit - PI = Plasticity Index
 *St = Hand Torvane Shear Strength
 *Qp = Pocket Penetrometer
 *Qu = Unconfined Compression Machine



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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-4 Page 3 of 4
BORING LOCATION: N: 767992, E: 12895938, Sta 1531+88, Offset 8.9 Lt.
METHOD OF DRILLING: 4.25" HSA. 3-7/8" Mud Rotary, Auto Hammer
GROUND ELEVATION: 969.5
NOTES: Installed Silt Fence

DATE DRILLED: 6-23-10 to -24-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: Bob Clark/Ray Farve
DRILL RIG: Diedrich D-90, ATV
LOGGED BY: Bob Clark and MAC
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
915.0	55	(52.0, 59.0) Alternating lenses/layers of SAND and CLAY		12SS 55-56.5 ft 6-8-8 (16)				Drove Rock @ 12SS
910.0	60	(59.0, 71.0) Stiff, Gray, Moist CLAY		13SS 60-61.5 ft 9-11-15 (26) 100%	24.6	127.2	Qu=0.94	
905.0	65	Silt Lens at 66 ft		14SS 65-66.5 ft 9-11-12 (23) 100%	23.6		Qp=1.5	
900.0	70	(71.0, 73.0) Dense, Gray, Wet SILT		15SS 70-71.5 ft 14-21-21 (42) 75%	20.0		Qp=1.0	
895.0	75	(73.0, 80.0) Medium Dense, Brown, Wet, fine to coarse SAND with fine Gravel		16SS 75-76.5 ft 9-12-13 (25) 70%				

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 3 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

*LL = Liquid Limit - PI = Plasticity Index
 *St = Hand Torvane Shear Strength
 *Qp = Pocket Penetrometer
 *Qu = Unconfined Compression Machine



SOIL BORING LOG

One Madison Ave
 Cadillac, MI 49601
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 231-775-3135 fax

CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-4 Page 4 of 4
BORING LOCATION: N: 767992, E: 12895938, Sta 1531+88, Offset 8.9 Lt.
METHOD OF DRILLING: 4.25" HSA. 3-7/8" Mud Rotary, Auto Hammer
GROUND ELEVATION: 969.5
NOTES: Installed Silt Fence

DATE DRILLED: 6-23-10 to -24-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: Bob Clark/Ray Farve
DRILL RIG: Diedrich D-90, ATV
LOGGED BY: Bob Clark and MAC
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
890.0	80	Driller Report coarse Gravel at 79 ft (80.0, 86.0) Dense, Brown, Wet, fine to coarse SAND; Frequent Lenses/Layers of Gravel		17SS 80-81.5 ft 12-14-18 (32) 50%				
885.0	85			18SS 85-86.5 ft 16-20-20 (40) 10%				
880.0	90	(86.0, 100.0) SAND and GRAVEL; Occasional Clay lenses - Coarse Gravel to Cobbles at 99 ft Hole Characterized by wash rotary cuttings and driller observations due to upper gravel layers collapsing.						
875.0	95							
870.0	100							

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 3 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

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SOIL BORING LOG

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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-5 Page 1 of 4
BORING LOCATION: N:767923, E: 12895917, Sta 1532+57, Offset 11.6 Rt.
METHOD OF DRILLING: 4.25 HSA to 35'; 3-7/8" Mud Rotary to 80'
GROUND ELEVATION: 967.7
NOTES: Silt Fence Installed
 SPT's with AWJ Rod, W.O.R. = Weight of Rods

DATE DRILLED: 6-3-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: Bob Clark/ Ray Farve
DRILL RIG: Diedrich D-90, ATV
LOGGED BY: Bob Clark/Mike Carpenter
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
967.5	0.0 - 0.6	ASPHALT (7.5")						
966.5	0.6 - 1.2	Brown, Moist GRAVEL (7")						
965.5	1.2 - 1.9	Gray, Moist SILTY SAND; Trace of Gravel (Fill)						
964.5	1.9 - 4.5	Gray, Moist to Wet, SILTY CLAYEY SAND (Fill)						
960.0	4.5 - 13.0	Very Soft, Black, Moist, Amorphous PEAT with wood fragments		1SS 5-6.5 ft 3-4-4 (8) 90%				
955.0	10			2SS 10-11.5 ft 1/1' - 1/6" 95%	286.3			
950.0	13.0 - 29.5	Very Soft, Gray, Moist to Wet MARL		3SS 12.5-14 ft W.O.R. 95%	160.7			
945.0	15			4SS 15-16.5 ft W.O.R. 100%	99.1			
940.0	20			5SS 17.5-19 ft W.O.R. 100%	106.7		Qp<0.25	
935.0	25			6SS 20-21.5 ft W.O.R. 100%				
930.0				7SS 22.5-24 ft 1-1-0 (1) 100%	109.9			
925.0				8SS 25-26.5 ft 1-1-1 (2)	103.9		Qp<0.25	

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 4 ft.
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

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 *Qp = Pocket Penetrometer
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SOIL BORING LOG

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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-5 Page 2 of 4
BORING LOCATION: N:767923, E: 12895917, Sta 1532+57, Offset 11.6 Rt.
METHOD OF DRILLING: 4.25 HSA to 35'; 3-7/8" Mud Rotary to 80'
GROUND ELEVATION: 967.7
NOTES: Silt Fence Installed
 SPT's with AWJ Rod, W.O.R. = Weight of Rods

DATE DRILLED: 6-3-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: Bob Clark/ Ray Farve
DRILL RIG: Diedrich D-90, ATV
LOGGED BY: Bob Clark/Mike Carpenter
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
940.0	30	(29.5, 46.0) Medium Dense to Loose, Brown, Wet, fine to medium SAND with Silt and fine to medium Gravel, with Silt	75% 9SS W.O.R. 27.5-29 ft 75%	105.2		Qp<0.25		
935.0	35		10SS 30-31.5 ft 6-6-7 (13) 10%					
930.0	40	Occasional lenses of coarse sand and fine gravel at 40' to 45'	11SS 35-36.5 ft 7-6-2 (8) 100%					
925.0	45		12SS 40-41.5 ft 3-4-6 (10) 100%					
920.0	50	(46.0, 52.5) Interbedded layers/lenses of Brown, Moist CLAY and SILTY fine to medium SAND	13SS 45-46.5 ft 6-6-7 (13) 50%					
			14SS 50-51.5 ft 6-10-12 (22) 100%	109.1		Qp=1.75-2.5		

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 4 ft.
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-5 Page 3 of 4
BORING LOCATION: N:767923, E: 12895917, Sta 1532+57, Offset 11.6 Rt.
METHOD OF DRILLING: 4.25 HSA to 35'; 3-7/8" Mud Rotary to 80'
GROUND ELEVATION: 967.7
NOTES: Silt Fence Installed
 SPT's with AWJ Rod, W.O.R. = Weight of Rods

DATE DRILLED: 6-3-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: Bob Clark/ Ray Farve
DRILL RIG: Diedrich D-90, ATV
LOGGED BY: Bob Clark/Mike Carpenter
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
915.0		(52.5, 64.0) Stiff to Very Stiff, Grayish Brown, Moist, CLAY, Trace of fine to medium Sand						
	55			15SS 55-56.5 ft 14-13-15 (28) 40%	16.3	138.6	Qu=1.28	
910.0								
	60			1ST 60-62 ft 100%	25.0	128.8	Qu=1.70	
905.0								
	65	(64.0, 80.0) Medium Dense, Brown, Wet, fine to coarse SAND with fine to coarse Gravel; Occasional Gravel Lenses						
				16SS 65-66.5 ft 9-10-9 (19) 40%				
900.0								
	70							2 SPT Attempts @70' No Sample, due to fall back from Gravel
895.0								
	75			17SS 75-75.7 ft 14-6/3" 100%				1 SPT Attempt at 75' Coarse Gravel unable to wash out, Good Blow Counts last 9"
890.0								

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 4 ft.
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-5 Page 4 of 4
BORING LOCATION: N:767923, E: 12895917, Sta 1532+57, Offset 11.6 Rt.
METHOD OF DRILLING: 4.25 HSA to 35'; 3-7/8" Mud Rotary to 80'
GROUND ELEVATION: 967.7
NOTES: Silt Fence Installed
 SPT's with AWJ Rod, W.O.R. = Weight of Rods

DATE DRILLED: 6-3-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: Bob Clark/ Ray Farve
DRILL RIG: Diedrich D-90, ATV
LOGGED BY: Bob Clark/Mike Carpenter
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
	80	Boring terminated due to coarse gravel lenses collapsing	•••					

GROUNDWATER OBSERVATIONS

⊘ DURING DRILLING: 4 ft.
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-6 Page 1 of 4
BORING LOCATION: N: 767853, E: 12895936, Sta 1533+27, Offset 8.0 Lt.
METHOD OF DRILLING: 4.25' HSA to 36', 3-1/8" Mud Rotary
GROUND ELEVATION: 966.9
NOTES: W.O.H.-Weight of Hammer, Silt Fence Installed

DATE DRILLED: 6-30-10 to 7-1-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: Mark Allen/JRL
DRILL RIG: Brat 22R
LOGGED BY: MLD
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
965.0	0.0 - 1.1	ASPHALT (13")						
	1.1 - 3.0	Dark Brown, Moist Gravel (FILL)						
	3.0 - 4.0	Grayish Brown, Moist, SILTY CLAY (FILL)						
	4.0 - 8.0	Medium Dense, Brown, Wet, GRAVEL with Sand (FILL)		1SS 3.5-5 ft 3-7-6 (13) 60%				
960.0	8.0 - 19.5	Very Soft, Black, Moist, Fibrous PEAT		2SS 8.5-10 ft 2-1-1 (2) 10%				
955.0				3SS 13.5-15 ft 1-1-0 (1) 30%				
950.0				4SS 18.5-20 ft W.O.H. 60%				
945.0	19.5 - 30.0	Very Soft, Black to Gray, Very Moist, SILTY PEATY MARL; Trace shells and woody fibers		5SS 23.5-25 ft W.O.H. 70%				

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 4 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Auger Cuttings, Bentonite Slurry/Chips, Cold Patch

*LL = Liquid Limit - PI = Plasticity Index
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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-6 Page 2 of 4
BORING LOCATION: N: 767853, E: 12895936, Sta 1533+27, Offset 8.0 Lt.
METHOD OF DRILLING: 4.25' HSA to 36', 3-1/8" Mud Rotary
GROUND ELEVATION: 966.9
NOTES: W.O.H.-Weight of Hammer, Silt Fence Installed

DATE DRILLED: 6-30-10 to 7-1-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: Mark Allen/JRL
DRILL RIG: Brat 22R
LOGGED BY: MLD
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
940.0								
	30	(30.0, 44.0) Medium Dense, Brown, Wet, fine to medium SAND; Trace Silt and fine Gravel		6SS 28.5-30 ft W.O.H. 80%				
935.0	35		7SS 33.5-35 ft 4-6-7 (13) 60%					
930.0	40	(44.0, 54.8) Medium Dense, Brown, Very Moist, fine SILTY SAND; Trace fine Gravel		8SS 38.5-40 ft 7-6-5 (11) 60%				
925.0	45		9SS 43.5-45 ft 4-6-7 (13) 50%					
920.0	50			10SS 48.5-50 ft 3-5-7 (12) 50%				
915.0								

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 4 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Auger Cuttings, Bentonite Slurry/Chips, Cold Patch

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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-6 Page 3 of 4
BORING LOCATION: N: 767853, E: 12895936, Sta 1533+27, Offset 8.0 Lt.
METHOD OF DRILLING: 4.25' HSA to 36', 3-1/8" Mud Rotary
GROUND ELEVATION: 966.9
NOTES: W.O.H.-Weight of Hammer, Silt Fence Installed

DATE DRILLED: 6-30-10 to 7-1-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: Mark Allen/JRL
DRILL RIG: Brat 22R
LOGGED BY: MLD
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
915.0								
	55	(54.8, 57.5) Dark Gray, Moist, SILTY CLAY; Trace Sands and fine Gravel		11SS 53.5-55 ft 5-9-6 (15) 60%	22.7			Qp=2.5
910.0		(57.5, 61.0) Medium Dense, Brown, Wet, SILTY fine SAND; Trace fine Gravel		12SS 58.5-60 ft 4-8-10 (18) 50%				
905.0		(61.0, 64.0) Stiff, Grayish Brown, Moist CLAY; Trace fine Gravel		13SS 63.5-65 ft 5-8-14 (22) 80%				Qp=2.0
900.0		(64.0, 69.5) Medium Dense, Brown, Wet, fine to coarse SAND; Trace fine Gravel		14SS 68.5-70 ft 6-10-13 (23) 70%				
895.0		(73.0, 75.0) Stiff, Brown, Moist, CLAY; Trace fine Gravel		15SS 73.5-75 ft 4-6-7 (13) 50%	17			Qp=1-1.5
890.0		(75.0, 78.5) Medium Dense, Gray, Wet, SILT						

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 4 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Auger Cuttings, Bentonite Slurry/Chips, Cold Patch

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 *St = Hand Torvane Shear Strength
 *Qp = Pocket Penetrometer
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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-6 Page 4 of 4
BORING LOCATION: N: 767853, E: 12895936, Sta 1533+27, Offset 8.0 Lt.
METHOD OF DRILLING: 4.25' HSA to 36', 3-1/8" Mud Rotary
GROUND ELEVATION: 966.9
NOTES: W.O.H.-Weight of Hammer, Silt Fence Installed

DATE DRILLED: 6-30-10 to 7-1-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: Mark Allen/JRL
DRILL RIG: Brat 22R
LOGGED BY: MLD
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
885.0	80	(78.5, 87.5) Medium Dense, Brown, Wet, fine to medium SAND Driller noted gravel layer 82-83 ft		16SS 78.5-80 ft. 6-10-12 (22) 70%				
880.0	85			17SS 83.5-85 ft 5-6-8 (14) 50%				
875.0	90	(87.5, 100.0) Loose to Medium Dense, Brown, Wet, fine to coarse GRAVEL; Occasional Sand Lenses		18SS 88.5-90 ft 4-3-4 (7) 30%				
870.0	95			19SS 93.5-95 ft 3-3-4 (7) 40%				
100	100			20SS 98.5-100 ft 4-5-7 (12) 60%				

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 4 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Auger Cuttings, Bentonite Slurry/Chips, Cold Patch

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CLIENT & PROJECT: URS, M-20 over Schrader Creek

DATE DRILLED: 6-16-10 to 6-18-10

BORING NO.: B-7

Page 1 of 4

JOB NUMBER: 22621.00005

BORING LOCATION: N: 767783, E: 12895918, Sta 1533+97, Offset 9.4 Rt.

DRILLER/HELPER: Bob Clark/Ray Farve

METHOD OF DRILLING: 4.25" HSA to 70', 3-7/8" Mud Rot. to 100', Auto Hamm.

DRILL RIG: Diedrich D-90, ATV

GROUND ELEVATION: 966.7

LOGGED BY: MAC - CDJ

NOTES: Augers @ 40', Water at 0.5' above road surface on 6-17.

TWP: Morton **COUNTY:** Mecosta

W.O.R. - Weight of Rods, Installed Silt Fence

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
965.0	0.0	(0.0, 1.3) ASPHALT (15.5")						Water flowing at 40 to 50 gpm on 6-18-10. Hole was drilled to 100'.
	1.3	(1.3, 2.1) Aggregate Base						
	2.1	(2.1, 3.3) Dark Brown, fine to coarse SAND (FILL)						
	3.3	(3.3, 8.0) Medium Dense, Dark Brownish Gray, Moist to Wet, SILTY SAND with fine Gravel (FILL)		1SS 5-6.5 ft 2-6-18 (24) 60%				
960.0	8.0	(8.0, 37.0) Very Soft, Black, Very Moist, Fibrous to Amorphous PEAT; Occasional Wood						
	10.0			2SS 10-11.5 ft 3-5-1 (6) 0%				
955.0	12.5			3SS 12.5-14 ft 6-3-1 (4) 0%				
	15.0			4SS 15-16.5 ft 2-1-1 (2) 5%	134.5			
950.0	20.0			5SS 20-21.5 ft 1-1-0 (1) 5%	180.2			
945.0	25.0			6SS 25-26.5 ft 1-0-0 (0)	56.3			

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 3 ft
 ⚡ AT COMPLETION OF DRILLING: NR
 ⚡ AFTER 18
 HOURS: 0.5' above road
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

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CLIENT & PROJECT: URS, M-20 over Schrader Creek

DATE DRILLED: 6-16-10 to 6-18-10

BORING NO.: B-7

Page 2 of 4

JOB NUMBER: 22621.00005

BORING LOCATION: N: 767783, E: 12895918, Sta 1533+97, Offset 9.4 Rt.

DRILLER/HELPER: Bob Clark/Ray Farve

METHOD OF DRILLING: 4.25" HSA to 70', 3-7/8" Mud Rot. to 100', Auto Hamm.

DRILL RIG: Diedrich D-90, ATV

GROUND ELEVATION: 966.7

LOGGED BY: MAC - CDJ

NOTES: Augers @ 40', Water at 0.5' above road surface on 6-17.

TWP: Morton **COUNTY:** Mecosta

W.O.R. - Weight of Rods, Installed Silt Fence

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
940.0								
	30			7SS 30-31.5 ft W.O.R. 100%	130.8			
935.0								
	35			8SS 35-36.5 ft W.O.R. 100%	146.4			
930.0		(37.0, 41.0) Very Loose, Gray, Wet, fine to medium SAND		9SS 37.5-39 ft W.O.R. 20%				
	40			10SS 40-41.5 ft 10-20-16 (36) 60%				
925.0		(41.0, 46.0) Dense, medium to coarse SAND with fine to coarse Gravel		11SS 45-46.5 ft 19-12-15 (27) 50%				
	45			12SS 50-51.5 ft 13-15-7 (22) 70%				
920.0		(46.0, 52.0) Medium Dense, Brown, Wet, fine to coarse SAND with Gravel; Occasional Gray Silt Lenses						
	50							
915.0								

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 3 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER 18
 HOURS: 0.5' above road
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

*LL = Liquid Limit - PI = Plasticity Index
 *St = Hand Torvane Shear Strength
 *Qp = Pocket Penetrometer
 *Qu = Unconfined Compression Machine



SOIL BORING LOG

One Madison Ave
 Cadillac, MI 49601
 231-775-7755
 231-775-3135 fax

CLIENT & PROJECT: URS, M-20 over Schrader Creek

DATE DRILLED: 6-16-10 to 6-18-10

BORING NO.: B-7

Page 3 of 4

JOB NUMBER: 22621.00005

BORING LOCATION: N: 767783, E: 12895918, Sta 1533+97, Offset 9.4 Rt.

DRILLER/HELPER: Bob Clark/Ray Farve

METHOD OF DRILLING: 4.25" HSA to 70', 3-7/8" Mud Rot. to 100', Auto Hamm.

DRILL RIG: Diedrich D-90, ATV

GROUND ELEVATION: 966.7

LOGGED BY: MAC - CDJ

NOTES: Augers @ 40', Water at 0.5' above road surface on 6-17.

TWP: Morton **COUNTY:** Mecosta

W.O.R. - Weight of Rods, Installed Silt Fence

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
		(52.0, 70.5) Stiff, Gray, Moist, CLAY; Gray, Wet Sand Lens at 57 ft						
910.0	55			13SS 55-56.5 ft 8-6-7 (13) 10%	20.3		Qp=1.5	
905.0	60			14SS 60-61.5 ft 5-5-6 (11) 20%	19.5		Qp=1.5	
900.0	65	Frequent Sand Lenses at 65'-70.5'		15SS 65-66.5 ft 7-7-8 (15) 60%	19.3		Qp=1.25	
895.0	70	(70.5, 73.0) Medium Stiff, Gray, Very Moist, SANDY CLAY		16SS 70-71.5 ft 3-4-4 (8) 50%	17.7		Qp=0.5	
890.0	75	(73.0, 79.0) Medium Dense, Gray, Wet, fine to coarse SAND with fine Gravel		17SS 75-77 ft 11-13-13-12 (26)				

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 3 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER 18
 HOURS: 0.5' above road
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

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CLIENT & PROJECT: URS, M-20 over Schrader Creek

DATE DRILLED: 6-16-10 to 6-18-10

BORING NO.: B-7

Page 4 of 4

JOB NUMBER: 22621.00005

BORING LOCATION: N: 767783, E: 12895918, Sta 1533+97, Offset 9.4 Rt.

DRILLER/HELPER: Bob Clark/Ray Farve

METHOD OF DRILLING: 4.25" HSA to 70', 3-7/8" Mud Rot. to 100', Auto Hamm.

DRILL RIG: Diedrich D-90, ATV

GROUND ELEVATION: 966.7

LOGGED BY: MAC - CDJ

NOTES: Augers @ 40', Water at 0.5' above road surface on 6-17.

TWP: Morton **COUNTY:** Mecosta

W.O.R. - Weight of Rods, Installed Silt Fence

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
885.0	80	(79.0, 91.0) Very Dense, Light Brown, Wet, fine to medium SAND with fine Gravel; Occasional Sandy Clay Lens		18SS 80-82 ft 12-19-23-27 (42) 30%				
880.0	85			19SS 85-87 ft 8-9-10-16 (26) 100%			Qp=0.25	
875.0	90	(91.0, 94.0) Medium Dense, Gray, Wet, CLAYEY SAND		20SS 90-92 ft 10-9-14-20 (23) 50%	20.5		Qp=0.25	
870.0	95	(94.0, 97.0) Driller Reports Stratified Lenses or Layers of CLAY and SAND		21SS 95-97 ft 12-10-7-4 (17) 0%				
100		(97.0, 100.0) Driller Reports fine to coarse GRAVEL						No SS sample due to Gravel layer collapsing

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 3 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER 18
 HOURS: 0.5' above road
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

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SOIL BORING LOG

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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-8 Page 1 of 4
BORING LOCATION: N: 767716, E: 12895935, Sta 1534+64, Offset 8.1 Lt.
METHOD OF DRILLING: 4.25' HSA to 43.5 ft, 3-1/8" Mud Rotary
GROUND ELEVATION: 966.9
NOTES: Installed Silt Fence, W.O.H.-Weight of Hammer
 W.O.R.-Weight of Rods

DATE DRILLED: 6-29-10 and 6-30-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: Mark Allen/JRL
DRILL RIG: Brat 22R
LOGGED BY: MLD
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
965.0	0.0 - 0.6	ASPHALT (8")						
965.0	0.6 - 2.0	AGGREGATE / ASPHALT MILLINGS						
	2.0 - 3.5	Dark Brown to Black, Moist, fine SAND; Trace Silt, Organics and fine Gravel (FILL)		1SS 3.5-5 ft 5-8-8 (16) 10%				
960.0	3.5 - 14.0	Medium Dense to Very Loose, Dark Brown, Wet, fine SAND; Trace Silt and fine Gravel (FILL)						
955.0	8.5 - 10			2SS 8.5-10 ft 3-2-2 (4) 60%				
950.0	14.0 - 24.0	Very Soft, Black, Moist PEAT		3SS 13.5-15 ft 1-1-0 (1) 40%				
945.0	18.5 - 20			4SS 18.5-20 ft W.O.H. 30%				
	23.5 - 25	Very Soft, Dark Gray to Gray, Very Moist, SILTY MARL; Trace Sand and Organics		5SS 23.5-25 ft W.O.R. 80%				

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 3.5 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Auger Cuttings, Bentonite Slurry/Chips, Cold Patch

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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-8 Page 2 of 4
BORING LOCATION: N: 767716, E: 12895935, Sta 1534+64, Offset 8.1 Lt.
METHOD OF DRILLING: 4.25' HSA to 43.5 ft, 3-1/8" Mud Rotary
GROUND ELEVATION: 966.9
NOTES: Installed Silt Fence, W.O.H.-Weight of Hammer
 W.O.R.-Weight of Rods

DATE DRILLED: 6-29-10 and 6-30-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: Mark Allen/JRL
DRILL RIG: Brat 22R
LOGGED BY: MLD
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
940.0								
	30			6SS 28.5-30 ft W.O.H. 70%				
935.0								
	35			7SS 33.5-35 ft W.O.H. 70%				
930.0								
	40			8SS 38.5-40 ft W.O.H. 80%				
925.0								
	45	(44.5, 63.0) Medium Dense, Brown, Wet, fine SAND; Trace Silt and fine Gravel		9SS 43.5-45 ft 1-0-3 (3) 80%				
920.0		Driller Report fine to coarse GRAVEL Layer at 45 to 46 ft						
	50			10SS 48.5-50 ft 4-7-8 (15) 50%				
915.0								

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 3.5 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Auger Cuttings, Bentonite Slurry/Chips, Cold Patch

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 *Qp = Pocket Penetrometer
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SOIL BORING LOG

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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-8 Page 3 of 4
BORING LOCATION: N: 767716, E: 12895935, Sta 1534+64, Offset 8.1 Lt.
METHOD OF DRILLING: 4.25' HSA to 43.5 ft, 3-1/8" Mud Rotary
GROUND ELEVATION: 966.9
NOTES: Installed Silt Fence, W.O.H.-Weight of Hammer
 W.O.R.-Weight of Rods

DATE DRILLED: 6-29-10 and 6-30-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: Mark Allen/JRL
DRILL RIG: Brat 22R
LOGGED BY: MLD
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
915.0								
	55			11SS 53.5-55 ft 4-6-7 (13) 50%				
910.0								
	60			12SS 58.5-60 ft 4-5-7 (12) 40%				
905.0		(63.0, 76.5) Very Stiff to Hard, Grayish Brown, Moist, CLAY						
	65			13SS 63.5-65 ft 2-4-6 (10) 70%	21.6	128.3	Qu=1.27	
900.0								
	70			14SS 68.5-70 ft 3-4-6 (10) 60%	24.0		Qp=2.5-3	
895.0								
	75			15SS 73.5-75 ft 4-5-6 (11) 80%	22.9		Qp=3-3.5	
890.0		(76.5, 78.0) Driller noted SAND with Gravel						

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 3.5 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Auger Cuttings, Bentonite Slurry/Chips, Cold Patch

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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-8 Page 4 of 4
BORING LOCATION: N: 767716, E: 12895935, Sta 1534+64, Offset 8.1 Lt.
METHOD OF DRILLING: 4.25' HSA to 43.5 ft, 3-1/8" Mud Rotary
GROUND ELEVATION: 966.9
NOTES: Installed Silt Fence, W.O.H.-Weight of Hammer
 W.O.R.-Weight of Rods

DATE DRILLED: 6-29-10 and 6-30-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: Mark Allen/JRL
DRILL RIG: Brat 22R
LOGGED BY: MLD
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
885.0	78.0	(78.0, 84.5) Loose to Medium Dense, Brown, Wet, fine to coarse GRAVEL with Sand	Gravel	16SS 78.5-80 ft 4-5-4 (9) 50%				
880.0	84.5	(84.5, 100.0) Medium Dense, Brown, Wet, fine SAND	Sand	17SS 83.5-85 ft 5-6-6 (12) 60%				
875.0	88.5		Sand	18SS 88.5-90 ft 7-6-8 (14) 50%				
870.0	93.5		Sand	19SS 93.5-95 ft 6-6-8 (14) 70%				
100	98.5		Sand	20SS 98.5-100 ft 4-6-6 (12) 70%				

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 3.5 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Auger Cuttings, Bentonite Slurry/Chips, Cold Patch

*LL = Liquid Limit - PI = Plasticity Index
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SOIL BORING LOG

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CLIENT & PROJECT: URS, M-20 over Schrader Creek

DATE DRILLED: 7-19-10

BORING NO.: B-9

Page 1 of 4

JOB NUMBER: 22621.00005

BORING LOCATION: N: 767637, E: 12895911 - Sta 1535+43, Offset 15.6 Rt.

DRILLER/HELPER: DY/WP

METHOD OF DRILLING: 4.25" HSA to 32', 3-7/8" Tri Cone Mud Rotary to 92.5'

DRILL RIG: CME 75

GROUND ELEVATION: 967.4

LOGGED BY: CDJ

NOTES: NWJ Rods, Installed Silt Fence

TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
965.0	0	(0.0, 0.5) ASPHALT						
965.0	0.5	(0.5, 8.5) Brownish Gray, Moist to Wet SAND with Gravel (FILL)						
960.0	5							
955.0	10	(8.5, 19.0) Black, Moist, Amorphous PEAT						
950.0	15							
945.0	20	(19.0, 28.0) Gray, Wet MARL						
	25							

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 4 ft.
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Bentonite Groute/Chips, Gravel, Cold Patch

*LL = Liquid Limit - PI = Plasticity Index
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CLIENT & PROJECT: URS, M-20 over Schrader Creek

DATE DRILLED: 7-19-10

BORING NO.: B-9

Page 3 of 4

JOB NUMBER: 22621.00005

BORING LOCATION: N: 767637, E: 12895911 - Sta 1535+43, Offset 15.6 Rt.

DRILLER/HELPER: DY/WP

METHOD OF DRILLING: 4.25" HSA to 32', 3-7/8" Tri Cone Mud Rotary to 92.5'

DRILL RIG: CME 75

GROUND ELEVATION: 967.4

LOGGED BY: CDJ

NOTES: NWJ Rods, Installed Silt Fence

TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
915.0								
	55							
910.0								
	60							
905.0				4SS 61-62.5 ft 3-4-5 (9) 5%				
	65							
900.0								
	70							
895.0				5SS 71-72.5 ft 4-4-6 (10) 40%				
	75							
890.0		(76.0, 79.0) Grayish Brown, Wet, fine to coarse SAND; Occasional Lenses of Gravel						

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 4 ft.
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Bentonite Groute/Chips, Gravel, Cold Patch

*LL = Liquid Limit - PI = Plasticity Index
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CLIENT & PROJECT: URS, M-20 over Schrader Creek

DATE DRILLED: 7-19-10

BORING NO.: B-9

Page 4 of 4

JOB NUMBER: 22621.00005

BORING LOCATION: N: 767637, E: 12895911 - Sta 1535+43, Offset 15.6 Rt.

DRILLER/HELPER: DY/WP

METHOD OF DRILLING: 4.25" HSA to 32', 3-7/8" Tri Cone Mud Rotary to 92.5'

DRILL RIG: CME 75

GROUND ELEVATION: 967.4

LOGGED BY: CDJ

NOTES: NWJ Rods, Installed Silt Fence

TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
880.0	80	(79.0, 92.5) Medium Dense, Grayish Brown, Wet, fine to coarse GRAVEL		6SS 81-82.5 ft 5-5-6 (11) 10%				
875.0	90	Boring Terminated due to time constraints		7SS 91-92.5 ft 8-8-9 (17) 20%				

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 4 ft.
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Bentonite Groute/Chips, Gravel, Cold Patch

*LL = Liquid Limit - PI = Plasticity Index
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SOIL BORING LOG

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CLIENT & PROJECT: URS, M-20 over Schrader Creek

DATE DRILLED: 6-28-10

BORING NO.: B-10

Page 1 of 4

JOB NUMBER: 22621.00005

BORING LOCATION: N: 767571, E: 12895935, Sta 1536+09, Offset 9.3 Lt.

DRILLER/HELPER: Bob Clark, Ray Favre

METHOD OF DRILLING: 4.25' HSA to 60 ft, 3-7/8" Mud Rotary, Auto Hammer

DRILL RIG: Diedrich D-90

GROUND ELEVATION: 968.7

LOGGED BY: MAC-BC

NOTES: Installed Silt Fence, W.O.R. - Weight of Rods

TWP: Morton **COUNTY:** Mecosta

NWJ Rods Starting at 60'

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
968.7	0.0	(0.0, 0.8) ASPHALT (10")						
	0.8	(0.8, 1.2) AGGREGATE						
965.0	1.2	(1.2, 5.0) Very Loose, Brown, Moist to Wet, SILTY fine SAND; Trace Gravel						
	5.0	(5.0, 7.0) Vvery Soft, Black, Moist PEAT; Occasional Marl Lenses	1SS	5-7 ft 1-0-1-0 (1) 15%				
960.0	7.0	(7.0, 25.5) Very Soft, Light Gray, Very Moist MARL						
	10.0		2SS	10-11.5 ft W.O.R. 100%				
955.0	15.0		3SS	15-16.5 ft W.O.R. 100%				
950.0	20.0		4SS	20-21.5 ft W.O.R. 100%				
945.0	25.0		5SS	25-26.5 ft 5-6-8 (14)				
	25.5	(25.5, 31.0) Medium Dense, Gray, Wet SAND with Silt;						

GROUNDWATER OBSERVATIONS

∅ DURING DRILLING: 3.5 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Auger Cuttings, Bentonite Slurry/Chips, Cold Patch

*LL = Liquid Limit - PI = Plasticity Index
 *St = Hand Torvane Shear Strength
 *Qp = Pocket Penetrometer
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CLIENT & PROJECT: URS, M-20 over Schrader Creek

DATE DRILLED: 6-28-10

BORING NO.: B-10

Page 2 of 4

JOB NUMBER: 22621.00005

BORING LOCATION: N: 767571, E: 12895935, Sta 1536+09, Offset 9.3 Lt.

DRILLER/HELPER: Bob Clark, Ray Favre

METHOD OF DRILLING: 4.25' HSA to 60 ft, 3-7/8" Mud Rotary, Auto Hammer

DRILL RIG: Diedrich D-90

GROUND ELEVATION: 968.7

LOGGED BY: MAC-BC

NOTES: Installed Silt Fence, W.O.R. - Weight of Rods

TWP: Morton **COUNTY:** Mecosta

NWJ Rods Starting at 60'

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
940.0	30	Occasional Silty Marl Lenses	Yellow dotted pattern	6SS 30-31.5 ft 4-2-3 (5) 70%				
935.0	35	(31.0, 36.5) Medium Stiff, Gray, Moist CLAY; Occasional lenses of Sand with Silt	Green diagonal lines	7SS 35-36.5 ft 4-5-5 (10) 70%	19.6			
930.0	40	(36.5, 46.3) Medium Dense, Gray, Wet, fine to medium SAND; Occasional to Frequent Lenses/Layers of Clay	Yellow dotted pattern	8SS 40-41.5 ft 7-8-8 (16) 10%	20.0			
925.0	45	(46.3, 48.5) Loose, Gray, Wet, fine to coarse GRAVEL with Sand	Yellow dotted pattern with circles	9SS 45-46.5 ft 4-3-3 (6) 100%	18.6	127.5	Qu=0.76	2 gpm artesian flow at 45'
920.0	50	(48.5, 49.5) Medium Stiff, Gray, Moist CLAY	Green diagonal lines					
		(49.5, 60.0) Loose, Gray, Wet, fine to coarse SAND with fine Gravel; Occasional lenses of Clay	Yellow dotted pattern	10SS 50-51.5 ft 3-5-4 (9) 100%	11.9			

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 3.5 ft
 ⚡ AT COMPLETION OF DRILLING: NR
 ⚡ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Auger Cuttings, Bentonite Slurry/Chips, Cold Patch

*LL = Liquid Limit - PI = Plasticity Index
 *St = Hand Torvane Shear Strength
 *Qp = Pocket Penetrometer
 *Qu = Unconfined Compression Machine



SOIL BORING LOG

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CLIENT & PROJECT: URS, M-20 over Schrader Creek

DATE DRILLED: 6-28-10

BORING NO.: B-10

Page 3 of 4

JOB NUMBER: 22621.00005

BORING LOCATION: N: 767571, E: 12895935, Sta 1536+09, Offset 9.3 Lt.

DRILLER/HELPER: Bob Clark, Ray Favre

METHOD OF DRILLING: 4.25' HSA to 60 ft, 3-7/8" Mud Rotary, Auto Hammer

DRILL RIG: Diedrich D-90

GROUND ELEVATION: 968.7

LOGGED BY: MAC-BC

NOTES: Installed Silt Fence, W.O.R. - Weight of Rods

TWP: Morton **COUNTY:** Mecosta

NWJ Rods Starting at 60'

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
915.0	55							No SS at 55' due to artesian flow
910.0	60	(60.0, 72.0) Medium Dense, Gray, Wet, fine to medium SAND; Occasional Gravel and Clay Lenses		11SS 60-61.5 ft 7-9-11 (20) 60%				
905.0	65			12SS 65-66.5 ft 8-6-7 (13) 20%				
900.0	70			13SS 70-71.5 ft 4-6-7 (13) 10%				
895.0	75	(72.0, 77.0) Loose, Gray, Wet, fine to coarse SAND with Gravel		14SS 75-76.5 ft 5-3-6 (9) 20%				
		(77.0, 90.0) fine to coarse SAND, Occasional gravel and clay lenses						

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 3.5 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Auger Cuttings, Bentonite Slurry/Chips, Cold Patch

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CLIENT & PROJECT: URS, M-20 over Schrader Creek

DATE DRILLED: 6-28-10

BORING NO.: B-10

Page 4 of 4

JOB NUMBER: 22621.00005

BORING LOCATION: N: 767571, E: 12895935, Sta 1536+09, Offset 9.3 Lt.

DRILLER/HELPER: Bob Clark, Ray Favre

METHOD OF DRILLING: 4.25' HSA to 60 ft, 3-7/8" Mud Rotary, Auto Hammer

DRILL RIG: Diedrich D-90

GROUND ELEVATION: 968.7

LOGGED BY: MAC-BC

NOTES: Installed Silt Fence, W.O.R. - Weight of Rods

TWP: Morton **COUNTY:** Mecosta

NWJ Rods Starting at 60'

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
890.0	80	Hole categorized based on wash rotary cuttings and driller observations from 77' to 100'-No SS due to upper hole collapsing.						
885.0	85							
880.0	90	(90.0, 97.0) fine to medium GRAVEL with Sand						
875.0	95							
870.0	100	(97.0, 100.0) fine to coarse SAND						

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 3.5 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Auger Cuttings, Bentonite Slurry/Chips, Cold Patch

*LL = Liquid Limit - PI = Plasticity Index
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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-11 Page 1 of 1
BORING LOCATION: N: 767527, E: 12895913, Sta 1536+53, Offset 12.3 Rt.
METHOD OF DRILLING: 3.25 inch HSA, Auto Hammer
GROUND ELEVATION: 969.5
NOTES:

DATE DRILLED: 6-14-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: Bob Clark/Ray Farve
DRILL RIG: Diedrich D-90, ATV
LOGGED BY: Bob Clark
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
	0	(0.0, 0.5) ASPHALT (6")						
	0.5	(0.5, 0.9) AGGREGATE						
	0.9	(0.9, 3.0) Very Loose, Brown, Moist, fine SAND (Fill)		1SS 2.5-4 ft 6-3-3 (6) 65%				
965.0	5	(3.0, 5.0) WOOD and PEAT		2SS 5-6.5 ft 2-1-1 (2) 30%				
	5.0	(5.0, 13.5) Very Soft, Gray, Very Moist MARL with Lenses/Layers of Peat Wood		3SS 7.5-9 ft 1-18" 100%	136.6			
960.0	10			4SS 10-11.5 ft 1-0-1 (1) 80%	61			
	10			5SS 12.5-14 ft 1-2-3 (5) 100%				
955.0	15	(13.5, 21.5) Loose to Medium Dense, Gray, Wet, fine SAND with Silt		6SS 15-16.5 ft 3-3-3 (6) 100%				
	15			7SS 17.5-19 ft 4-8-8 (16) 100%				
950.0	20			8SS 20-21.5 ft 10-5-6 (11)				

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 5 ft.
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Cold Patch

*LL = Liquid Limit - PI = Plasticity Index
 *St = Hand Torvane Shear Strength
 *Qp = Pocket Penetrometer
 *Qu = Unconfined Compression Machine



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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-12 Page 1 of 1
BORING LOCATION: N: 767404, E: 12895917, Sta 1537+76, Offset 7.3 Rt.
METHOD OF DRILLING: 3.25" HSA, Auto Hammer
GROUND ELEVATION: 970.9
NOTES: Overcast, 55° - 74° F

DATE DRILLED: 6-14-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: Bob Clark/Ray Farve
DRILL RIG: Diedrich D-90, ATV
LOGGED BY: Bob Clark/Mike Carpenter
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
970.0	0	(0.0, 0.4) Asphalt (5")						
		(0.4, 0.8) AGGREGATE Base (5")						
		(0.8, 2.0) Light Brown, Moist, SILTY SAND; Trace fine Gravel (Fill)		1SS 2.5-4 ft 6-4-11 (15) 90%	15.6			
965.0	5	(2.0, 3.5) Medium Dense, Dark Brown, Moist, SILTY SAND; Frequent Wood Lenses		2SS 5-6.5 ft 4-7-6 (13) 90%				
		(3.5, 6.5) Medium Dense, Light Brown, Moist to Wet, fine to medium SAND						

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 5.5 ft.
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Cold Patch

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 *St = Hand Torvane Shear Strength
 *Qp = Pocket Penetrometer
 *Qu = Unconfined Compression Machine



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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-13 Page 1 of 1
BORING LOCATION: N: 767291, E: 12895930, Sta 1538+89, Offset 6.3 Lt.
METHOD OF DRILLING: 3.25" HSA, Auto Hammer
GROUND ELEVATION: 971.3
NOTES:

DATE DRILLED: 6-25-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: Bob Clark/Ray Farve
DRILL RIG: Diedrich D-90, ATV
LOGGED BY: Bob Clark and MAC
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
970.0	0	(0.0, 0.5) ASPHALT (5.5")						
		(0.5, 0.8) AGGREGATE						
		(0.8, 2.0) Brown, Moist, SILTY SAND with fine to medium Gravel (FILL)		1SS 2.5-4 ft 4-8-10 (18) 95%				
965.0	5	(2.0, 6.5) Medium Dense to Loose, Brown, Moist to Wet, fine to medium SAND		2SS 5-6.5 ft 5-3-4 (7) 65%				

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 4 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings - Cold Patch

*LL = Liquid Limit - PI = Plasticity Index
 *St = Hand Torvane Shear Strength
 *Qp = Pocket Penetrometer
 *Qu = Unconfined Compression Machine



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CLIENT & PROJECT: URS, M-20 over Schrader Creek

BORING NO.: B-14

Page 1 of 1

BORING LOCATION: N: 767193, E: 12895907, Sta 1539+87, Offset 16.1 Rt.

METHOD OF DRILLING: 3.25" HSA, Auto Hammer

GROUND ELEVATION: 970.5

NOTES:

DATE DRILLED: 6-14-10

JOB NUMBER: 22621.00005

DRILLER/HELPER: Bob Clark/Ray Farve

DRILL RIG: Diedrich D-90, ATV

LOGGED BY: Bob Clark/Mike Carpenter

TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
970.0	0	(0.0, 0.4) AGGREGATE Base (5")						
		(0.4, 1.0) Reddish Brown, Moist, CLAYEY SAND (FILL)						
		(1.0, 2.0) Light Brown, Moist, medium to coarse SAND; Trace of fine Gravel (FILL)		1SS 2.5-4 ft 7-1-4 (5) 60%	25.5			
965.0	5	(2.0, 2.5) Grayish Brown, Moist, SANDY CLAY with Gravel (FILL)		2SS 5-6.5 ft 1-4-6 (10) 10%				
		(2.5, 10.5) Loose, Gray, Moist to Wet, fine to medium SAND with Silt; Peat Lens at 3'		3SS 7.5-9 ft 2-3-6 (9) 45%				
960.0	10	(10.5, 12.0) Very Stiff, Grayish Brown, Moist CLAY		4SS 10-11.5 ft 5-3-7 (10) 50%	19.7		Qp=2.25	
		(12.0, 21.3) Medium Dense, Brown, Wet, fine to medium SAND		5SS 12.5-14 ft 7-11-8 (19) 50%				
955.0	15			5SS 15-16.5 ft 13-7-4 (11) 50%				
				6SS 17.5-19 ft 9-7-5 (12) 70%				
950.0	20	(21.3, 21.5) Stiff, Grayish Brown, Moist CLAY with Sand		6SS 20-21.5 ft 7-4-5 (9) 0%	20.3			

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 3.5 ft.
 ⚡ AT COMPLETION OF DRILLING: NR
 ⚡ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings

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 *Qu = Unconfined Compression Machine



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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-15 Page 1 of 4
BORING LOCATION: N: 767127, E: 12895932, Sta 1540+53, Offset 9.2 Lt.
METHOD OF DRILLING: 4.25" HSA, 3-7/8" Mud Rotary, Auto Hammer
GROUND ELEVATION: 970.0
NOTES: AWJ Rods to 60', NWJ 65' -100'
 Silt Fence Installed, W.O.R. - Weight of Rods

DATE DRILLED: 6-29-10 to 6-30-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: Bob Clark/Ray Farve
DRILL RIG: Diedrich D-90, ATV
LOGGED BY: Bob Clark/Mike Carpenter
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
970.0	0	(0.0, 0.9) ASPHALT (11")						
		(0.9, 1.2) Sandy Aggregate						
		(1.2, 3.5) Brown, Moist, Silty fine SAND (FILL)						
965.0	5	(3.5, 7.0) Very Soft, Black, Very Moist, amorphous to fibrous PEAT; Some wood material		1SS 5-6.5 ft 1-2-1 (3) 20%				
		(7.0, 10.5) Very Soft, Brown, Very Moist MARL						
960.0	10	(10.5, 13.5) Loose, Light Gray, Wet, fine to medium SAND; Occasional Gravel Lenses		2SS 10-11.5 ft 3-5-5 (10) 50%				
		(13.5, 15.0) Gray, Moist CLAY						
955.0	15	(15.0, 25.5) Medium Dense to Loose, Brown, Wet, fine to coarse SAND; Occasional Clay Lenses		3SS 15-16.5 ft 2-7-7 (14) 100%				
950.0	20			4SS 20-21.5 ft 3-5-6 (11) 100%				
945.0	25	(25.5, 31.4) Very Stiff, Gray, Moist CLAY; Occasional Gravel		5SS 25-26.5 ft 3-5-5 (10)	19.9		Qp=2.3	

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 6.5 ft
 ⚡ AT COMPLETION OF DRILLING: NR
 ⚡ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

*LL = Liquid Limit - PI = Plasticity Index
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 *Qp = Pocket Penetrometer
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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-15 Page 2 of 4
BORING LOCATION: N: 767127, E: 12895932, Sta 1540+53, Offset 9.2 Lt.
METHOD OF DRILLING: 4.25" HSA, 3-7/8" Mud Rotary, Auto Hammer
GROUND ELEVATION: 970.0
NOTES: AWJ Rods to 60', NWJ 65' -100'
 Silt Fence Installed, W.O.R. - Weight of Rods

DATE DRILLED: 6-29-10 to 6-30-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: Bob Clark/Ray Farve
DRILL RIG: Diedrich D-90, ATV
LOGGED BY: Bob Clark/Mike Carpenter
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
		Lenses						
940.0	30			6SS 30-31.5 ft 9-15-13 (28) 60%				Approximately 1 gallon/minute artesian flow at 31 ft
		(31.4, 41.0) Medium Dense, Light Brown, Wet, fine to coarse SAND; Occasional Clay Lenses						
935.0	35			7SS 35-36.5 ft 6-9-8 (17) 75%			Qp=0.75	
930.0	40			8SS 40-41.5 ft 7-10-11 (21) 75%			Qp=1.0	
		(41.0, 50.0) Medium Dense, Brown, Wet, fine GRAVEL; Occasional Clay Lenses						
925.0	45			9SS 45-46.5 ft 4-9-7 (16) 75%			Qp=0.75	
920.0	50			10SS 50-51.5 ft 8-9-11 (20) 50%	10.4		Qp=0.75	Approximately 4 gallon/minute artesian flow at 50 ft
		(50.0, 55.0) Medium Stiff, Gray, Wet CLAY with fine Gravel						

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 6.5 ft
 ⚡ AT COMPLETION OF DRILLING: NR
 ⚡ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-15 Page 3 of 4
BORING LOCATION: N: 767127, E: 12895932, Sta 1540+53, Offset 9.2 Lt.
METHOD OF DRILLING: 4.25" HSA, 3-7/8" Mud Rotary, Auto Hammer
GROUND ELEVATION: 970.0
NOTES: AWJ Rods to 60', NWJ 65' -100'
 Silt Fence Installed, W.O.R. - Weight of Rods

DATE DRILLED: 6-29-10 to 6-30-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: Bob Clark/Ray Farve
DRILL RIG: Diedrich D-90, ATV
LOGGED BY: Bob Clark/Mike Carpenter
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
915.0	55	(55.0, 57.0) Medium Dense, Brown, Wet, fine to coarse GRAVEL with Sand	Green diagonal lines	11SS 55-56.5 ft 10-8-8 (16) 60%				
		(57.0, 74.0) Medium Dense, Gray, Wet, fine to coarse SAND with fine Gravel; Occasional Gravel and Clay Lenses	Yellow dots	12SS 60-61.5 ft 7-7-7 (14) 50%				
910.0	60							
905.0	65			13SS 65-66.5 ft 6-10-13 (23) 5%				Drove Rock at 65 ft
900.0	70			14SS 70-71.5 ft 4-6-6 (12) 30%				
895.0	75	(74.0, 81.5) Medium Dense, Gray, Wet, fine to coarse GRAVEL with Sand; Occasional Clay Lenses	Green diagonal lines	15SS 75-76.5 ft 8-10-11 (21) 5%				Drove Rock at 75 ft

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 6.5 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-15 Page 4 of 4
BORING LOCATION: N: 767127, E: 12895932, Sta 1540+53, Offset 9.2 Lt.
METHOD OF DRILLING: 4.25" HSA, 3-7/8" Mud Rotary, Auto Hammer
GROUND ELEVATION: 970.0
NOTES: AWJ Rods to 60', NWJ 65' -100'
 Silt Fence Installed, W.O.R. - Weight of Rods

DATE DRILLED: 6-29-10 to 6-30-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: Bob Clark/Ray Farve
DRILL RIG: Diedrich D-90, ATV
LOGGED BY: Bob Clark/Mike Carpenter
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
890.0	80	(81.5, 86.0) Medium Dense, Brown, Wet, fine to medium SAND; Trace Gravel	16SS	80-81.5 ft 12-11-13 (24) 20%				
885.0	85	Driller Reports COBBLES at 84 ft						
880.0	90	(86.0, 101.5) Very Hard, Grayish Brown, Moist CLAY with Sand; Frequent Silt lenses 97 to 101.5 ft						
		No samples obtained at 85 to 95 ft due to caving of cobbles at 84 ft						
875.0	95							
870.0	100		17SS	100-101.5 ft 39-58-75 (133) 75%	18.7	133.1	Qu=1.63	Drove Rock at 17SS

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 6.5 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

*LL = Liquid Limit - PI = Plasticity Index
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 *Qp = Pocket Penetrometer
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CLIENT & PROJECT: URS, M-20 over Schrader Creek

DATE DRILLED: 6-14-10 to 6-16-10

BORING NO.: B-16

Page 1 of 4

JOB NUMBER: 22621.00005

BORING LOCATION: N: 767061, E: 12895913, Sta 1541+19, Offset 9.4 Rt.

DRILLER/HELPER: Bob Clark/Ray Farve

METHOD OF DRILLING: 4.25" HSA to 65', 3-7/8" Mud Rotary, Auto Hammer

DRILL RIG: Diedrich D-90, ATV

GROUND ELEVATION: 968.7

LOGGED BY: Bob Clark/Mike Carpenter

NOTES: W.O.R. - Weight of Rods, Installed Silt Fence

TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
968.7	0.0	(0.0, 1.2) ASPHALT (14")						
	1.2	(1.2, 1.6) AGGREGATE Base						
965.0	1.6	(1.6, 4.0) Light Grayish Brown, moist to wet, fine to coarse SAND with fine Gravel (Fill)			471.3			
	4.0	(4.0, 11.0) Very Soft, Black, Very Moist Fibrous PEAT; Occasional Wood		1SS 5-6.5 ft 2-1-0 0%				Wood in Sampler at 1SS & 2SS
960.0	7.5			2SS 7.5-9 ft 6-3-1 (4) 0%				
	10.0	(11.0, 20.5) Very Soft, Light Gray, Very Moist MARL		3SS 10-11.5 ft W.O.R. 10%	116.5			
955.0	15.0			4SS 15-16.5 ft 1-2-5 (7) 10%	35.9			
950.0	20.5	(20.5, 23.0) Loose, Light Gray, Wet, fine to medium SAND; Trace of Silt		5SS 20-21.5 ft 3-2-3 (5) 20%				
945.0	23.0	(23.0, 27.5) Loose, Light Gray, Wet, SILTY SAND with fine to coarse Gravel		6SS 25-26.5 ft 4-5-4 (9)				

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 2 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

*LL = Liquid Limit - PI = Plasticity Index
 *St = Hand Torvane Shear Strength
 *Qp = Pocket Penetrometer
 *Qu = Unconfined Compression Machine



SOIL BORING LOG

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 Cadillac, MI 49601
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 231-775-3135 fax

CLIENT & PROJECT: URS, M-20 over Schrader Creek

BORING NO.: B-16

Page 2 of 4

BORING LOCATION: N: 767061, E: 12895913, Sta 1541+19, Offset 9.4 Rt.

METHOD OF DRILLING: 4.25" HSA to 65', 3-7/8" Mud Rotary, Auto Hammer

GROUND ELEVATION: 968.7

NOTES: W.O.R. - Weight of Rods, Installed Silt Fence

DATE DRILLED: 6-14-10 to 6-16-10

JOB NUMBER: 22621.00005

DRILLER/HELPER: Bob Clark/Ray Farve

DRILL RIG: Diedrich D-90, ATV

LOGGED BY: Bob Clark/Mike Carpenter

TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
940.0	30	(27.5, 33.5) Stiff, Light Brown, Moist CLAY; Frequent Silt Lenses	Green diagonal hatching	7SS 30-31.5 ft 4-6-8 (14) 20%	18.9		Qp=1.0	
935.0	35	(33.5, 38.5) Loose, Light Brown, Wet SILTY SAND	Yellow dotted	8SS 35-36.5 ft 7-7-2 (9) 5%	18.7			
930.0	40	(38.5, 48.0) Medium Dense, Light Brown, Wet, fine to coarse SAND with fine Gravel	Yellow dotted	9SS 40-41.5 ft 7-8-8 (16) 20%				Approximately 1 gallon/minute artesian flow at 40.5 ft
925.0	45		Yellow dotted	10SS 45-46.5 ft 4-7-6 (13) 100%				
920.0	50	(48.0, 56.0) Medium Dense, Brown, Wet, coarse SAND with fine Gravel; Occasional Clay Lens	Yellow dotted	11SS 50-51.5 ft 12-14-10 (24) 90%				

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 2 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

*LL = Liquid Limit - PI = Plasticity Index
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CLIENT & PROJECT: URS, M-20 over Schrader Creek

BORING NO.: B-16

Page 3 of 4

BORING LOCATION: N: 767061, E: 12895913, Sta 1541+19, Offset 9.4 Rt.

METHOD OF DRILLING: 4.25" HSA to 65', 3-7/8" Mud Rotary, Auto Hammer

GROUND ELEVATION: 968.7

NOTES: W.O.R. - Weight of Rods, Installed Silt Fence

DATE DRILLED: 6-14-10 to 6-16-10

JOB NUMBER: 22621.00005

DRILLER/HELPER: Bob Clark/Ray Farve

DRILL RIG: Diedrich D-90, ATV

LOGGED BY: Bob Clark/Mike Carpenter

TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
915.0	55	(56.0, 57.0) Medium Dense, Brown, Wet, fine to coarse GRAVEL with Sand	[Yellow dotted pattern]	12SS 55-56.5 ft 9-15-11 (26) 70%				
910.0	60	(57.0, 78.0) Medium Dense, Light Brown, Wet, fine to coarse SAND with fine Gravel; Occasional Gravel Lenses/Layers		13SS 60-61.5 ft 11-14-11 (25) 90%				
905.0	65			14SS 65-67 ft 4-4-7-9 (16) 100%				
900.0	70			15SS 70-72 ft 5-6-7-7 (14) 90%				
895.0	75			16SS 75-77 ft 7-9-11-12 (23) 90%				

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 2 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

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CLIENT & PROJECT: URS, M-20 over Schrader Creek

BORING NO.: B-16

Page 4 of 4

BORING LOCATION: N: 767061, E: 12895913, Sta 1541+19, Offset 9.4 Rt.

METHOD OF DRILLING: 4.25" HSA to 65', 3-7/8" Mud Rotary, Auto Hammer

GROUND ELEVATION: 968.7

NOTES: W.O.R. - Weight of Rods, Installed Silt Fence

DATE DRILLED: 6-14-10 to 6-16-10

JOB NUMBER: 22621.00005

DRILLER/HELPER: Bob Clark/Ray Farve

DRILL RIG: Diedrich D-90, ATV

LOGGED BY: Bob Clark/Mike Carpenter

TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
890.0	80	(78.0, 85.5) Medium Dense, Light Brown, Wet, fine to medium SAND; Occasional fine Gravel Lens	Yellow dotted pattern	17SS 80-82 ft 5-7-11-14 (25) 90%				
885.0	85	(85.5, 88.0) Medium Dense, Light Brown, Wet, fine to coarse SAND with occasional fine Gravel Lenses	Yellow dotted pattern	18SS 85-87 ft 10-10-11-7 (18) 70%				
880.0	90	(88.0, 93.5) Medium Dense, Brown, Wet, fine GRAVEL with fine to coarse Sand	Yellow pattern with gravel symbols	19SS 90-92 ft 10-9-9-11 (20) 20%				
875.0	95	(93.5, 101.5) Very Hard, Grayish Brown, Moist CLAY	Green diagonal lines	20SS 95-96.5 ft 32-60-81 (141) 45%	20.8		Qp=4.5+	
870.0	100		Green diagonal lines	21SS 100-101.5 ft 51-70-87 (157) 5%	19.9			Drove Rock at 21SS

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 2 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-17 Page 1 of 4
BORING LOCATION: N: 766991, E: 12895932, Sta 1541+89, Offset 9.9 Lt.
METHOD OF DRILLING: 4.25' HSA to 36 ft /3-1/8" Mud Rotary
GROUND ELEVATION: 967.5
NOTES: Installed Silt Fence, W.O.H.- Weight of Hammer
 W.O.R.- Weight of Rods

DATE DRILLED: 6-28-10 to 6-29-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: Mark Allen/JRL
DRILL RIG: Brat 22R
LOGGED BY: MLD
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
0	(0.0, 0.7)	ASPHALT (8")						
965.0	(0.7, 3.0)	AGGREGATE / ASPHALT MILLINGS						
	(3.0, 4.0)	Loose, Brown, Moist, SANDY GRAVEL (FILL)						
	(4.0, 8.0)	Loose, Brown, Moist to Wet, fine SAND with Gravel (FILL)		1SS 3.5-5 ft 5-3-4 (7) 40%				
960.0	(8.0, 9.0)	Loose, Grayish Brown, Very Moist, fine SAND; Trace fine Gravel and Woody Fibers (FILL)						
	(9.0, 14.0)	Soft, Brown to Black, Moist PEAT		2SS 8.5-10 ft 1-5-2 (7) 30%				
955.0								
	(14.0, 29.5)	Very Soft, Light Brown, Very Moist SILTY MARL; Trace Sands and Woody Fibers		3SS 13.5-15 ft 1/9"-1/24" 80%				
950.0								
				4SS 18.5-20 ft W.O.H.				
945.0								
				5SS 23.5-25 ft W.O.R. 60%				

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 5 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Auger Cuttings, Bentonite Slurry/Chips, Cold Patch

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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-17 Page 2 of 4
BORING LOCATION: N: 766991, E: 12895932, Sta 1541+89, Offset 9.9 Lt.
METHOD OF DRILLING: 4.25' HSA to 36 ft /3-1/8" Mud Rotary
GROUND ELEVATION: 967.5
NOTES: Installed Silt Fence, W.O.H.- Weight of Hammer
 W.O.R.- Weight of Rods

DATE DRILLED: 6-28-10 to 6-29-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: Mark Allen/JRL
DRILL RIG: Brat 22R
LOGGED BY: MLD
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
940.0	30	(29.5, 34.0) Loose to Medium Dense, Brown, Wet, fine SAND; Trace Silt and fine Gravel	6SS	28.5-30 ft 3-4-3 (7) 90%				
935.0	35	(34.0, 44.0) Stiff, Reddish Brown, Moist to Very Moist CLAY; Trace fine Gravel	7SS	33.5-35 ft 3-5-6 (11) 80%	28.2		Qp=1-1.5	
930.0	40		8SS	38.5-40 ft 1-2-4 (6) 30%	35.0		Qp=1	
925.0	45	(44.0, 53.0) Loose, Brown, Wet, fine SILTY SAND; Occasional Clay and Gravel Lenses	9SS	43.5-45 ft 2-4-5 (9) 60%	21.0		Qp=1-2	
920.0	50		10SS	48.5-50 ft 2-3-3 (6) 40%				

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 5 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Auger Cuttings, Bentonite Slurry/Chips, Cold Patch

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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-17 Page 3 of 4
BORING LOCATION: N: 766991, E: 12895932, Sta 1541+89, Offset 9.9 Lt.
METHOD OF DRILLING: 4.25' HSA to 36 ft /3-1/8" Mud Rotary
GROUND ELEVATION: 967.5
NOTES: Installed Silt Fence, W.O.H.- Weight of Hammer
 W.O.R.- Weight of Rods

DATE DRILLED: 6-28-10 to 6-29-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: Mark Allen/JRL
DRILL RIG: Brat 22R
LOGGED BY: MLD
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
915.0		(53.0, 60.0) Very Loose to Loose, Brown, Wet, fine to coarse SAND with Gravel		11SS 53.5-55 ft 2-2-2 (4) 30%				
55								
910.0		(60.0, 95.0) Medium Dense, Brown, Wet, fine to coarse GRAVEL; Occasional Sand lenses/layers below 70 ft		12SS 58.5-60 ft 7-10-6 (16) 40%				
60								
905.0								
900.0		Gravel formation collapsed during sampling attempts from 70 to 95 ft. Hole characterized by wash cuttings and driller observations.		13SS 63.5-65 ft 4-9-6 (15) 60%				
65								
70								
895.0				1Wash Sample (WS) 68.5-70 ft				
75				2WS 73.5-75 ft				
890.0								

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 5 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Auger Cuttings, Bentonite Slurry/Chips, Cold Patch

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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-17 Page 4 of 4
BORING LOCATION: N: 766991, E: 12895932, Sta 1541+89, Offset 9.9 Lt.
METHOD OF DRILLING: 4.25' HSA to 36 ft /3-1/8" Mud Rotary
GROUND ELEVATION: 967.5
NOTES: Installed Silt Fence, W.O.H.- Weight of Hammer
 W.O.R.- Weight of Rods

DATE DRILLED: 6-28-10 to 6-29-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: Mark Allen/JRL
DRILL RIG: Brat 22R
LOGGED BY: MLD
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
880.0	78.5			3WS 78.5-80 ft				
885.0	83.5			4WS 83.5-85 ft				
880.0	88.5			5WS 88.5-90 ft				
875.0	93.5			6WS 93.5-95 ft				

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 5 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Auger Cuttings, Bentonite Slurry/Chips, Cold Patch

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CLIENT & PROJECT: URS, M-20 over Schrader Creek

BORING NO.: B-18

Page 1 of 4

BORING LOCATION: N: 766921, E: 12895911, Sta 1542+59, Offset 10.6 Rt.

METHOD OF DRILLING: 4.25" HSA to 45', 3-7/8" Mud Rotary from 45'-100'

GROUND ELEVATION: 966.7

NOTES: AWJ Rods to 45', NWJ starting at 50'

Mostly Sunny, 50°, Installed Silt Fence

DATE DRILLED: 6-8-10

JOB NUMBER: 22621.00005

DRILLER/HELPER: Bob Clark/Ray Farve

DRILL RIG: Diedrich D-90, ATV

LOGGED BY: MAC - CDJ

TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
965.0	0	(0.0, 1.8) Asphalt (21.5")						
965.0	1.8	(1.8, 2.6) Brown, moist GRAVEL - Aggregate Base (9.5")		1SS 2.5-4 ft 2-4-4 (8) 40%				
960.0	2.6	(2.6, 13.9) Loose to very loose, gray, wet, SILTY fine to medium SAND (FILL)		2SS 5-6.5 ft 0-2-1 (3) 50%				
955.0	10			3SS 10-11.5 ft 4-1-1 (2) 25%				
955.0	13.9	(13.9, 16.0) WOOD & SAND mixed (FILL)		4SS 12.5-14 ft 6-5-3 (8) 60%				
950.0	16.0	(16.0, 19.5) Brownish gray, wet, fine to medium SAND (Possible Fill)						
945.0	19.5	(19.5, 35.5) Very soft, black, wet, semi-fibrous PEAT; Frequent lenses of sand, some wood fragments		5SS 20-21.5 ft 8-8-6 (14) 0%				Driving wood at 5SS
945.0	25			6SS 25-26.5 ft 2-4-3 (7)	241.2			

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 2 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

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CLIENT & PROJECT: URS, M-20 over Schrader Creek

BORING NO.: B-18

Page 2 of 4

BORING LOCATION: N: 766921, E: 12895911, Sta 1542+59, Offset 10.6 Rt.

METHOD OF DRILLING: 4.25" HSA to 45', 3-7/8" Mud Rotary from 45'-100'

GROUND ELEVATION: 966.7

NOTES: AWJ Rods to 45', NWJ starting at 50'

Mostly Sunny, 50°, Installed Silt Fence

DATE DRILLED: 6-8-10

JOB NUMBER: 22621.00005

DRILLER/HELPER: Bob Clark/Ray Farve

DRILL RIG: Diedrich D-90, ATV

LOGGED BY: MAC - CDJ

TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
940.0								
	30			7SS 30-31.5 ft 2-2-2 (4) 40%		114.8		
935.0								
	35			8SS 35-36.5 ft 2-4-2 (6) 100%		110.5		
930.0		(35.5, 45.9) Loose to medium dense, light brown, wet, fine to medium SAND; Trace silt						
	40			9SS 40-41.5 ft 8-7-10 (17) 90%				
925.0								
	45			10SS 45-46.5 ft 8-8-9 (17) 10%		21.9	Qp=4.5	
920.0		(45.9, 46.4) Light brown, wet SANDY SILT						
	50			11SS 50-51.5 ft 6-8-9 (17) 90%		28.0	Qp=2.5-3.0	
915.0		(46.4, 54.0) Alternating layers/lenses of very stiff, brown clay and medium dense, brown, fine to medium SAND with Silt						

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 2 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

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CLIENT & PROJECT: URS, M-20 over Schrader Creek

BORING NO.: B-18

Page 3 of 4

BORING LOCATION: N: 766921, E: 12895911, Sta 1542+59, Offset 10.6 Rt.

METHOD OF DRILLING: 4.25" HSA to 45', 3-7/8" Mud Rotary from 45'-100'

GROUND ELEVATION: 966.7

NOTES: AWJ Rods to 45', NWJ starting at 50'

Mostly Sunny, 50°, Installed Silt Fence

DATE DRILLED: 6-8-10

JOB NUMBER: 22621.00005

DRILLER/HELPER: Bob Clark/Ray Farve

DRILL RIG: Diedrich D-90, ATV

LOGGED BY: MAC - CDJ

TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
910.0	55	(54.0, 66.0) Medium dense, brown, wet, fine to medium SAND; Frequent clay and silt lenses	12SS	55-56.5 ft 12-9-7 (16) 100%				
905.0	60		13SS	60-61.5 ft 6-6-7 (13) 100%				
900.0	65	(66.0, 69.0) Medium dense, brown, wet, medium to coarse SAND with fine Gravel	14SS	65-66.5 ft 6-6-7 (13) 100%				
895.0	70	(69.0, 80.5) Medium dense, brown, wet, fine to coarse GRAVEL with Sand	15SS	70-71.5 ft 6-5-6 (11) 5%				
890.0	75		16SS	75-76.5 ft 10-12-14 (26) 5%				

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 2 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

*LL = Liquid Limit - PI = Plasticity Index
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 *Qp = Pocket Penetrometer
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CLIENT & PROJECT: URS, M-20 over Schrader Creek

BORING NO.: B-18

Page 4 of 4

BORING LOCATION: N: 766921, E: 12895911, Sta 1542+59, Offset 10.6 Rt.

METHOD OF DRILLING: 4.25" HSA to 45', 3-7/8" Mud Rotary from 45'-100'

GROUND ELEVATION: 966.7

NOTES: AWJ Rods to 45', NWJ starting at 50'

Mostly Sunny, 50°, Installed Silt Fence

DATE DRILLED: 6-8-10

JOB NUMBER: 22621.00005

DRILLER/HELPER: Bob Clark/Ray Farve

DRILL RIG: Diedrich D-90, ATV

LOGGED BY: MAC - CDJ

TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
		Driller reports gravel at 78 - 79 ft						
885.0		(71.5, 80.5) Medium dense, brown, wet, fine to coarse SAND with Gravel; frequent Clay and Gravel Lenses 76-80.5'		17SS 80-81.5 ft 14-18-39 (57) 75%	13.7		Qp=4.5+	
		(80.5, 101.5) Very hard, grayish brown, moist CLAY						
880.0				18SS 85-86.5 ft 30-46-68 (114) 100%	18.3	135.3	Qu=3.68	
875.0				19SS 90-91.5 ft 32-48-58 (106) 75%			Qp=4.5+	
870.0				20SS 95-96.5 ft 46-66-106 (172) 70%			Qp=4.5+	
				21SS 100-101.5 26-46-150 (196) 50%	16.3		Qp=4.5+	

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 2 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

*LL = Liquid Limit - PI = Plasticity Index
 *St = Hand Torvane Shear Strength
 *Qp = Pocket Penetrometer
 *Qu = Unconfined Compression Machine



SOIL BORING LOG

One Madison Ave
 Cadillac, MI 49601
 231-775-7755
 231-775-3135 fax

CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-19 Page 1 of 4
BORING LOCATION: N: 766852, E: 12895932, Sta 1543+28, Offset 10.7 Lt.
METHOD OF DRILLING: 4.25" HSA to 43.5' / 3-1/8" Mud Rotary
GROUND ELEVATION: 966.7
NOTES: Silt Fence Installed, W.O.H.-Weight of Hammer

DATE DRILLED: 6-24-10 to 6-25-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: MGA/JRL
DRILL RIG: BRAT 22R
LOGGED BY: MLD
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
965.0	0.0 - 0.9	ASPHALT (11")						
	0.9 - 2.0	Grayish Brown, Moist, SANDY GRAVEL (FILL)						
	2.0 - 3.5	Grayish Brown, Moist, fine SAND (FILL)						
	3.5 - 6.0	Very Loose, Gray, Very Moist to Wet, CLAYEY SAND (FILL)		1SS 3.5-5 ft 2-1-2 (3) 40%				
960.0	6.0 - 18.0	Very Loose, Grayish Brown, Wet, fine to medium SAND (FILL)						
	8.5 - 10			2SS 8.5-10 ft 2-1-1 (2) 50%				
	13.5 - 15			3SS 13.5-15 ft 1/9", 1/9" 60%				
950.0	18.0 - 23.0	Very Soft, Brown, Very Moist, Fibrous PEAT with Wood						
	18.5 - 20			4SS 18.5-20 ft 1/9", 1/9" 60%				
945.0	23.0 - 29.5	Very Soft, Brown, Very Moist, SANDY MARL						
	23.5 - 25			5SS 23.5-25 ft 1/9, 1/12" 0%				

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 4 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

*LL = Liquid Limit - PI = Plasticity Index
 *St = Hand Torvane Shear Strength
 *Qp = Pocket Penetrometer
 *Qu = Unconfined Compression Machine



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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-19 Page 2 of 4
BORING LOCATION: N: 766852, E: 12895932, Sta 1543+28, Offset 10.7 Lt.
METHOD OF DRILLING: 4.25" HSA to 43.5' / 3-1/8" Mud Rotary
GROUND ELEVATION: 966.7
NOTES: Silt Fence Installed, W.O.H.-Weight of Hammer

DATE DRILLED: 6-24-10 to 6-25-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: MGA/JRL
DRILL RIG: BRAT 22R
LOGGED BY: MLD
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
940.0	30	(29.5, 33.0) Very Soft, Light Brown to Brown, Very Moist MARL		6SS 28.5-30 ft W.O.H. 50%		109.7		
935.0	35	(33.0, 39.0) Very Soft, Dark Gray, Wet, SILTY MARL		7SS 33.5-35 ft W.O.H. 50%		84.7		
930.0	40	(39.0, 39.8) Brown, Wet, fine to medium SAND; Trace fine Gravel (39.8, 42.0) Stiff, Brown, Very Moist CLAY		8SS 38.5-40 ft 3-2-1 (3) 60%			Qp=1.5	
925.0	45	(42.0, 48.0) Very Loose, Brown, Wet, fine SAND; Trace Gravel		9SS 43.5-45 ft W.O.H. 70%				
920.0	50	(48.0, 53.0) Brown, Very Moist, CLAY		10SS 48.5-50 ft 2-2-2 (4)				
915.0								

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 4 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

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 *St = Hand Torvane Shear Strength
 *Qp = Pocket Penetrometer
 *Qu = Unconfined Compression Machine



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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-19 Page 3 of 4
BORING LOCATION: N: 766852, E: 12895932, Sta 1543+28, Offset 10.7 Lt.
METHOD OF DRILLING: 4.25" HSA to 43.5' / 3-1/8" Mud Rotary
GROUND ELEVATION: 966.7
NOTES: Silt Fence Installed, W.O.H.-Weight of Hammer

DATE DRILLED: 6-24-10 to 6-25-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: MGA/JRL
DRILL RIG: BRAT 22R
LOGGED BY: MLD
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
910.0	55	(53.0, 63.0) Loose to Very Loose, Brown, Wet, fine SAND; Occasional fine to coarse Sand Lenses/Layers		11SS 53.5-55 ft 3-3-3 (6) 80%				
905.0	60			12SS 58.5-60 ft 2-2-2 (4) 50%				
900.0	65	(63.0, 74.5) Loose to Medium Dense, Brown, Wet GRAVEL		13SS 63.5-65 ft 4-3-3 (6)				
895.0	70			14SS 68.5-70 ft 5-5-8 (13) 30%				
890.0	75	(74.5, 78.5) Medium Dense, Grayish Brown, Wet, fine SAND; Trace fine Gravel		15SS 73.5-75 ft 4-6-10 (16) 50%				

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 4 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-19 Page 4 of 4
BORING LOCATION: N: 766852, E: 12895932, Sta 1543+28, Offset 10.7 Lt.
METHOD OF DRILLING: 4.25" HSA to 43.5' / 3-1/8" Mud Rotary
GROUND ELEVATION: 966.7
NOTES: Silt Fence Installed, W.O.H.-Weight of Hammer

DATE DRILLED: 6-24-10 to 6-25-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: MGA/JRL
DRILL RIG: BRAT 22R
LOGGED BY: MLD
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
885.0	78.5	(78.5, 100.0) Very Hard, Dark Gray, Moist CLAY; Trace fine Gravel, Occasional Silt Partings		16SS 78.5-80 ft 3-4-6 (10) 50%		14.6		Qp=4-4.5+
880.0	83.5			17SS 83.5-85 ft 6-8-9 (17) 70%	18.6	134.8	Qu=2.05	Qp=4.5+
875.0	88.5			18SS 88.5-90 ft 9-10-11 (21) 60%		19.3		Qp=4.5+
	93.5			19SS 93.5-95 ft 5-10-14 (24) 10%		26.9		
870.0	98.5			20SS 98.5-100 ft 7-15-21 (36) 80%		14.5		Qp=4.5+

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 4 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Slurry/Chips, Cold Patch

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 *St = Hand Torvane Shear Strength
 *Qp = Pocket Penetrometer
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SOIL BORING LOG

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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-20 Page 1 of 4
BORING LOCATION: N: 766782, E: 12895911, Sta 1543+98, Offset 9.9 Rt.
METHOD OF DRILLING: 4.375' HSA, Safety Hammer
GROUND ELEVATION: 968.0
NOTES: Silt Fence Installed

DATE DRILLED: 6-1 to 6-2, 2010
JOB NUMBER: 22621.00005
DRILLER/HELPER: MGA/JRL
DRILL RIG: Diedrich D-90, ATV
LOGGED BY: MLD
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
968.0	0.0	(0.0, 1.0) ASPHALT (12")	ASPHALT					
965.0	1.0	(1.0, 2.5) AGGREGATE / ASPHALT MILLINGS	AGGREGATE					
965.0	2.5	(2.5, 12.0) Medium Dense to Very Loose, Grayish Brown, Very Moist to Wet, fine to medium SAND; Trace Silt and fine Gravel (FILL)	SAND	1SS 3.5-5 ft 10-10-10 (20)				
965.0	5			2SS 6-7.5 ft 1-1-1 (2)				
960.0	10			3SS 8.5-10 ft 10-5-6 (11)				
960.0	11			4SS 11-12.5 ft 1-2-2 (4)	21.3		Qp=2-2.25	
955.0	12.0	(12.0, 13.0) Stiff, Gray, Very Moist SILTY CLAY (FILL)	CLAY					
955.0	13.0	(13.0, 16.0) Very Loose, Brown, Wet GRAVEL (FILL)	GRAVEL	5SS 13.5-15 ft 2-1-1 (2)				
950.0	16.0	(16.0, 24.0) Very Soft, Black, Moist, MARLY PEAT; Occasional Silty Marl Lenses	PEAT	6SS 16-17.5 ft 1-1-2 (3)				
950.0	18.5			7SS 18.5-20 ft 5-3-2 (5)	40.0			
945.0	21			8SS 21-22.5 ft 4-3-4 (7)	64.7			
945.0	23.5			9SS 23.5-25 ft 1-1-1 (2)	96.6			
945.0	24.0	(24.0, 39.0) Very Soft, Very Moist, SILTY MARL	MARL	10SS				

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 3 ft.
 ⚡ AT COMPLETION OF DRILLING: NR
 ⚡ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Chips, Cold Patch

*LL = Liquid Limit - PI = Plasticity Index
 *St = Hand Torvane Shear Strength
 *Qp = Pocket Penetrometer
 *Qu = Unconfined Compression Machine



SOIL BORING LOG

One Madison Ave
 Cadillac, MI 49601
 231-775-7755
 231-775-3135 fax

CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-20 Page 2 of 4
BORING LOCATION: N: 766782, E: 12895911, Sta 1543+98, Offset 9.9 Rt.
METHOD OF DRILLING: 4.375' HSA, Safety Hammer
GROUND ELEVATION: 968.0
NOTES: Silt Fence Installed

DATE DRILLED: 6-1 to 6-2, 2010
JOB NUMBER: 22621.00005
DRILLER/HELPER: MGA/JRL
DRILL RIG: Diedrich D-90, ATV
LOGGED BY: MLD
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
940.0	0-1			26-.27.5 ft 0-1-1(2)				
	30			11SS 28.5-30 ft 1/16"-1/12"	267.3			
935.0	35			12SS 33.5-35 ft 1/18"	58.8			
930.0	40	(39.0, 43.0) Loose, Brown, Wet, SILTY fine SAND		13SS 38.5-40 ft 2-3-3 (6)				
925.0	45	(43.0, 53.0) Very Loose to Loose, Brown, Wet, fine to medium SAND		14SS 43.5-45 ft 1/9"-1/9"				
920.0	50			15SS 48.5-50 ft 1-4-4 (8)				

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 3 ft.
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Chips, Cold Patch

*LL = Liquid Limit - PI = Plasticity Index
 *St = Hand Torvane Shear Strength
 *Qp = Pocket Penetrometer
 *Qu = Unconfined Compression Machine



SOIL BORING LOG

One Madison Ave
 Cadillac, MI 49601
 231-775-7755
 231-775-3135 fax

CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-20 Page 3 of 4
BORING LOCATION: N: 766782, E: 12895911, Sta 1543+98, Offset 9.9 Rt.
METHOD OF DRILLING: 4.375' HSA, Safety Hammer
GROUND ELEVATION: 968.0
NOTES: Silt Fence Installed

DATE DRILLED: 6-1 to 6-2, 2010
JOB NUMBER: 22621.00005
DRILLER/HELPER: MGA/JRL
DRILL RIG: Diedrich D-90, ATV
LOGGED BY: MLD
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
915.0	55	(53.0, 69.0) Loose, Brown, Wet, fine SAND	Yellow dotted pattern	16SS 53.5-55 ft 4-3-2 (5)	45.6			
910.0	60			17SS 58.5-60 ft 2-4-5 (9)				
905.0	65	Trace Wood Fibers @ 64'		18SS 63.5-65 ft 5-8-9 (17)				
900.0	70	(66.0, 69.0) Dense, Brown, Wet GRAVEL	Green diagonal pattern	19SS 68.5-70 ft 29-50/5"	13.8		Qp=4.5+	
		(69.0, 70.5) Very Hard, Grayish Brown, Moist, CLAY	Green diagonal pattern		13.8			
		(70.5, 74.0) Dense, Brown, Very Moist, fine SAND	Yellow dotted pattern					
895.0	75	(74.0, 80.0) Very Hard, Grayish Brown, Moist, CLAY; Trace of Sand	Green diagonal pattern	20SS 73.5-75 ft 5-17-29 (46)	14.0	142.6	Qu=4.42	Qp=4.5+
890.0		Boring Terminated due to Large Excess of Cuttings - Modified						

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 3 ft.
 ⚡ AT COMPLETION OF DRILLING: NR
 ⚡ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Chips, Cold Patch

*LL = Liquid Limit - PI = Plasticity Index
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 *Qu = Unconfined Compression Machine



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CLIENT & PROJECT: URS, M-20 over Schrader Creek

BORING NO.: B-20

Page 4 of 4

BORING LOCATION: N: 766782, E: 12895911, Sta 1543+98, Offset 9.9 Rt.

METHOD OF DRILLING: 4.375' HSA, Safety Hammer

GROUND ELEVATION: 968.0

NOTES: Silt Fence Installed

DATE DRILLED: 6-1 to 6-2, 2010

JOB NUMBER: 22621.00005

DRILLER/HELPER: MGA/JRL

DRILL RIG: Diedrich D-90, ATV

LOGGED BY: MLD

TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
890.0	80	Drilling Methods		21SS 78.5-80 ft. 7-10-26 (36)	13.6		Qp=4.5+	

GROUNDWATER OBSERVATIONS

⊘ DURING DRILLING: 3 ft.
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings, Bentonite Chips, Cold Patch

*LL = Liquid Limit - PI = Plasticity Index
 *St = Hand Torvane Shear Strength
 *Qp = Pocket Penetrometer
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SOIL BORING LOG

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 231-775-3135 fax

CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-21 Page 1 of 4
BORING LOCATION: N: 766714, E: 12895931, Sta 1544+66, Offset 10.5 Lt.
METHOD OF DRILLING: 4.25" HSA to 40', 3-1/8" Mud Rotary
GROUND ELEVATION: 970.7
NOTES: Installed Silt Fence, W.O.H.-Weight of Hammer

DATE DRILLED: 6-21-10, 6-22-10, 6-23-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: MGA/JRL
DRILL RIG: BRAT 22R
LOGGED BY: MLD
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
970.0	0	(0.0, 0.5) ASPHALT (6")						
		(0.5, 1.0) Brown, Moist SANDY GRAVEL						
		(1.0, 4.0) Very Loose, Brown, Moist, fine SAND (FILL)						
965.0	5	(4.0, 9.0) Loose, Dark Brown and Gray, Wet CLAYEY SAND; Trace fine Gravel (Fill)		1SS 3.5-5 ft 3-4-3 (7) 50%				
960.0	10	(9.0, 13.5) Very Soft, Dark Brown to Black, Moist, FIBROUS PEAT		2SS 8.5-10 ft 2-1-2 (3) 60%	214.9			
				3SS 11-12.5 ft 2-2-2 (4) 60%	80.1			
955.0	15	(13.5, 21.0) Very Soft, Light Gray, Very Moist SILTY MARL; some Peat to 15'		4SS 13.5-15 ft 1/9"-1/9" 80%	80.2			
				5SS 16-17.5 ft W.O.H. 100%	75.7			
950.0	20			6SS 18.5-20 ft 1-0-1 (1) 80%	46.2			
		(21.0, 29.5) Very Loose to Loose, Brown, Wet, fine SAND; Trace fine Gravel; Trace Woody Fibers at 24'±		7SS 21-22.5 ft 1/12"-1/12" 50%				
				8SS 23.5-25 ft 1-1-1 (2) 10%				
945.0	25							

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 4 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings

*LL = Liquid Limit - PI = Plasticity Index
 *St = Hand Torvane Shear Strength
 *Qp = Pocket Penetrometer
 *Qu = Unconfined Compression Machine



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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-21 Page 2 of 4
BORING LOCATION: N: 766714, E: 12895931, Sta 1544+66, Offset 10.5 Lt.
METHOD OF DRILLING: 4.25" HSA to 40', 3-1/8" Mud Rotary
GROUND ELEVATION: 970.7
NOTES: Installed Silt Fence, W.O.H.-Weight of Hammer

DATE DRILLED: 6-21-10, 6-22-10, 6-23-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: MGA/JRL
DRILL RIG: BRAT 22R
LOGGED BY: MLD
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
940.0	30	(29.5, 34.5) Loose, Brown, Wet SILTY fine SAND	9SS	28.5-30 ft 3-3-4 (7) 50%				
935.0	35	(34.5, 38.5) Loose, Brown, Wet, fine SAND; Trace Silt and fine Gravel	10SS	33.5-35 ft 2-3-4 (7) 70%	19.8			
930.0	40	(38.5, 43.0) Loose, Brown, Wet SILTY fine SAND; Trace fine Gravel	11SS	38.5-40 ft 1-3-4 (7) 70%	21.1			
925.0	45	(43.0, 46.0) Stiff, Brown, Wet SILTY CLAY; Trace fine Gravel	12SS	43.5-45 ft 5-3-4 (7) 20%	25.1		Qp=1	
		(46.0, 48.0) Brown, Wet, fine to coarse SAND with fine Gravel						
920.0	50	(48.0, 60.0) Loose, Brown, Wet GRAVEL; Trace Silt	13SS	48.5-50 ft 3-2-3 (5) 20%				

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 4 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings

*LL = Liquid Limit - PI = Plasticity Index
 *St = Hand Torvane Shear Strength
 *Qp = Pocket Penetrometer
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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-21 Page 3 of 4
BORING LOCATION: N: 766714, E: 12895931, Sta 1544+66, Offset 10.5 Lt.
METHOD OF DRILLING: 4.25" HSA to 40', 3-1/8" Mud Rotary
GROUND ELEVATION: 970.7
NOTES: Installed Silt Fence, W.O.H.-Weight of Hammer

DATE DRILLED: 6-21-10, 6-22-10, 6-23-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: MGA/JRL
DRILL RIG: BRAT 22R
LOGGED BY: MLD
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
915.0	55			14SS 53.5-55 ft 3-4-6 (10) 0%				
910.0	60	(60.0, 68.0) Very Stiff to Hard, Dark Gray, Moist CLAY; Trace fine Gravel						
905.0	65			15SS 63.5-65 ft 9-16-19 (35) 60%	16.0		Qp=3.5-4.5+	
900.0	70	(68.0, 73.0) Loose, Dark Gray, Wet CLAYEY SAND		16SS 68.5-70 ft 3-6-4 (10) 50%				
895.0	75	(73.0, 100.0) Very Stiff to Very Hard, Dark Gray, Moist CLAY; Occasional Gravel Lenses and Silt Partings		17SS 73.5-75 ft 6-9-13 (22) 70%	16.0	137.6	Qu=2.40	

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 4 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings

*LL = Liquid Limit - PI = Plasticity Index
 *St = Hand Torvane Shear Strength
 *Qp = Pocket Penetrometer
 *Qu = Unconfined Compression Machine



SOIL BORING LOG

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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-21 Page 4 of 4
BORING LOCATION: N: 766714, E: 12895931, Sta 1544+66, Offset 10.5 Lt.
METHOD OF DRILLING: 4.25" HSA to 40', 3-1/8" Mud Rotary
GROUND ELEVATION: 970.7
NOTES: Installed Silt Fence, W.O.H.-Weight of Hammer

DATE DRILLED: 6-21-10, 6-22-10, 6-23-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: MGA/JRL
DRILL RIG: BRAT 22R
LOGGED BY: MLD
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
890.0	80			18SS 78.5-80 ft 4-6-6 (12) 60%	23.3		Qp=2.5-3.5	
885.0	85			19SS 83.5-85 ft 6-8-9 (17) 0%	22.4			
880.0	90			20SS 88.5-90 ft 6-8-10 (18) 60%	22.4		Qp=3.5	
875.0	95			21SS 93.5-95 ft 8-14-17 (31) 80%	19.5		Qp=4.5+	
100	100			22SS 98.5-100 ft 8-18-20 (38) 60%	21.4		Qp=4.5+	

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 4 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings

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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-22 Page 1 of 4
BORING LOCATION: N: 766643 , E: 12895911, Sta 1545+37, Offset 9.1 Rt.
METHOD OF DRILLING: 4.25 " HSA, 3-7/8" Mud Rotary, Auto Hammer
GROUND ELEVATION: 973.6
NOTES: Sunny/Partly Cloudy 57-67°F
 Installed Silt Fence

DATE DRILLED: 6-10-10 to 6-11-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: Bob Clark/ Ray Farve
DRILL RIG: Diedrich D-90, ATV
LOGGED BY: Bob Clark/Mike Carpenter
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
970.0	0.0 - 1.1	ASPHALT (13")						
	1.1 - 2.4	Brown, Moist, fine to medium SAND (Fill)						
	2.4 - 5.5	Loose, Dark Brown, Very Moist, fine to medium SAND with Silt (Fill)						
	5.5 - 11.5	Loose, Brown, Moist to Wet, SILTY SAND with fine Gravel (Fill)		1SS 5-6.5 ft 1-2-2 (4) 75%	8.9			
965.0		2" Lens of Peat at 11'						
	11.5 - 13.5	Very Loose, Gray, Wet, fine to medium SAND		2SS 10-11.5 ft 1-1-1 (2) 25%	12.0			
960.0	13.5 - 14.0	Loose, Brown, Wet, fine to medium SILTY SAND; trace of gravel						
	14.0 - 22.5	Very stiff, Gray, Moist, CLAY		3SS 15-16.5 ft 2-4-2 (6) 50%				
955.0							Qp=3.0	
	20 - 21.5			4SS 20-21.5 ft 5-5-6 (11) 75%	26.0			
950.0	22.5 - 31.5	Medium Dense, Brown, Wet SILTY SAND; Occasional Clay lenses		5SS 25-26.5 ft 7-12-13 (25)				

GROUNDWATER OBSERVATIONS

∇ DURING DRILLING: 7.5 ft.
 ▼ AT COMPLETION OF DRILLING: NR
 ▾ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings

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 *Qu = Unconfined Compression Machine



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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-22 Page 2 of 4
BORING LOCATION: N: 766643 , E: 12895911, Sta 1545+37, Offset 9.1 Rt.
METHOD OF DRILLING: 4.25 " HSA, 3-7/8" Mud Rotary, Auto Hammer
GROUND ELEVATION: 973.6
NOTES: Sunny/Partly Cloudy 57-67°F
 Installed Silt Fence

DATE DRILLED: 6-10-10 to 6-11-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: Bob Clark/ Ray Farve
DRILL RIG: Diedrich D-90, ATV
LOGGED BY: Bob Clark/Mike Carpenter
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
945.0	30	(31.5, 32.5) Hard, Brown, Moist, CLAY with Sand	6SS	30-31.5 ft 9-8-9 (17) 70%	18.1		Qp=4.0	
940.0	35	(32.5, 40.7) Loose, Brown, Wet, fine to medium SAND with Silt	7SS	35-36.5 ft 7-5-5 (10) 60%				
935.0	40	(40.7, 43.7) Stiff, Brown, Moist SANDY CLAY	8SS	40-41.5 ft 10-9-9 (18) 60%			Qp=1.8	
930.0	45	(43.7, 47.0) Medium Dense, Light Brown, Wet, fine to coarse SAND with fine Gravel	9SS	45-46.5 ft 10-13-12 (25) 80%				
925.0	50	(47.0, 53.0) Medium Dense, Light Brown, Wet, fine to medium SAND; Occasional lenses of brown sandy clay	10SS	50-51.5 ft 8-13-11 (24) 75%	17.0			

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 7.5 ft.
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings

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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-22 Page 3 of 4
BORING LOCATION: N: 766643 , E: 12895911, Sta 1545+37, Offset 9.1 Rt.
METHOD OF DRILLING: 4.25 " HSA, 3-7/8" Mud Rotary, Auto Hammer
GROUND ELEVATION: 973.6
NOTES: Sunny/Partly Cloudy 57-67°F
 Installed Silt Fence

DATE DRILLED: 6-10-10 to 6-11-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: Bob Clark/ Ray Farve
DRILL RIG: Diedrich D-90, ATV
LOGGED BY: Bob Clark/Mike Carpenter
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
920.0	55	(53.0, 59.5) Medium Dense, Light Brown, Wet, medium to coarse SAND		11SS 55-56.5 ft 8-13-12 (25) 70%				
915.0	60	(59.5, 93.0) Very Stiff to Very Hard, Grayish Brown, Moist CLAY		12SS 60-61.5 ft 12-19-29 (48) 100%	14.8	139.7	Qu=2.19	
910.0	65			13SS 65-67 ft 17-19-25 (44) 100%	17.6	136.1	Qu=1.95	
905.0	70			14SS 70-71.5 ft 10-13-19 (32) 100%	17.8		Qp=3.4	
900.0	75			15SS 75-76.5 ft 13-19-21 (40) 100%	18.1	134.6	Qu=1.80	

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 7.5 ft.
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings

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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-22 Page 4 of 4
BORING LOCATION: N: 766643 , E: 12895911, Sta 1545+37, Offset 9.1 Rt.
METHOD OF DRILLING: 4.25 " HSA, 3-7/8" Mud Rotary, Auto Hammer
GROUND ELEVATION: 973.6
NOTES: Sunny/Partly Cloudy 57-67°F
 Installed Silt Fence

DATE DRILLED: 6-10-10 to 6-11-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: Bob Clark/ Ray Farve
DRILL RIG: Diedrich D-90, ATV
LOGGED BY: Bob Clark/Mike Carpenter
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
895.0	80			16SS 80-81.5 ft 10-14-21 (35) 100%			Qp=4.5+	
890.0	85			17SS 85-86.5 ft 9-12-18 (30) 100%	18.6		Qp=4.5+	
885.0	90			18SS 90-91.5 ft 11-20-20 (40) 100%	20.0		Qp=4.5+	
880.0	95	(93.0, 97.0) Very Dense, Light Brown, Wet, fine SAND; Occasional Silt Lens		19SS 95-96.5 ft 19-26-27 (53) 100%	19.1		Qp=4.5+	
875.0	100	(97.0, 101.5) Hard, Dark Grayish Brown, Moist CLAY		20SS 100-101.5 ft 23-32-43 (75) 100%	18.3		Qp=4.5+	

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 7.5 ft.
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings

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CLIENT & PROJECT: URS, M-20 over Schrader Creek
BORING NO.: B-23 Page 1 of 1
BORING LOCATION: N: 766585, E: 12895941, Sta 1545+95, Offset 21.2 Lt.
METHOD OF DRILLING: 3.25" HSA, Auto Hammer
GROUND ELEVATION: 975.1
NOTES:

DATE DRILLED: 6-25-10
JOB NUMBER: 22621.00005
DRILLER/HELPER: Bob Clark/Ray Farve
DRILL RIG: Diedrich D-90, ATV
LOGGED BY: Bob Clark
TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
975.0	0	(0.0, 0.8) AGGREGATE						
		(0.8, 3.5) Very Loose, Brown, Moist CLAYEY SAND; Trace fine Gravel (FILL)		1SS 2.5-4 ft 2-1-2 (3) 50%				
970.0	5	(3.5, 5.5) Medium Stiff, Brown, Moist SILTY CLAY with Sand		2SS 5-6.5 ft 2-4-6 (10) 65%				
		(5.5, 20.5) Medium Dense, Brown, Wet, fine SAND with Silt		3SS 7.5-9 ft 5-7-8 (15) 95%				
965.0	10			4SS 10-11.5 ft 8-11-9 (20) 100%				
				5SS 12.5-14 ft 11-11-6 (17) 65%				
960.0	15			6SS 15-16.5 ft 6-6-8 (14) 95%				
				7SS 17.5-19 ft 8-10-7 (17) 95%				
955.0	20	(20.5, 21.5) Medium Dense, Brown, Wet, fine to medium SAND with Silt		8SS 20-21.5 ft 5-10-7 (17) 100%				

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 5.5 ft
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings

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 *Qu = Unconfined Compression Machine



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CLIENT & PROJECT: URS, M-20 over Schrader Creek

BORING NO.: B-24

Page 1 of 1

BORING LOCATION: N: 766446, E: 12895902, Sta 1547+34, Offset 17.1 Rt.

METHOD OF DRILLING: 3.25" HSA, Auto Hammer

GROUND ELEVATION: 980.8

NOTES: 68' N of Staked Location - Traffic Control Restraints

DATE DRILLED: 6-14-10

JOB NUMBER: 22621.00005

DRILLER/HELPER: Bob Clark/Ray Farve

DRILL RIG: Diedrich D-90, ATV

LOGGED BY: Bob Clark/Mike Carpenter

TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
980.0	0	(0.0, 0.8) Brown, Moist, fine to coarse SAND and fine gravel	[Yellow with black dots]	1SS 2.5-4 ft 4--3-3 (6) 0%	17.7		Qp=1.75	
		(0.8, 3.5) Loose, Grayish Brown, Moist CLAYEY SAND with fine Gravel						
975.0	5	(3.5, 6.5) Stiff, Brown, Moist CLAY with fine Gravel	[Green with black diagonal lines]	2SS 5-6.5 ft 2-2-2 (4)	28.7		Qp=1.75	

GROUNDWATER OBSERVATIONS

☞ DURING DRILLING: NE
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings

*LL = Liquid Limit - PI = Plasticity Index
 *St = Hand Torvane Shear Strength
 *Qp = Pocket Penetrometer
 *Qu = Unconfined Compression Machine



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CLIENT & PROJECT: URS, M-20 over Schrader Creek

BORING NO.: B-25

Page 1 of 4

BORING LOCATION: N: 767496, E: 12895909 - Sta 1536+84, Offset 15.8 Rt.

METHOD OF DRILLING: 4.25 " HSA to 31', 3-7/8" Tri Cone Mud Rotary to 99'

GROUND ELEVATION: 969.7

NOTES: NWJ Rods, Installed Silt Fence

DATE DRILLED: 7-20-10

JOB NUMBER: 22621.00005

DRILLER/HELPER: DY/WP

DRILL RIG: CME 75

LOGGED BY: CDJ

TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
965.0	0	(0.0, 5.0) SAND and GRAVEL (FILL)						
960.0	5	(5.0, 10.0) PEAT and MARL						
955.0	10	(10.0, 16.0) Grayish Brown, Wet, SILTY SAND with fine Gravel						
950.0	15	(16.0, 30.0) Gray, Moist CLAY; Occasional Sand Lenses						
945.0	20			1SS 20-21.5 ft 7-7-9 (16) 60%				

GROUNDWATER OBSERVATIONS

∅ DURING DRILLING: 5 Ft.
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings

*LL = Liquid Limit - PI = Plasticity Index
 *St = Hand Torvane Shear Strength
 *Qp = Pocket Penetrometer
 *Qu = Unconfined Compression Machine



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CLIENT & PROJECT: URS, M-20 over Schrader Creek

DATE DRILLED: 7-20-10

BORING NO.: B-25

Page 2 of 4

JOB NUMBER: 22621.00005

BORING LOCATION: N: 767496, E: 12895909 - Sta 1536+84, Offset 15.8 Rt.

DRILLER/HELPER: DY/WP

METHOD OF DRILLING: 4.25 " HSA to 31', 3-7/8" Tri Cone Mud Rotary to 99'

DRILL RIG: CME 75

GROUND ELEVATION: 969.7

LOGGED BY: CDJ

NOTES: NWJ Rods, Installed Silt Fence

TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
940.0	30	(30.0, 40.0) Very Loose to Medium Dense, Brown, Wet, fine to medium SAND; Occasional coarse Sand and Clay Lenses		2SS 31-32.5 ft 4-2-1 (3) 40%				
935.0	35			3SS 37-38.5 ft 7-8-9 (17) 100%				
930.0	40	(40.0, 87.5) Medium Dense, Brown, Wet, fine SAND with fine Gravel; Occasional Clay and coarse Gravel Lenses		4SS 47-48.5 ft 4-5-6 (11) 100%				
925.0	45							
920.0	50							

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 5 Ft.
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings

*LL = Liquid Limit - PI = Plasticity Index
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CLIENT & PROJECT: URS, M-20 over Schrader Creek

DATE DRILLED: 7-20-10

BORING NO.: B-25

Page 3 of 4

JOB NUMBER: 22621.00005

BORING LOCATION: N: 767496, E: 12895909 - Sta 1536+84, Offset 15.8 Rt.

DRILLER/HELPER: DY/WP

METHOD OF DRILLING: 4.25" HSA to 31', 3-7/8" Tri Cone Mud Rotary to 99'

DRILL RIG: CME 75

GROUND ELEVATION: 969.7

LOGGED BY: CDJ

NOTES: NWJ Rods, Installed Silt Fence

TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
915.0	55		5SS 57-58.5 ft 5-6-5 (11) 40%					
910.0	60							
905.0	65							
900.0	70		6SS 67-68.5 ft 5-5-5 (10) 40%					
895.0	75							
			7SS 77-78.5 ft 5-5-7 (12)					

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 5 Ft.
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings

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 *St = Hand Torvane Shear Strength
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CLIENT & PROJECT: URS, M-20 over Schrader Creek

DATE DRILLED: 7-20-10

BORING NO.: B-25

Page 4 of 4

JOB NUMBER: 22621.00005

BORING LOCATION: N: 767496, E: 12895909 - Sta 1536+84, Offset 15.8 Rt.

DRILLER/HELPER: DY/WP

METHOD OF DRILLING: 4.25" HSA to 31', 3-7/8" Tri Cone Mud Rotary to 99'

DRILL RIG: CME 75

GROUND ELEVATION: 969.7

LOGGED BY: CDJ

NOTES: NWJ Rods, Installed Silt Fence

TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
890.0	80							
885.0	85							
880.0	90	(87.5, 99.0) Medium Dense to Very Dense, Brown, Wet, fine to coarse GRAVEL		8SS 87-88.5 ft 3-5-6 (11) 30%				Driller Noted Harder Drilling Starting at 92'
875.0	95			9SS 97-99 ft 15-30-32-45 (62) 50%				Pushed through 1' of fall back @ 97' prior to SPT
		Boring Terminated						

GROUNDWATER OBSERVATIONS

☒ DURING DRILLING: 5 Ft.
 ▼ AT COMPLETION OF DRILLING: NR
 ▼ AFTER NR
 HOURS: NR
 NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings

*LL = Liquid Limit - PI = Plasticity Index
 *St = Hand Torvane Shear Strength
 *Qp = Pocket Penetrometer
 *Qu = Unconfined Compression Machine



SOIL BORING LOG

One Madison Ave
 Cadillac, MI 49601
 231-775-7755
 231-775-3135 fax

CLIENT & PROJECT: URS, M-20 over Schrader Creek

DATE DRILLED: Nov. 1 to 9, 2010

BORING NO.: B-34

Page 1 of 4

JOB NUMBER: 22621.00005

BORING LOCATION: N: 767796.5, E: 12895905.2, Sta 1533+83, Offset 22.3' Rt

DRILLER/HELPER: Stearns

METHOD OF DRILLING: 8.25" HSA to 63.5', Set 6" Steel Casing to 64'

DRILL RIG: CME 1050 ATV

GROUND ELEVATION: 966.9

LOGGED BY: CDJ/RM

NOTES: 5-7/8" Tricone Mud Rotary to 140'

TWP: Morton **COUNTY:** Mecosta

Installed 2" PVC Piezometer w/ Screen at 133'-138'. See MW-34 for well construction.

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
965.0	0	(0.0, 63.0) See B-7 for Soil Description	KL					
	5							
960.0								
	10							
955.0								
	15							
950.0								
	20							
945.0								
	25							
940.0								
	30							
935.0								
	35							
930.0								

GROUNDWATER OBSERVATIONS

- ☒ DURING DRILLING: 1 ft. - then Artesian
- ☒ AT COMPLETION OF DRILLING: Artesian
- ☒ AFTER 24 HOURS: 16.4' Above G.S.

NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings - Cement Grout

- *LL = Liquid Limit - PI = Plasticity Index
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CLIENT & PROJECT: URS, M-20 over Schrader Creek

DATE DRILLED: Nov. 1 to 9, 2010

BORING NO.: B-34 Page 2 of 4

JOB NUMBER: 22621.00005

BORING LOCATION: N: 767796.5, E: 12895905.2, Sta 1533+83, Offset 22.3' Rt

DRILLER/HELPER: Stearns

METHOD OF DRILLING: 8.25" HSA to 63.5', Set 6" Steel Casing to 64'

DRILL RIG: CME 1050 ATV

GROUND ELEVATION: 966.9

LOGGED BY: CDJ/RM

NOTES: 5-7/8" Tricone Mud Rotary to 140'

TWP: Morton **COUNTY:** Mecosta

Installed 2" PVC Piezometer w/ Screen at 133'-138'. See MW-34 for well construction.

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
925.0	40							
910.0	55	Brown, Wet, fine SAND with Silt @ 1SS		1SS 54 - 56 ft. 7-2-2-4 (4) 83%				
905.0	60	1 GPM flow at 60 ft. SAND @ 2SS		2SS 60 - 62 ft. 47-60-80 (140)				Pushing Poly Plug at 2SS
900.0	65	(63.0, 72.0) Gray, Moist, CLAY Brown, Moist, CLAY @ 3SS		3SS 63.5 - 65.5 ft. 5-5-7-9 (12) 83%				
895.0	75	(72.0, 102.0) Loose to Medium Dense, Gray, Wet, fine to coarse SAND with fine to medium GRAVEL						Natural collapse to 72' during overnight stoppage. Hole had been drilled to 103' bgs.

GROUNDWATER OBSERVATIONS

- ☒ DURING DRILLING: 1 ft. - then Artesian
- ☒ AT COMPLETION OF DRILLING: Artesian
- ☒ AFTER 24 HOURS: 16.4' Above G.S.

NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings - Cement Grout

- *LL = Liquid Limit - PI = Plasticity Index
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DATE DRILLED: Nov. 1 to 9, 2010

BORING NO.: B-34

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JOB NUMBER: 22621.00005

BORING LOCATION: N: 767796.5, E: 12895905.2, Sta 1533+83, Offset 22.3' Rt

DRILLER/HELPER: Stearns

METHOD OF DRILLING: 8.25" HSA to 63.5', Set 6" Steel Casing to 64'

DRILL RIG: CME 1050 ATV

GROUND ELEVATION: 966.9

LOGGED BY: CDJ/RM

NOTES: 5-7/8" Tricone Mud Rotary to 140'

TWP: Morton **COUNTY:** Mecosta

Installed 2" PVC Piezometer w/ Screen at 133'-138'. See MW-34 for well construction.

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
890.0								
885.0								
880.0								
875.0				4SS 90 - 92 ft. 1-2-3-3 (5) 70%				
870.0				5SS 94 - 96 ft. 7-5-5-4 (10) 80%				
865.0				6SS 99 - 101 ft. 5-6-14-27 (20) 80%				
860.0		(102.0, 106.0) Hard, Gray, Moist, CLAY		7SS 103 - 105 ft. 24-23-50-55 (73) 100%	10.8	142.7	Qp=4.5+	
855.0		(106.0, 113.0) Alternating Layers of Grayish Brown, Moist CLAY 6" to 12" thick and Wet, fine SAND 6" to 12" thick		8SS 108 - 110 ft. 25-42-110-75/3" 83%	13.0			
				9SS	13.6		Qp=4.5+	

GROUNDWATER OBSERVATIONS

- ☒ DURING DRILLING: 1 ft. - then Artesian
- ☒ AT COMPLETION OF DRILLING: Artesian
- ☒ AFTER 24 HOURS: 16.4' Above G.S.

NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings - Cement Grout

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BORING NO.: B-34

Page 4 of 4

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METHOD OF DRILLING: 8.25" HSA to 63.5', Set 6" Steel Casing to 64'

DRILL RIG: CME 1050 ATV

GROUND ELEVATION: 966.9

LOGGED BY: CDJ/RM

NOTES: 5-7/8" Tricone Mud Rotary to 140'

TWP: Morton **COUNTY:** Mecosta

Installed 2" PVC Piezometer w/ Screen at 133'-138'. See MW-34 for well construction.

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
115		(113.0, 123.5) Hard, Gray, Moist, CLAY; Trace Sand		113 - 115 ft. 10-21-43-56 (64) 83%				
850.0				10SS 118 - 120 ft. 20-27-33-42 (60) 75%	13.8	140.0	Qp=4.5+	
845.0				11SS 123 - 125 ft. 10-22-33-33 (55) 100%	8.2		Qp=2.75 - 4.5	
840.0		(126.0, 135.5) Medium to Very Dense, Brown, fine to medium SAND; Driller reports occasional fine to coarse Gravel Lenses and Cobbles		12SS 128 - 130 ft. 11-9-13-26 (22) 100%				Artesian flow head measured at 16 ft. above ground surface. Flow controlled via drilling mud weighing 15.5 lbs/gal.
835.0				13SS 133 - 135 ft. 21-63-100/4" 50%				
830.0				14SS 138 - 140 ft. 8-25-36-15 (61) 100%				
		(135.5, 137.5) Driller reported Clay						
		(137.5, 139.3) Brown, Wet, fine SAND; Trace Gravel						
		(139.3, 139.8) Gray, Moist, SANDY CLAY; Trace Silt						
		(139.8, 140.0) Very Dense, Gray, Wet, fine SAND						

GROUNDWATER OBSERVATIONS

- ☒ DURING DRILLING: 1 ft. - then Artesian
- ☒ AT COMPLETION OF DRILLING: Artesian
- ☒ AFTER 24 HOURS: 16.4' Above G.S.

NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings - Cement Grout

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CLIENT & PROJECT: URS, M-20 over Schrader Creek

DATE DRILLED: Nov. 1, 10 & 11, 2010

BORING NO.: B-35 Page 1 of 4

JOB NUMBER: 22621.00005

BORING LOCATION: N: 767484.4, E: 12895909.4, Sta 1536+96, Offset 15.6' Rt

DRILLER/HELPER: Stearns

METHOD OF DRILLING: 8.25" HSA to 20', Set 6" Steel Casing to 19.5',

DRILL RIG: CME 1050

GROUND ELEVATION: 970.1

LOGGED BY: RM

NOTES: 5-7/8" TriCone Mud Rotary

TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
970.0	0	(0.0, 93.0) See B-25 for Soil Description						
965.0	5							
960.0	10							
955.0	15							
950.0	20	Gray, Moist CLAY at ISS		1SS 19 - 21 ft. NR 100%				
945.0	25							
940.0	30							
935.0	35							

GROUNDWATER OBSERVATIONS

- ☒ DURING DRILLING: 5 ft. then Artesian
- ☒ AT COMPLETION OF DRILLING: Artesian
- ☒ AFTER NR HOURS: NR

NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings - Cement Grout

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BORING NO.: B-35 Page 2 of 4

JOB NUMBER: 22621.00005

BORING LOCATION: N: 767484.4, E: 12895909.4, Sta 1536+96, Offset 15.6' Rt

DRILLER/HELPER: Stearns

METHOD OF DRILLING: 8.25" HSA to 20', Set 6" Steel Casing to 19.5',

DRILL RIG: CME 1050

GROUND ELEVATION: 970.1

LOGGED BY: RM

NOTES: 5-7/8" TriCone Mud Rotary

TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
930.0	40							
925.0	45							
920.0	50							
915.0	55							
910.0	60							
905.0	65							
900.0	70							
895.0	75							

GROUNDWATER OBSERVATIONS

- ☒ DURING DRILLING: 5 ft. then Artesian
- ☒ AT COMPLETION OF DRILLING: Artesian
- ☒ AFTER NR HOURS: NR

NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings - Cement Grout

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DATE DRILLED: Nov. 1, 10 & 11, 2010

BORING NO.: B-35 Page 3 of 4

JOB NUMBER: 22621.00005

BORING LOCATION: N: 767484.4, E: 12895909.4, Sta 1536+96, Offset 15.6' Rt

DRILLER/HELPER: Stearns

METHOD OF DRILLING: 8.25" HSA to 20', Set 6" Steel Casing to 19.5',

DRILL RIG: CME 1050

GROUND ELEVATION: 970.1

LOGGED BY: RM

NOTES: 5-7/8" TriCone Mud Rotary

TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
890.0	80							
885.0	85							
880.0	90							
875.0	95	(93.0, 102.0) Loose, Brown, Moist, medium to coarse SAND with Gravel and Silt	2SS	93 - 95 ft. 5-4-4-3 (8) 100%				
870.0	100		3SS	98 - 100 ft. 5-2-4-6 (6) 100%				
865.0	105	(102.0, 114.0) Very Dense, Brown, Wet, fine to medium SAND; Trace Gravel and Silt	4SS	103 - 105 ft. 14-23-32-55 (55) 100%				
860.0	110		5SS	108 - 110 ft. 30-100/6" 100%				
			6SS		14.0		Qp=4.5+	

GROUNDWATER OBSERVATIONS

- ☒ DURING DRILLING: 5 ft. then Artesian
- ☒ AT COMPLETION OF DRILLING: Artesian
- ☒ AFTER NR HOURS: NR

NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings - Cement Grout

- *LL = Liquid Limit - PI = Plasticity Index
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DATE DRILLED: Nov. 1, 10 & 11, 2010

BORING NO.: B-35 Page 4 of 4

JOB NUMBER: 22621.00005

BORING LOCATION: N: 767484.4, E: 12895909.4, Sta 1536+96, Offset 15.6' Rt

DRILLER/HELPER: Stearns

METHOD OF DRILLING: 8.25" HSA to 20', Set 6" Steel Casing to 19.5',

DRILL RIG: CME 1050

GROUND ELEVATION: 970.1

LOGGED BY: RM

NOTES: 5-7/8" TriCone Mud Rotary

TWP: Morton **COUNTY:** Mecosta

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
855.0	115	(114.0, 127.0) Hard, Gray, Moist CLAY; Occasional lenses of Wet Sand		113 - 115 ft. 48-60-41-51 (101) 100%				
				7SS 118 - 120 ft. 25-32-53-62 (85) 100%	13.8	136.7	Qu=5.66	
850.0	120			8SS 123 - 125 ft. 21-41-60-75 (101) 100%	18.4	132.6	Qp=6.19	
845.0	125			9SS 128 - 130 ft. 85-10/6" 50%				
840.0	130	(127.0, 141.0) Very Dense, Brown, Wet, fine to medium SAND; Trace Gravel and Silt		10SS 133 - 135 ft. 29-75-100/6"				
835.0	135			11SS 138 - 140 ft. 75-100/6"				
830.0	140			12SS 143 - 145 ft. 44-45-60-100/6" 100%	8.0	149.1	Qu=9.14	
825.0	145	(141.0, 147.0) Very Hard, Brown, Dry, CLAYEY SAND; Trace Gravel		13SS 147 - 149 ft. 42-48-38-64 (86) 100%				
		(147.0, 148.3) Brown, fine SAND; Trace Silt						
		(148.3, 149.0) Alternating Lenses of Brown, Moist, SANDY CLAY and Wet, fine SAND						

GROUNDWATER OBSERVATIONS

- ☒ DURING DRILLING: 5 ft. then Artesian
- ☒ AT COMPLETION OF DRILLING: Artesian
- ☒ AFTER NR HOURS: NR

NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings - Cement Grout

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SOIL BORING LOG

CLIENT & PROJECT: URS, M-20 over Schrader Creek

DATE DRILLED: Nov. 2, 5 & 8, 2010

BORING NO.: B-36

Page 1 of 4

JOB NUMBER: 22621.00005

BORING LOCATION: N: 767012.7, E: 12895898.3, Sta 1541+67, Offset 23.8' Rt

DRILLER/HELPER: Stearns

METHOD OF DRILLING: 8.25" HSA to 38', Set 6" Steel Casing to 39'

DRILL RIG: CME 1050

GROUND ELEVATION: 965.7

LOGGED BY: RM

NOTES: 5-7/8" Tricone Mud Rotary, Set Mud Mats for Access and Working

TWP: Morton

COUNTY: Mecosta

Platform. Installed 2" monitoring well w/screen at 100'-105'. See MW-36 for well construction.

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
965.0	0	(0.0, 69.0) See B-16 & B-17 for Soil Description						
960.0	5							
955.0	10							
950.0	15							
945.0	20							
940.0	25							
935.0	30	Driller felt difference in drilling sampled - SAND @ 1SS		1SS 27 - 29 ft.				
930.0	35	Brown, Wet, fine SAND @ 2SS		2SS 32 - 34 ft.				
		Gray, Moist, CLAY @ 3SS		3SS 35 - 37 ft.				

GROUNDWATER OBSERVATIONS

- ☒ DURING DRILLING: 1'-then Artesian
- ☒ AT COMPLETION OF DRILLING: Artesian
- ☒ AFTER 24 HOURS: 5.9' Above G.S.

NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings

- *LL = Liquid Limit - PI = Plasticity Index
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CLIENT & PROJECT: URS, M-20 over Schrader Creek

DATE DRILLED: Nov. 2, 5 & 8, 2010

BORING NO.: B-36

Page 2 of 4

JOB NUMBER: 22621.00005

BORING LOCATION: N: 767012.7, E: 12895898.3, Sta 1541+67, Offset 23.8' Rt

DRILLER/HELPER: Stearns

METHOD OF DRILLING: 8.25" HSA to 38', Set 6" Steel Casing to 39'

DRILL RIG: CME 1050

GROUND ELEVATION: 965.7

LOGGED BY: RM

NOTES: 5-7/8" Tricone Mud Rotary, Set Mud Mats for Access and Working

TWP: Morton

COUNTY: Mecosta

Platform. Installed 2" monitoring well w/screen at 100'-105'. See MW-36 for well construction.

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
925.0	40	Gray, Moist, CLAY @ 4SS		4SS 38 - 40 ft.				
920.0	45							
915.0	50							
910.0	55							
905.0	60							
900.0	65							
895.0	70	(69.0, 84.0) Loose to Medium Dense, Brown, Wet, fine to medium SAND; Trace Gravel and Silt		5SS 69 - 71 ft. 4-2-5-4 (7) 70%				
890.0	75			6SS 74 - 76 ft.				Drove Rock at 6SS & 7SS

GROUNDWATER OBSERVATIONS

- ☒ DURING DRILLING: 1'-then Artesian
- ☒ AT COMPLETION OF DRILLING: Artesian
- ☒ AFTER 24 HOURS: 5.9' Above G.S.

NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings

- *LL = Liquid Limit - PI = Plasticity Index
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DATE DRILLED: Nov. 2, 5 & 8, 2010

BORING NO.: B-36

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JOB NUMBER: 22621.00005

BORING LOCATION: N: 767012.7, E: 12895898.3, Sta 1541+67, Offset 23.8' Rt

DRILLER/HELPER: Stearns

METHOD OF DRILLING: 8.25" HSA to 38', Set 6" Steel Casing to 39'

DRILL RIG: CME 1050

GROUND ELEVATION: 965.7

LOGGED BY: RM

NOTES: 5-7/8" Tricone Mud Rotary, Set Mud Mats for Access and Working

TWP: Morton

COUNTY: Mecosta

Platform. Installed 2" monitoring well w/screen at 100'-105'. See MW-36 for well construction.

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
890.0				5-4-3-4 (7) 5%				
885.0	80			7SS 79 - 81 ft. 10-11-9-14 (20) 5%				
880.0	85	(84.0, 110.3) Medium Dense, Gray, Wet, fine to coarse GRAVEL		8SS 84 - 86 ft. 7-7-5-7 (12) 50%				
875.0	90			9SS 89 - 91 ft. 7-7-7-6 (14) 40%				
870.0	95			10SS 94 - 96 ft. 6-6-7-4 (13) 50%				
865.0	100			11SS 99 - 101 ft. 23-18-13-9 (31) 10%				
860.0	105			12SS 104 - 106 ft. 15-16-20-21 (36) 2%				
855.0	110	(110.3, 124.5) Hard, Gray, Moist, CLAY; Trace Gravel and Sand		13SS 109 - 110.5 ft. 20-56-50 (106) 100%	15.4		Qp=4.5+	3" Split Spoon

GROUNDWATER OBSERVATIONS

- ☒ DURING DRILLING: 1'-then Artesian
- ☒ AT COMPLETION OF DRILLING: Artesian
- ☒ AFTER 24 HOURS: 5.9' Above G.S.

NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings

- *LL = Liquid Limit - PI = Plasticity Index
- *St = Hand Torvane Shear Strength
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BORING NO.: B-36

Page 4 of 4

JOB NUMBER: 22621.00005

BORING LOCATION: N: 767012.7, E: 12895898.3, Sta 1541+67, Offset 23.8' Rt

DRILLER/HELPER: Stearns

METHOD OF DRILLING: 8.25" HSA to 38', Set 6" Steel Casing to 39'

DRILL RIG: CME 1050

GROUND ELEVATION: 965.7

LOGGED BY: RM

NOTES: 5-7/8" Tricone Mud Rotary, Set Mud Mats for Access and Working

TWP: Morton

COUNTY: Mecosta

Platform. Installed 2" monitoring well w/screen at 100'-105'. See MW-36 for well construction.

Elevation	Depth (ft)	Material Description	Soil Type	Sample #/Type Sample Depth SPT Results (N-Value) % REC.	Moisture %	Natural Unit Weight (pcf)	Unconfined Comp. Strength* (tsf)	*Test Data - Comments
850.0	115			14SS 114 - 116 ft. 9-12-18-20 (30) 100%	19.6	133.7	Qp=4.5+	
845.0	120			15SS 119 - 121 ft. 53-90-82-89 (172) 50%				
840.0	125			(124.5, 143.0) Very Dense, Brown, Wet, fine SAND with Silt 16SS 124 - 126 ft. 33-53-100/5" 40%				
835.0	130			17SS 129 - 131 ft. 28-82-50/2" 40%				
830.0	135			18SS 134 - 136 ft. 28-53-100/6" 60%				
825.0	140			19SS 139 - 141 ft. 37 - 100/5" 40%				
820.0	145	(143.0, 150.0) Very Dense, Brown, Wet, fine to coarse SAND with Gravel		20SS 144 - 146 ft. 55-100/6" 40%				
	150	21SS 149 - 150 ft. 48-100/6" 83%						

GROUNDWATER OBSERVATIONS

- ☒ DURING DRILLING: 1'-then Artesian
- ☒ AT COMPLETION OF DRILLING: Artesian
- ☒ AFTER 24 HOURS: 5.9' Above G.S.

NE - Not Encountered NR - Not Recorded

HOLE COLLAPSE

AT COMPLETION: NR
 AFTER NR HOURS: NR

BACKFILL: Soil Cuttings

- *LL = Liquid Limit - PI = Plasticity Index
- *St = Hand Torvane Shear Strength
- *Qp = Pocket Penetrometer
- *Qu = Unconfined Compression Machine



GENERAL NOTES FOR SOIL CHARACTERIZATION

Soil Property Symbols

N:	Standard Penetration Resistance (ASTM D-1586). Blows of a 140-lb hammer falling 30 inches required to drive a 2 inch O.D. split-spoon sampler (except where otherwise noted) 1 foot into the soil.	w:	Water Content, % (ASTM D-2216)
Q _u :	Controlled strain unconfined compressive strength, tsf (ASTM D-2166)	LL:	Liquid Limit, % (ASTM D-4318)
Q _p :	Calibrated hand penetrometer unconfined compressive strength, tsf	PL:	Plastic Limit, % (ASTM D-4318)
S _t :	Calibrated Torvane shear strength, tsf	PI:	Plasticity Index, % (ASTM D-4318)
γ:	Natural Unit Weight, pcf	PID:	Photoionization detection values, ppm
		LOI:	Loss on Ignition, %

Drilling and Sampling Symbols

B-#:	Boring	#-PS:	Probe Sample
MW-#:	Monitoring Well	#-RC:	Rock Core Sample
#-SS:	Split-spoon Sample	#-GS:	Grab Sample
#-ST:	Shelby Tube Sample	#-PMT	Pressuremeter Test
#-AS:	Auger Sample	NR:	No Recovery
#-GW:	Groundwater Sample	DS:	Disturbed Sample
#-WS:	Wash Sample	DR:	Drove Rock

Sample Classification

Samples visually classified based upon guidance provided by ASTM Standard D-2488 and the Unified Soil Classification System.

Particle Size

Boulders:	Greater than 12" (305 mm)
Cobbles:	3" to 12" (76 mm to 305 mm)
Coarse Gravel:	3/4" to 3" (19 mm to 76 mm)
Fine Gravel:	#4 to 3/4" (4.76 mm to 19 mm)
Coarse Sand:	#10 to #4 (2.00 mm to 4.76 mm)
Medium Sand:	#40 to #10 (0.425 mm to 2.00 mm)
Fine Sand:	#200 to #40 (0.075 mm to 0.425 mm)
Silt:	0.005 mm to 0.075 mm
Clay:	Less than 0.005 mm

Constituent Terms (Structures/Minor Constituents)

Trace:	0 - 5% (Clay)	0 – 15% (Sand)
With:	>5% to 15% (Clay)	>15% – 30% (Sand)
>15% (clay) & >30% (sand): Move descriptor to front of major constituent (i.e. Clayey SAND, Sandy CLAY)		
Parting:	Less than 3/8" thick	
Lens:	3/8" to 4" thick	
Layer:	Greater than 4" thick	
Occasional:	Occurs once or less per 12" thickness	
Frequent:	Occurs more than once per 12" thickness	

Relative Density and Consistency

GRANULAR SOILS

Very Loose	0- 4
Loose	5 - 10
Medium Dense	11 - 29
Dense	30 - 49
Very Dense	50 and Greater

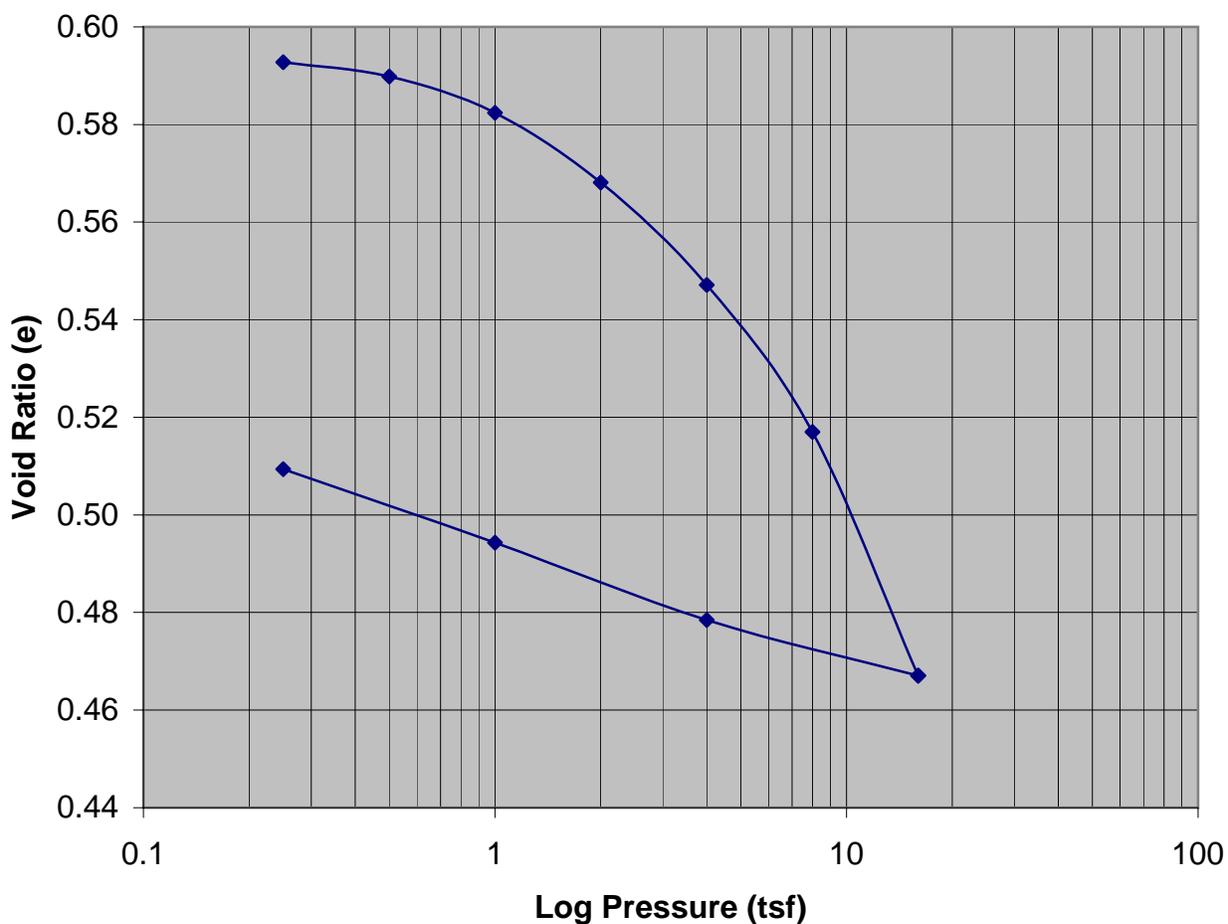
STANDARD PENETRATION (N) VALUE, BLOWS/FOOT

COHESIVE SOILS

Very Soft	Less than 0.25
Soft	0.25 - 0.49
Medium Stiff	0.50 - 0.99
Stiff	1.00 - 1.99
Very Stiff	2.00 - 3.99
Hard	4.00 – 8.00
Very Hard	Greater than 8.00

UNCONFINED COMPRESSIVE STRENGTH (Q_u or Q_p), tsf

e vs. log p



Moisture Content (%):..... Initial 21.2 Final 19.1
 Saturation (%):..... Initial 100 Final 100
 Dry Density (pcf):..... Initial 105.7 Final 114.9 $C_c =$ 0.17 $C_r =$ 0.03
 Void Ratio:..... Initial 0.59 Final 0.47 $LL =$ 35 $PI =$ 19

Overconsolidation (p_c) = 3.9 (tsf) Overburden (p_o) = 0.93 (tsf) $G_s =$ 2.70 Assumed

Boring No: B-3 Depth: 31 ft. Station: 1531+14 Offset: 9.3' RT Line: N/A

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 Grand Rapids, Michigan



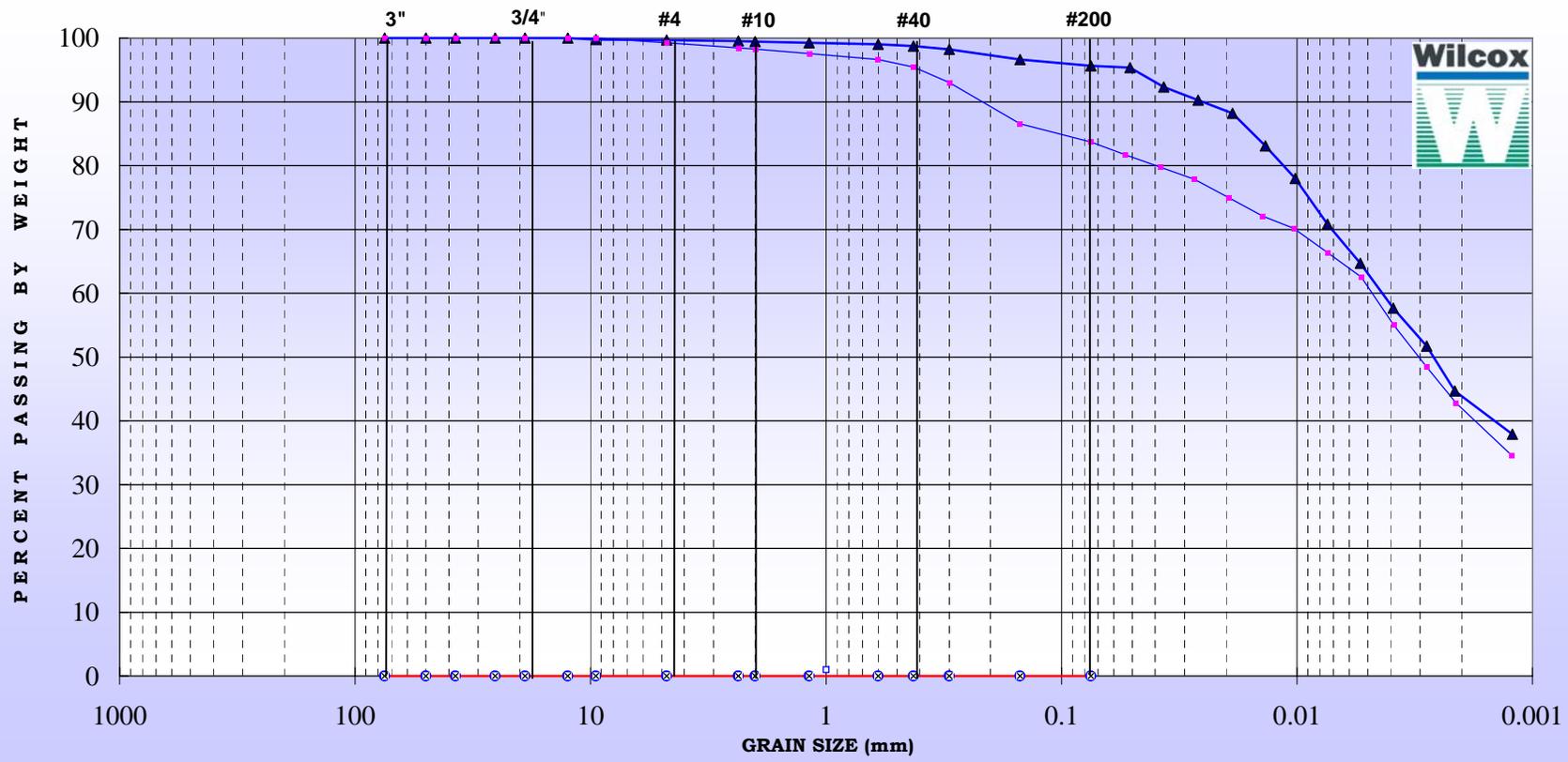
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 Cadillac, Michigan

Project Name:
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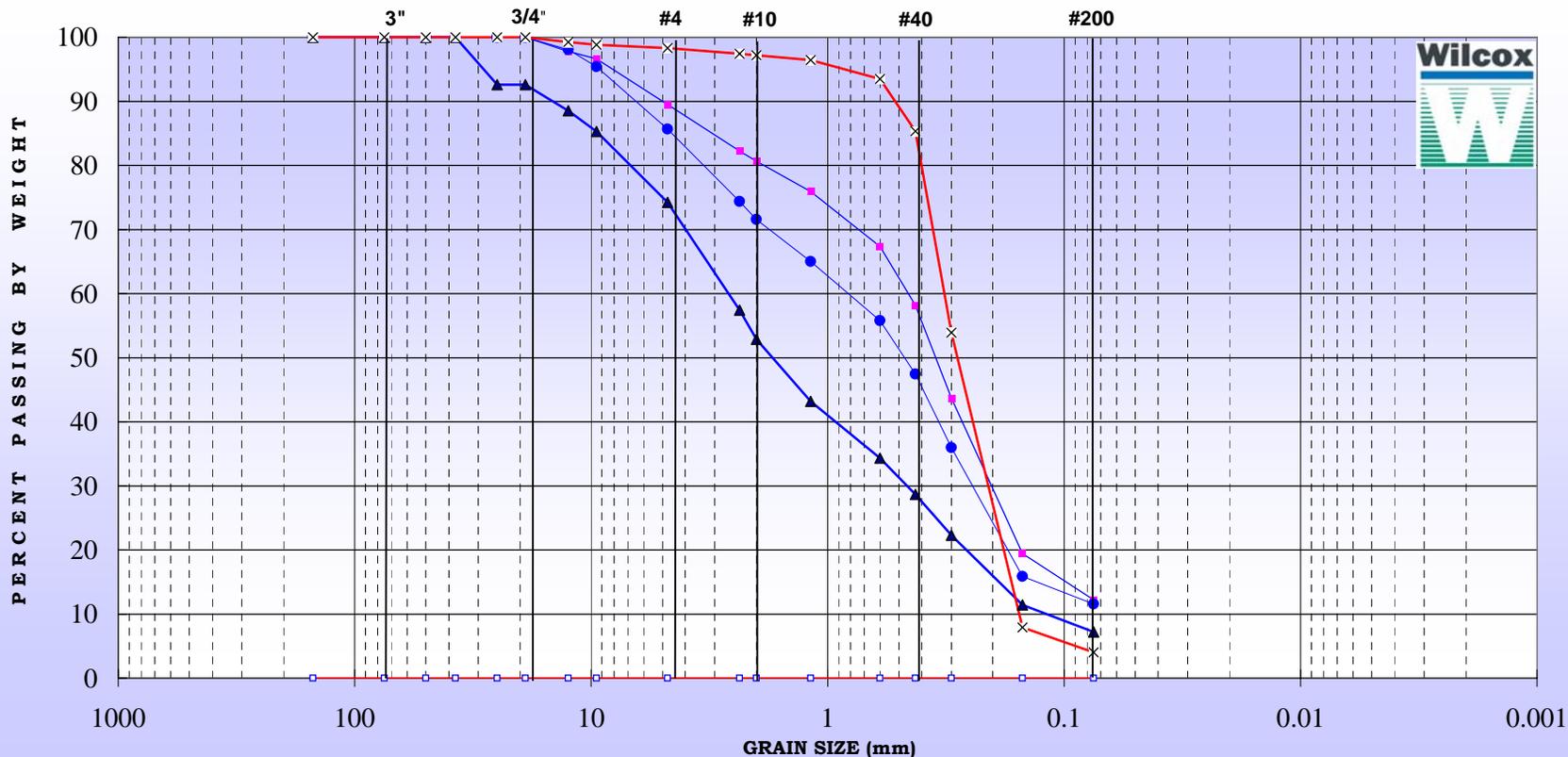
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GRAIN SIZE DISTRIBUTION - ASTM D422 - US STANDARD SIEVE OPENING SIZES



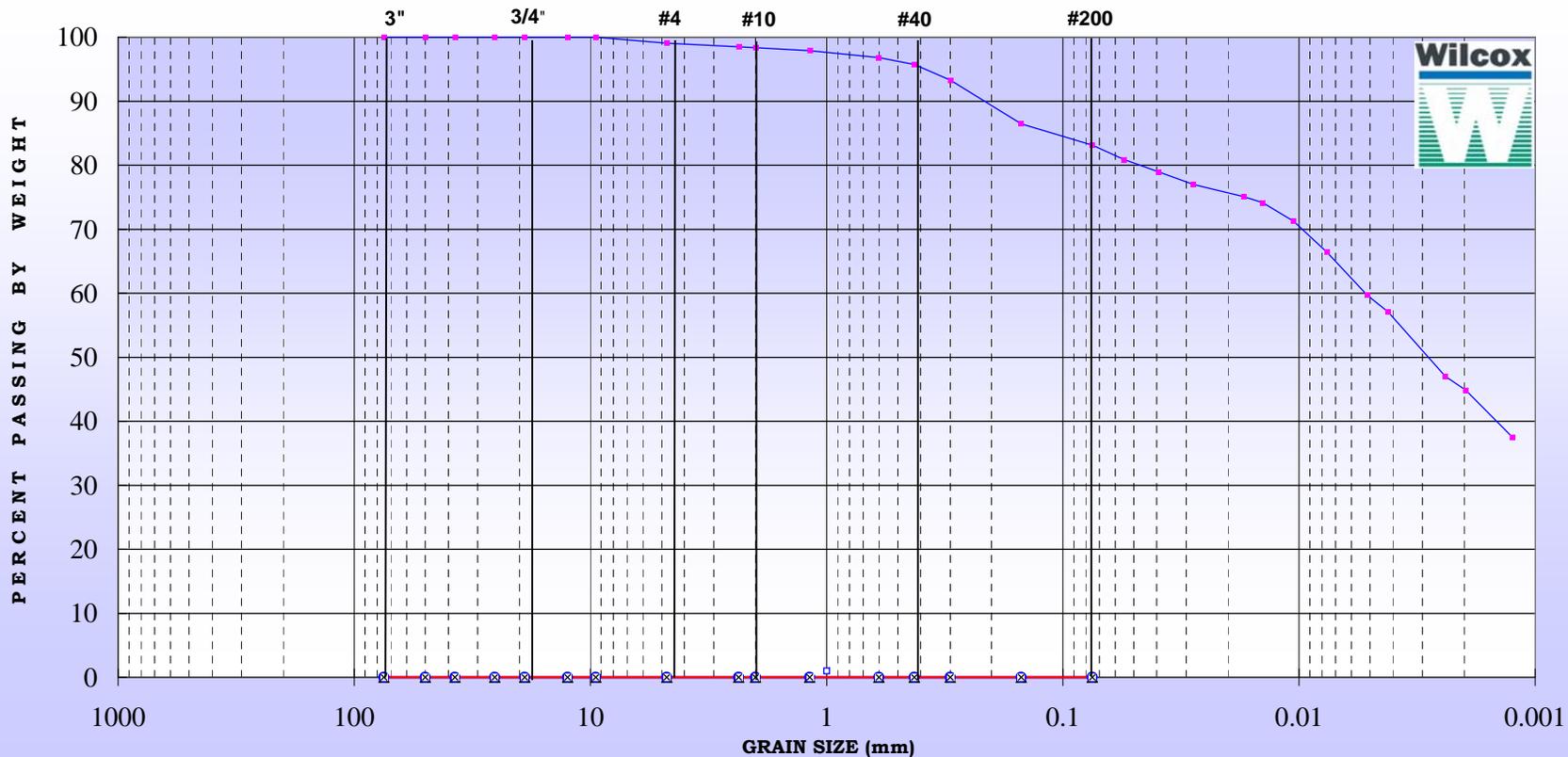
GRAIN SIZE DISTRIBUTION - ASTM D 422 - US STANDARD SIEVE OPENING SIZES



COBBLES	Coarse	Fine	Coarse	Medium	Fine	SILT OR CLAY
	GRAVEL		SAND			

SAMPLE ID	DEPTH (FT)	MDOT Granular Materials Check	NAT. w%	PL	LL	PI	%GRAVEL	%SAND	% SILT / CLAY	D ₆₀	D ₃₀	D ₁₀	Cc	Cu	
							>#4	#4 - #200	<#200	(mm)	(mm)	(mm)			
■	B-3	Subbase	Fails Class II; Meets Class III	5.8%	-	-	-	11	77	12	0.46	0.20	N/A	N/A	N/A
▲	B-5	Subbase	Meets Class II	6.4%	-	-	-	26	67	7	2.73	0.47	0.12	0.6	21.8
●	B-20	Subbase	Fails Class II; Meets Class III	11.0%	-	-	-	14	74	12	0.81	0.26	N/A	N/A	N/A
×	B-13	2.5 to 6.5	Meets Class II	-	-	-	-	2	94	4	0.32	0.22	0.16	1.0	2.1
□															
△															

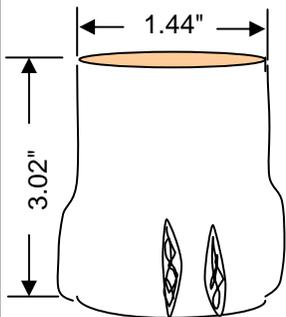
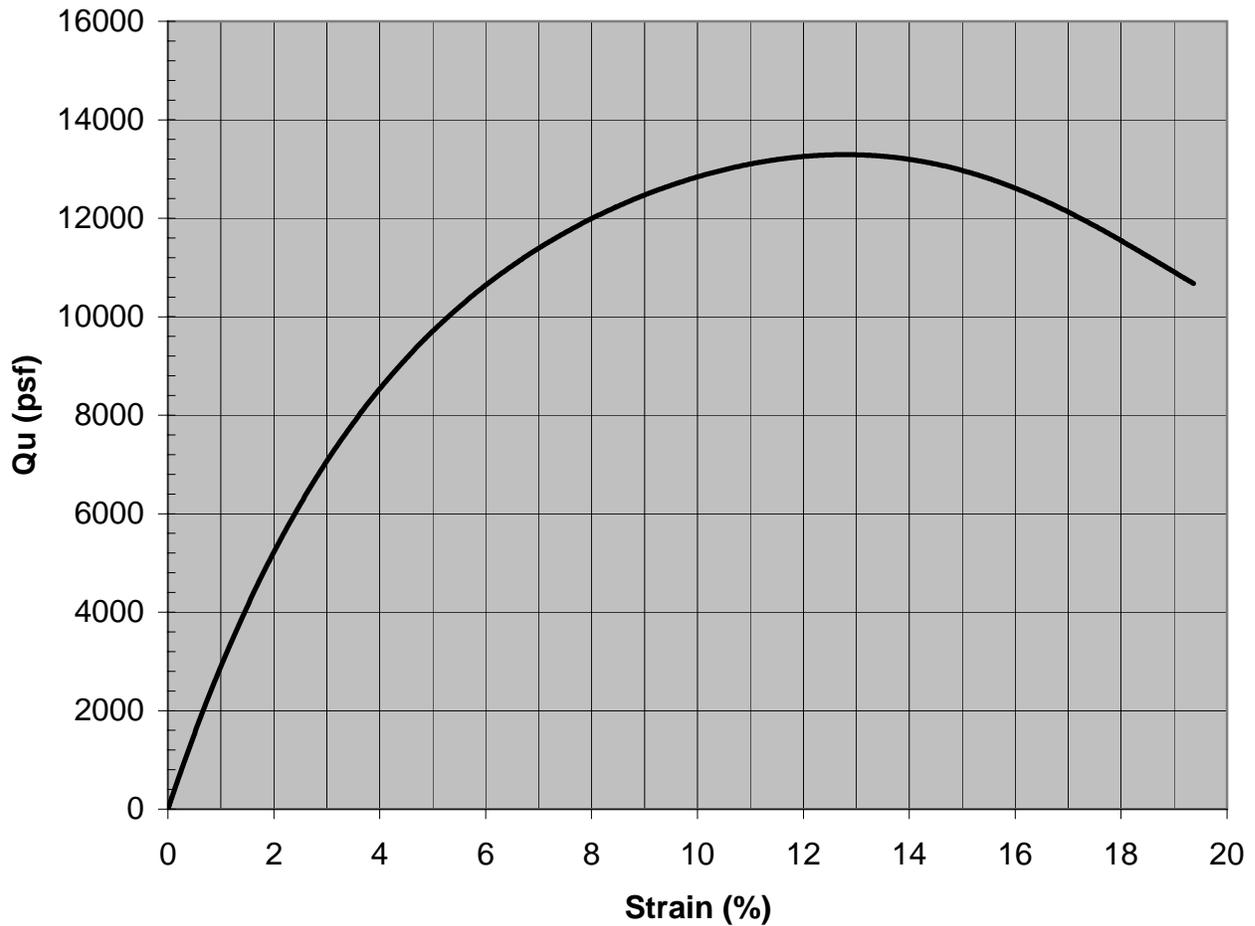
GRAIN SIZE DISTRIBUTION - ASTM D422 - US STANDARD SIEVE OPENING SIZES



COBBLES	Coarse	Fine	Coarse	Medium	Fine	SILT OR CLAY
	GRAVEL		SAND			

SAMPLE ID	DEPTH (FT)	UNIFIED SOIL CLASSIFICATION SYSTEM	NAT. w%	PL	LL	PI	GRAVEL		%SILT / CLAY		D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	Cc	Cu
							>#4	#4 - #200	<#200	>#200					
■ B-35	118-125	Lean Clay with Sand	16.1%	15	34	19	1	16	83	0.005	N/A	N/A	N/A	N/A	N/A
▲															
●															
X															
□															
△															

Unconfined Compression Test



FAILURE SKETCH

Sample Location : B-3

Depth (ft) : 88.5-90 Moisture Content (%) : 14.3

Strain Rate : 0.03015 1.0% Dry Unit Weight (pcf) : 123.0

Soil Description : Grayish Brown Clay

Unconfined Compression Strength (psf) : 13,360

Failure Strain (%) : 12.8

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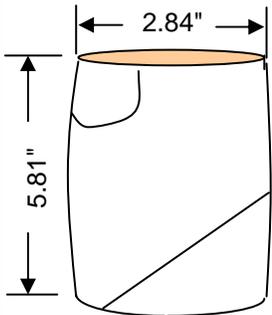
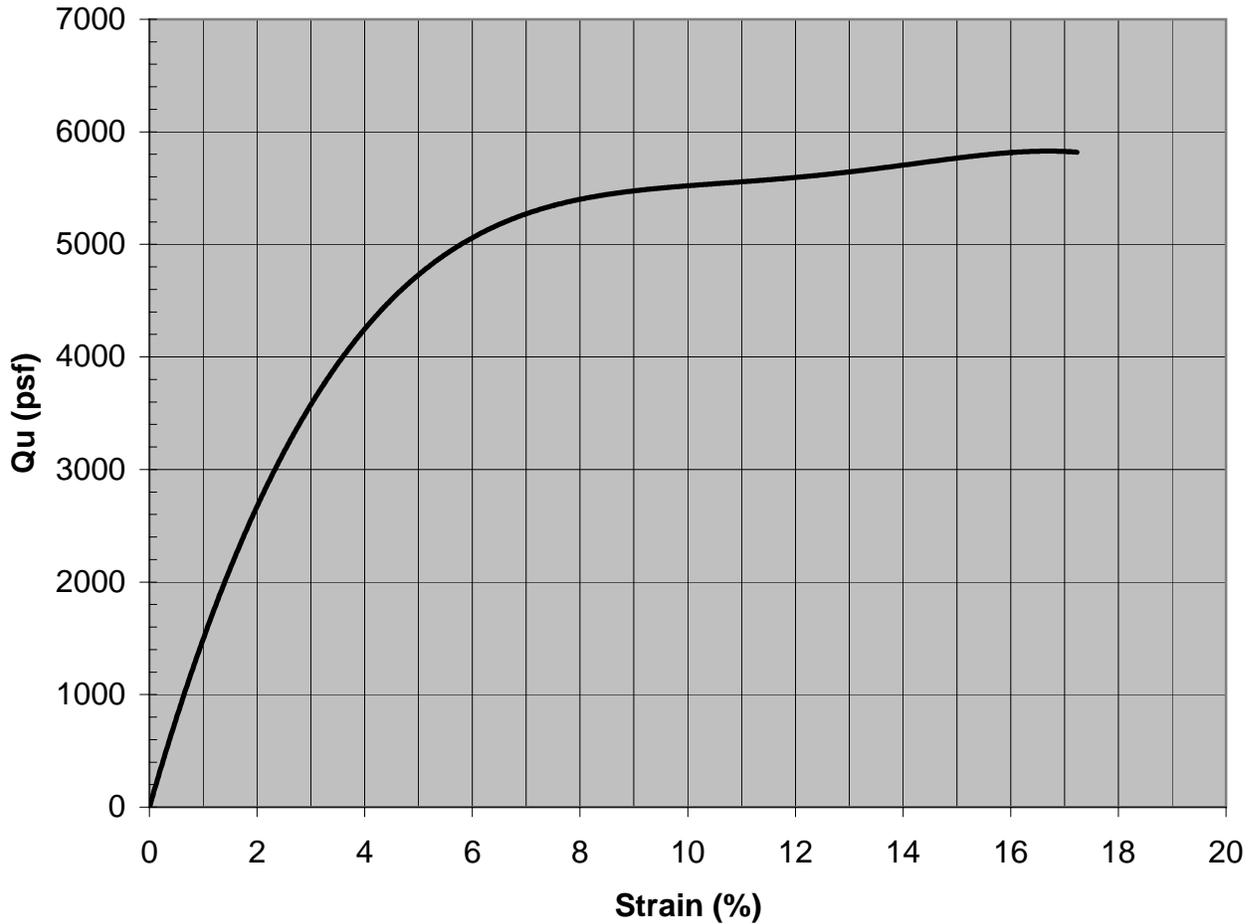


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Unconfined Compression Test



FAILURE SKETCH

Sample Location : B-3
 Depth (ft) : 30-32 Moisture Content (%) : 20.1
 Strain Rate : 0.05809 1.0% Dry Unit Weight (pcf) : 111.4
 Soil Description : Brownish Gray Clay
 Unconfined Compression Strength (psf) : 5,750
 Failure Strain (%) : 12.8

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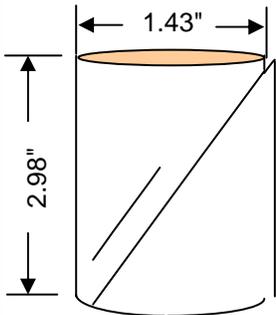
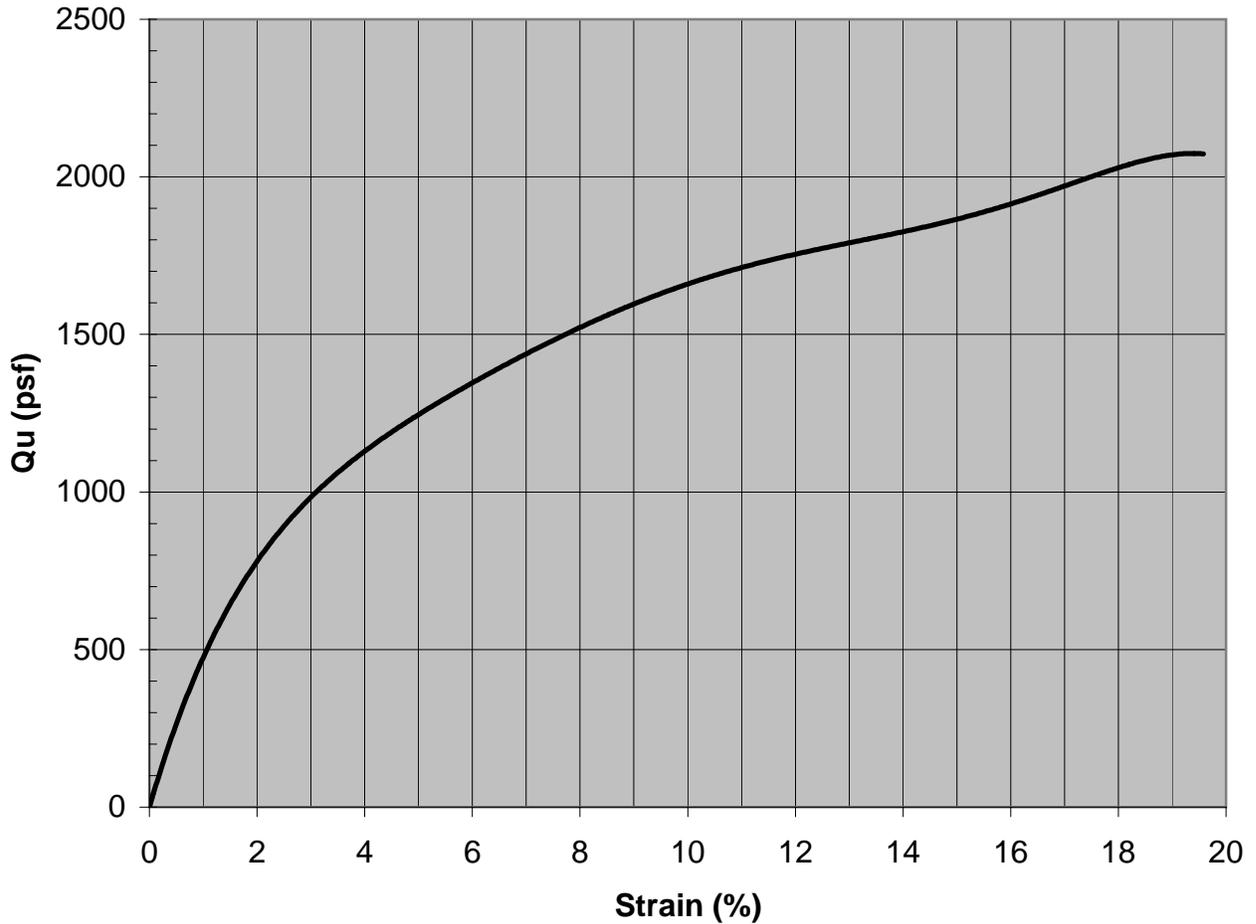


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Unconfined Compression Test



FAILURE SKETCH

Sample Location : B-4
 Depth (ft) : 60-61.5 Moisture Content (%) : 24.6
 Strain Rate : 0.02983 1.0% Dry Unit Weight (pcf) : 102.1
 Soil Description : Gray Clay
 Unconfined Compression Strength (psf) : 1,870
 Failure Strain (%) : 15.0

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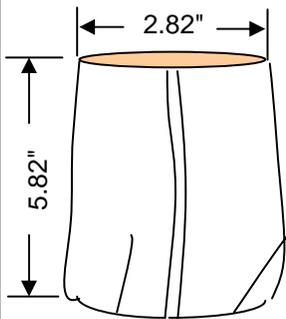


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Unconfined Compression Test



FAILURE SKETCH

Sample Location : B-5

Depth (ft) : 60-62 Moisture Content (%) : 25.0

Strain Rate : 0.05815 1.0% Dry Unit Weight (pcf) : 103.0

Soil Description : Grayish Brown Clay

Unconfined Compression Strength (psf) : 3,390

Failure Strain (%) : 2.8

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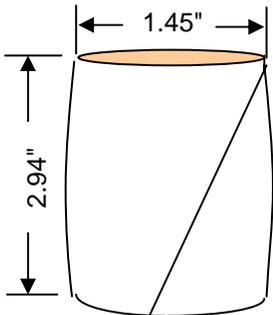
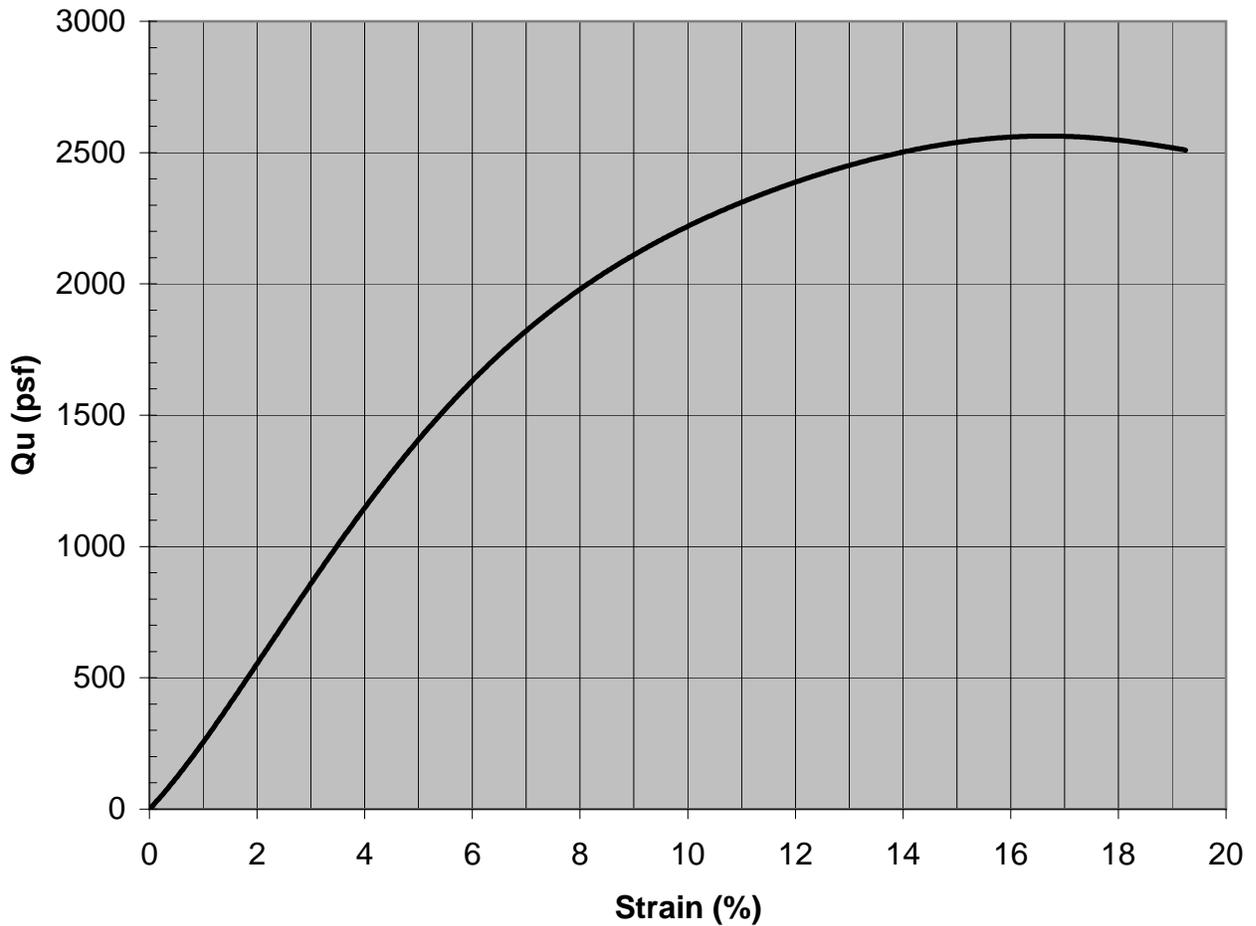


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Unconfined Compression Test



FAILURE SKETCH

Sample Location : B-5
 Depth (ft) : 55-56.5 Moisture Content (%) : 16.3
 Strain Rate : 0.02935 1.0% Dry Unit Weight (pcf) : 119.2
 Soil Description : Grayish Brown Clay
 Unconfined Compression Strength (psf) : 2,550
 Failure Strain (%) : 15.0

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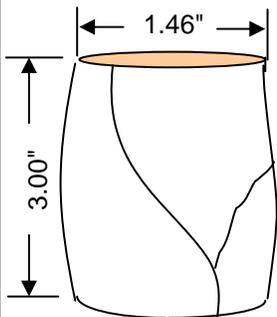
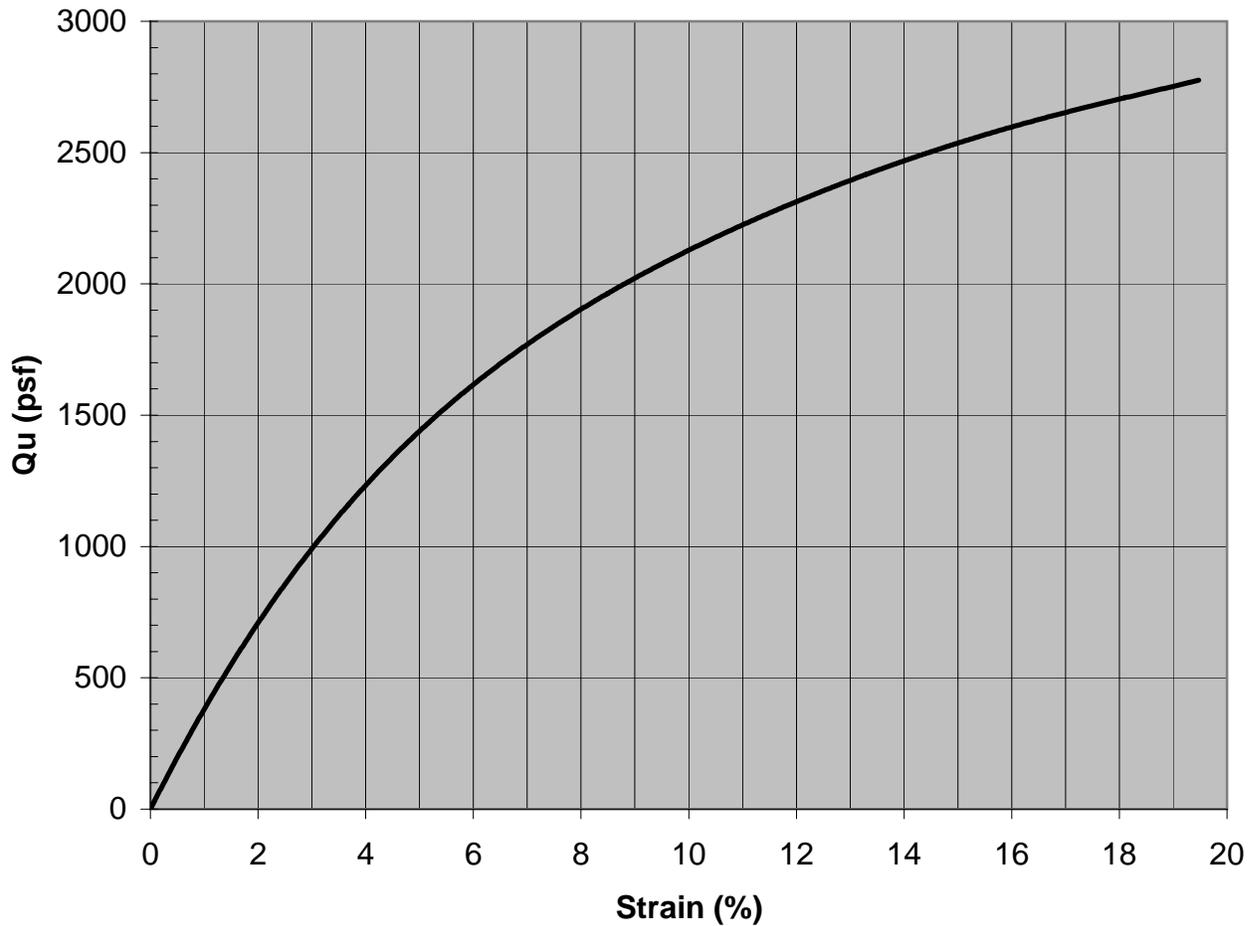


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Unconfined Compression Test



FAILURE SKETCH

Sample Location : B-8

Depth (ft) : 63.5-65 Moisture Content (%) : 21.6

Strain Rate : 0.02999 1.0% Dry Unit Weight (pcf) : 105.5

Soil Description : Grayish Brown Clay

Unconfined Compression Strength (psf) : 2,530

Failure Strain (%) : 15.0

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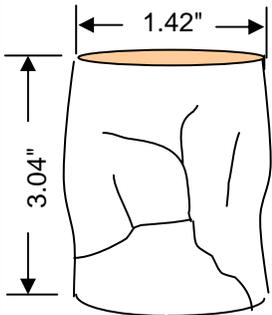
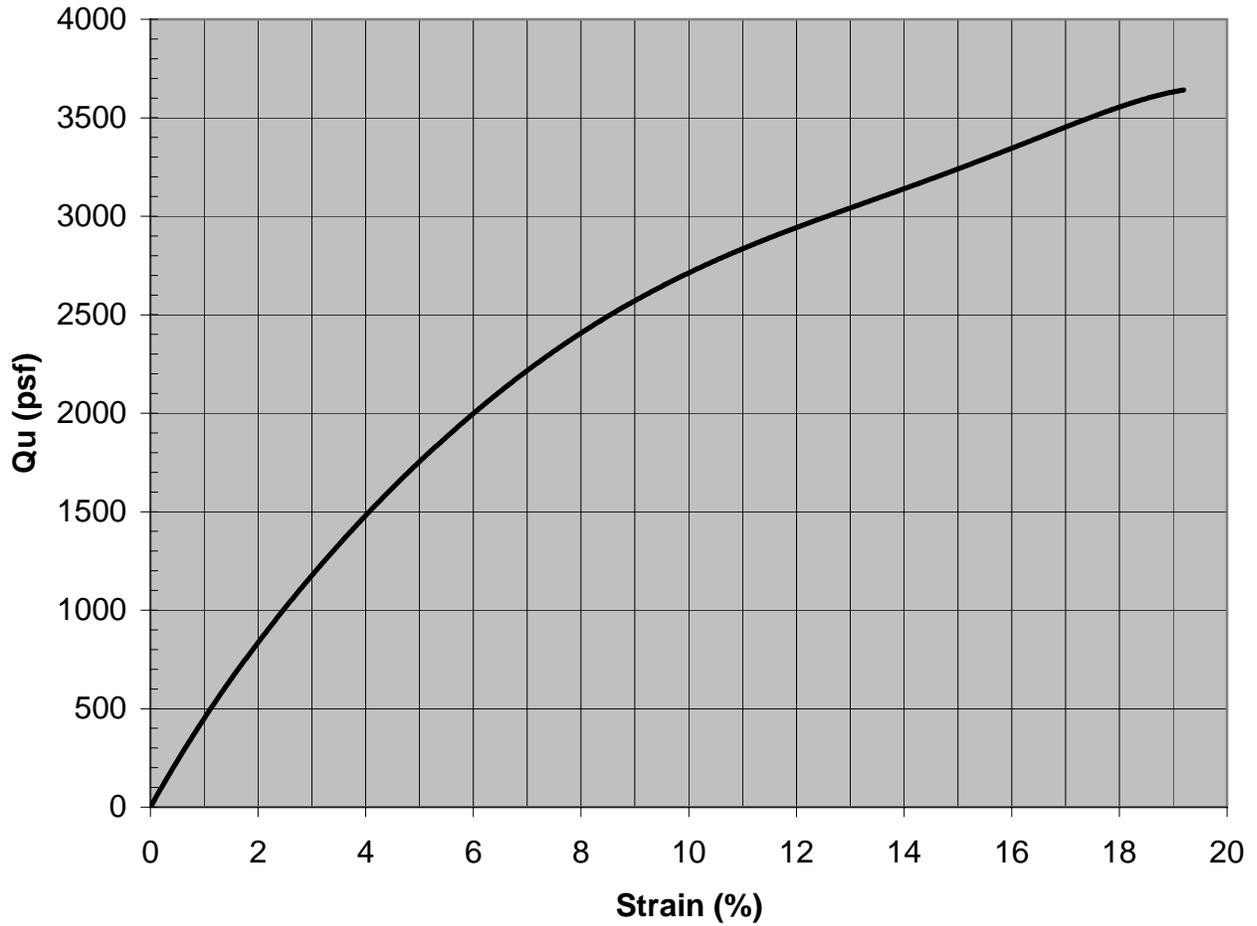


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Unconfined Compression Test



FAILURE SKETCH

Sample Location : B-15

Depth (ft) : 100-101.5 Moisture Content (%) : 18.7

Strain Rate : 0.03042 1.0% Dry Unit Weight (pcf) : 112.1

Soil Description : Grayish Brown Clay

Unconfined Compression Strength (psf) : 3,250

Failure Strain (%) : 15.0

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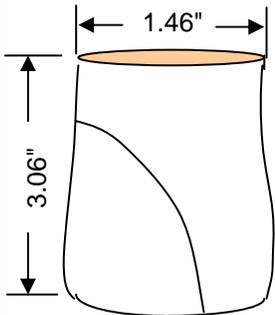
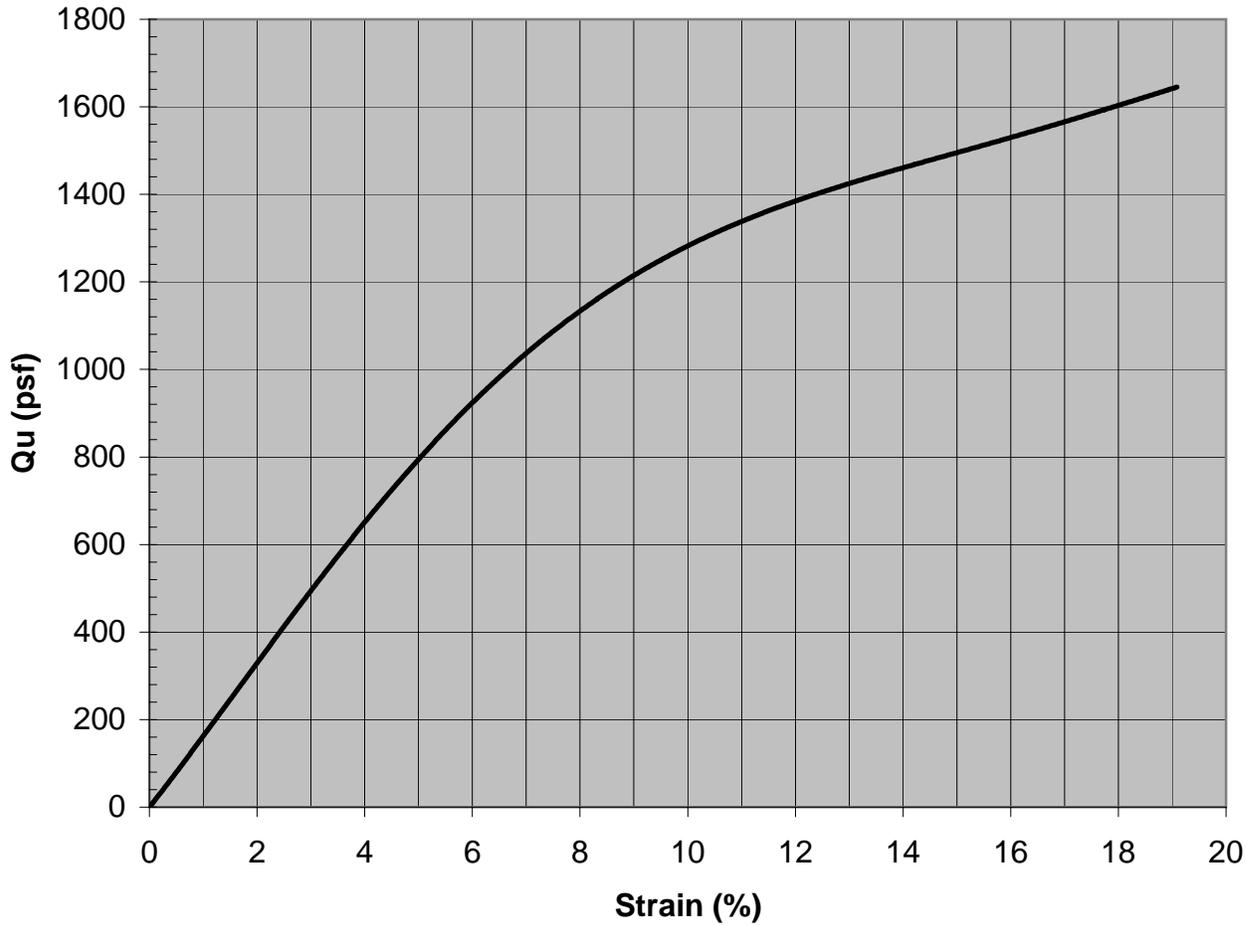


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Unconfined Compression Test



FAILURE SKETCH

Sample Location : B-10

Depth (ft) : 45-46.5 Moisture Content (%) : 18.6

Strain Rate : 0.03059 1.0% Dry Unit Weight (pcf) : 107.6

Soil Description : Gray Clay

Unconfined Compression Strength (psf) : 1,520

Failure Strain (%) : 15.0

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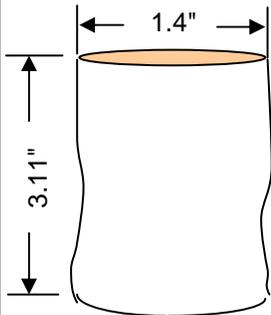
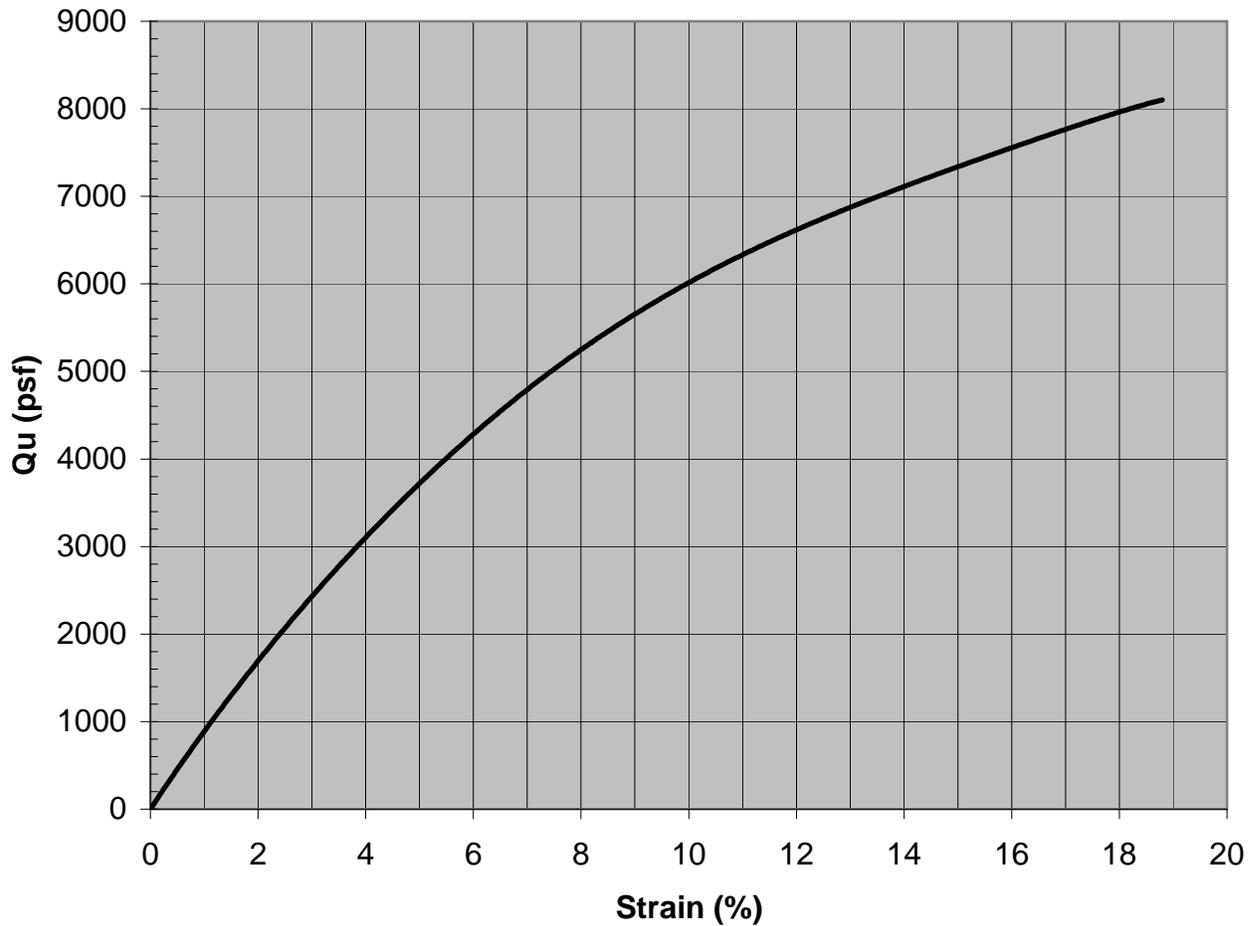


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Unconfined Compression Test



FAILURE SKETCH

Sample Location : B-18

Depth (ft) : 85-86.5 Moisture Content (%) : 18.3

Strain Rate : 0.03107 1.0% Dry Unit Weight (pcf) : 114.4

Soil Description : Grayish Brown Clay

Unconfined Compression Strength (psf) : 7,360

Failure Strain (%) : 15.0

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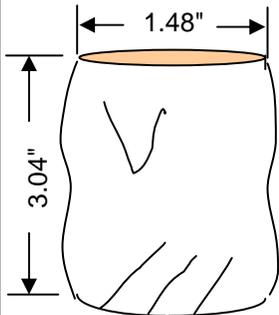
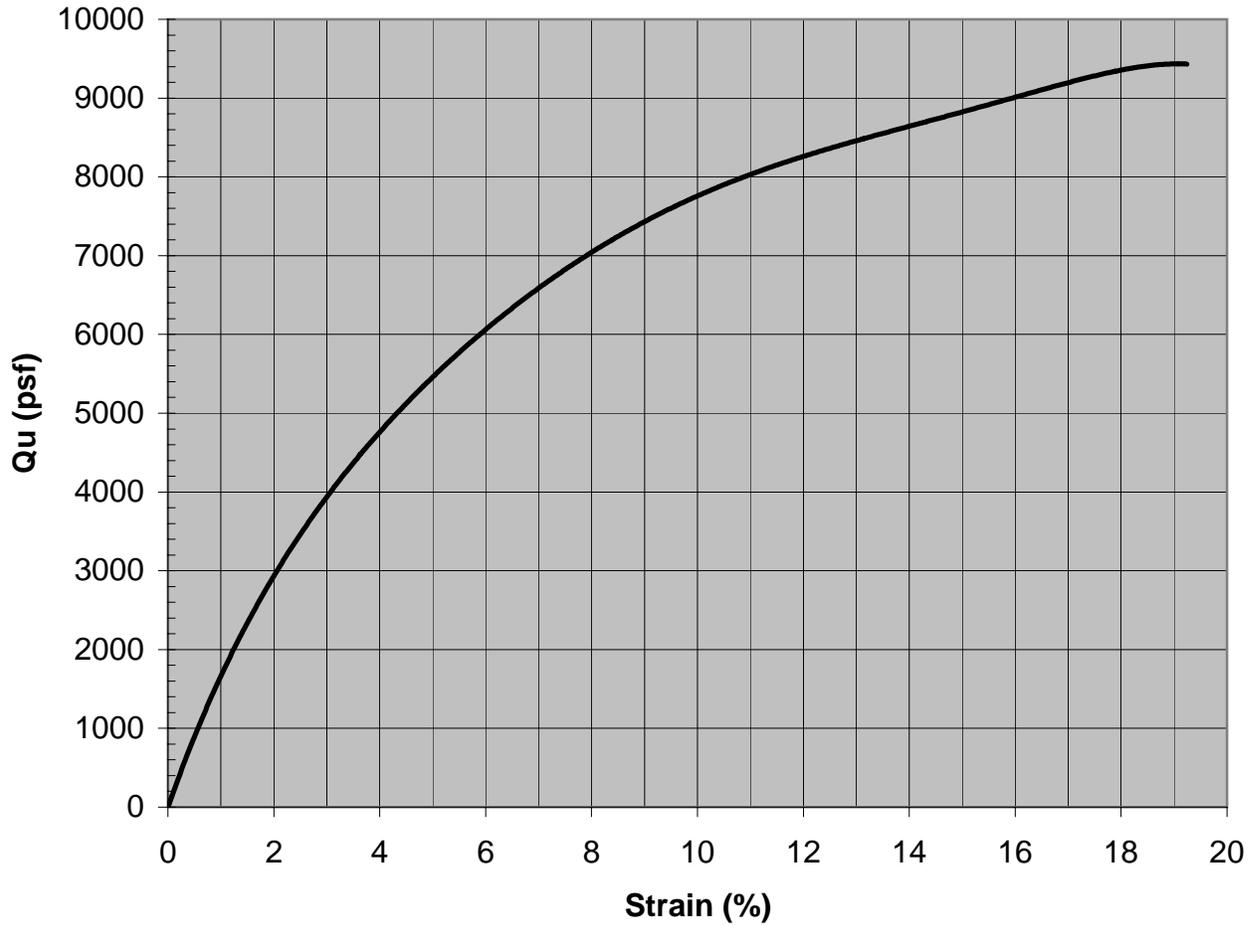


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DATE:
June 16, 2010

Unconfined Compression Test



FAILURE SKETCH

Sample Location : B-20

Depth (ft) : 73.5-75 Moisture Content (%) : 14.0

Strain Rate : 0.03035 1.0% Dry Unit Weight (pcf) : 125.1

Soil Description : Grayish Brown Clay

Unconfined Compression Strength (psf) : 8,830

Failure Strain (%) : 15.0

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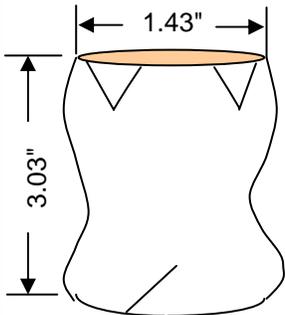
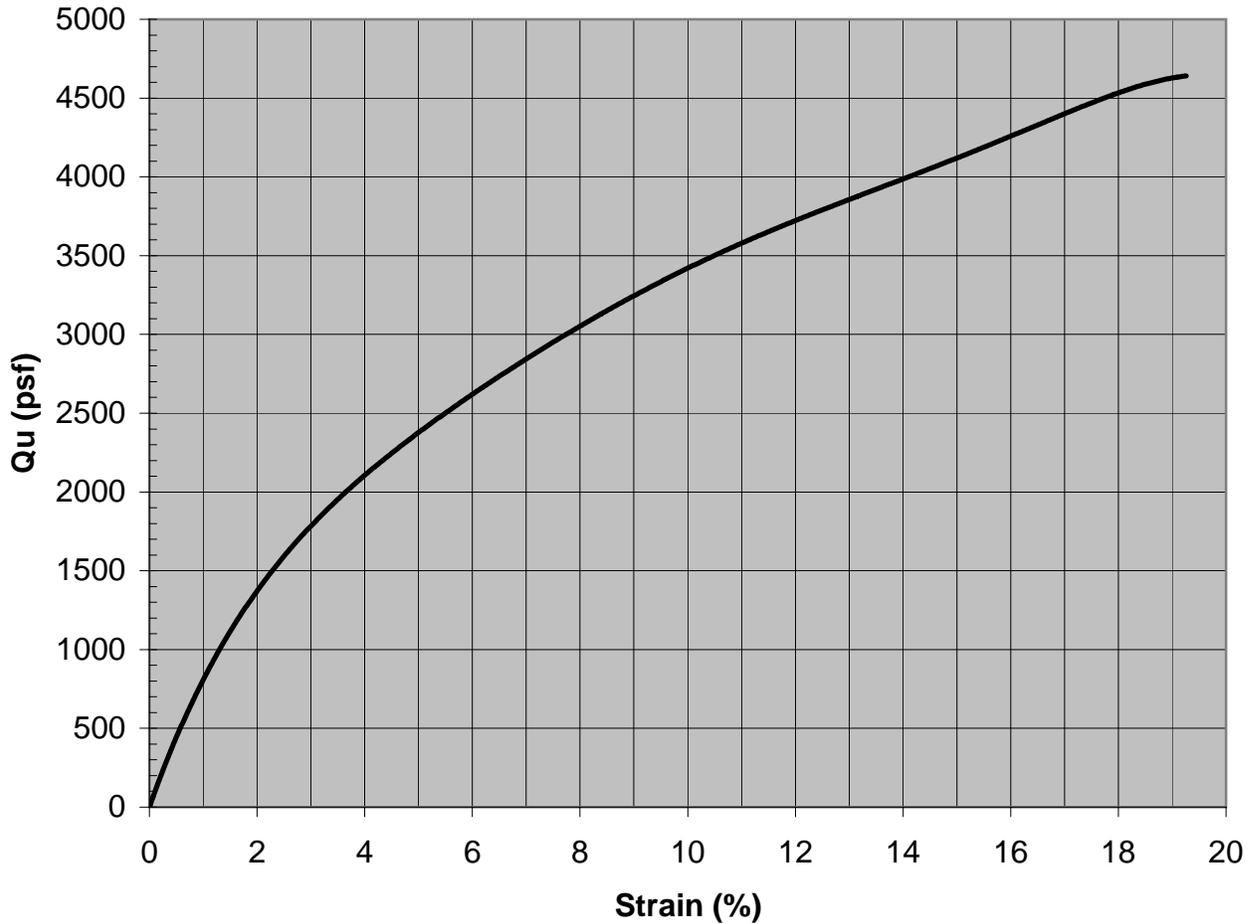


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Unconfined Compression Test



FAILURE SKETCH

Sample Location : B-19

Depth (ft) : 83.5-85 Moisture Content (%) : 18.6

Strain Rate : 0.03032 1.0% Dry Unit Weight (pcf) : 113.7

Soil Description : Dark Gray Clay

Unconfined Compression Strength (psf) : 4,100

Failure Strain (%) : 15.0

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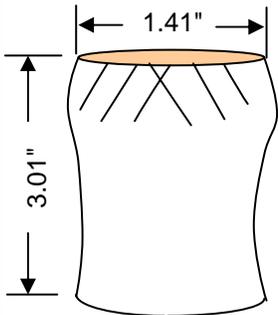
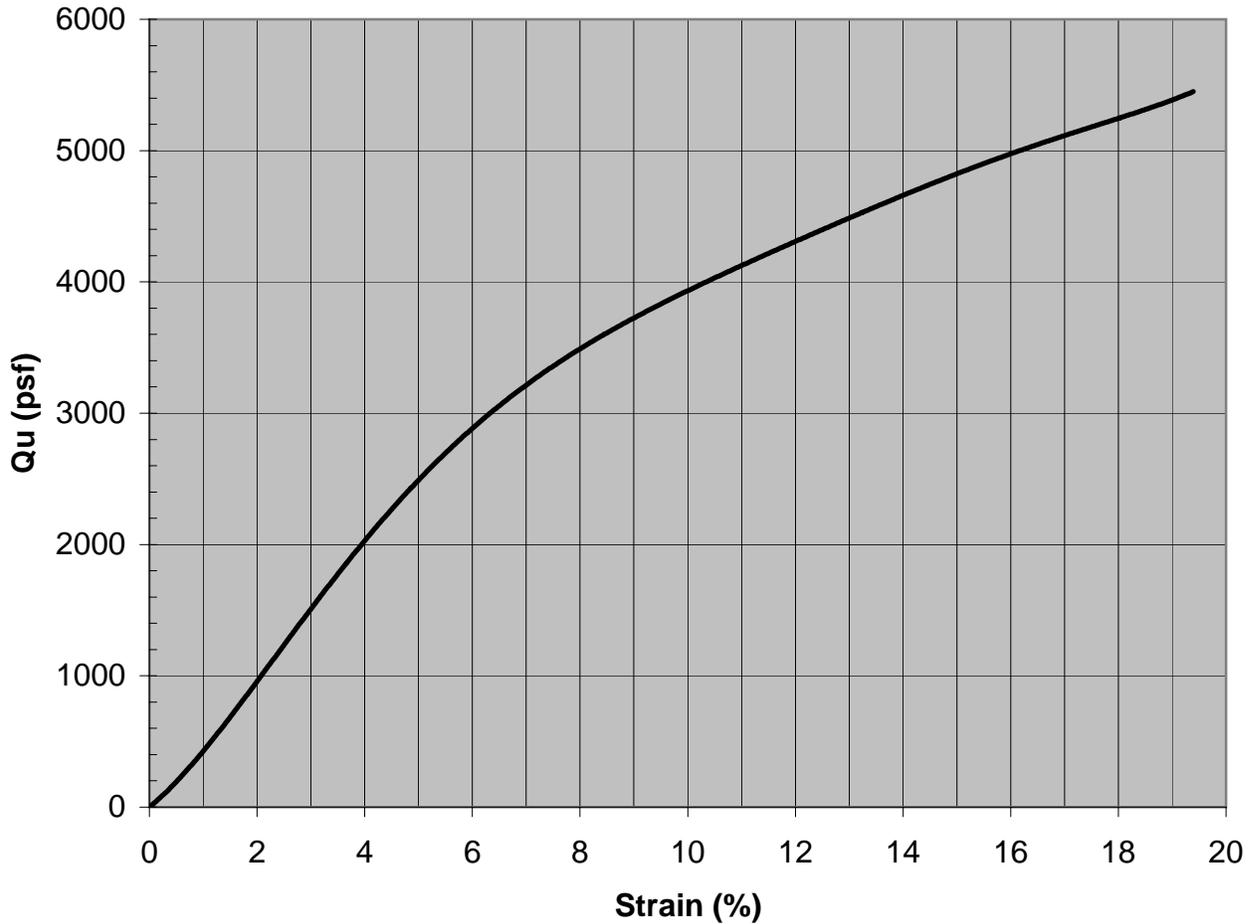


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22621.00005

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June 30, 2010

Unconfined Compression Test



FAILURE SKETCH

Sample Location : B-21
 Depth (ft) : 73.5-75 Moisture Content (%) : 16.0
 Strain Rate : 0.03012 1.0% Dry Unit Weight (pcf) : 118.6
 Soil Description : Dark Gray Clay
 Unconfined Compression Strength (psf) : 4,800
 Failure Strain (%) : 15.0

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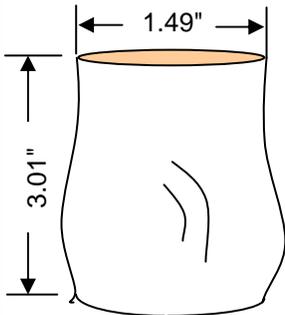
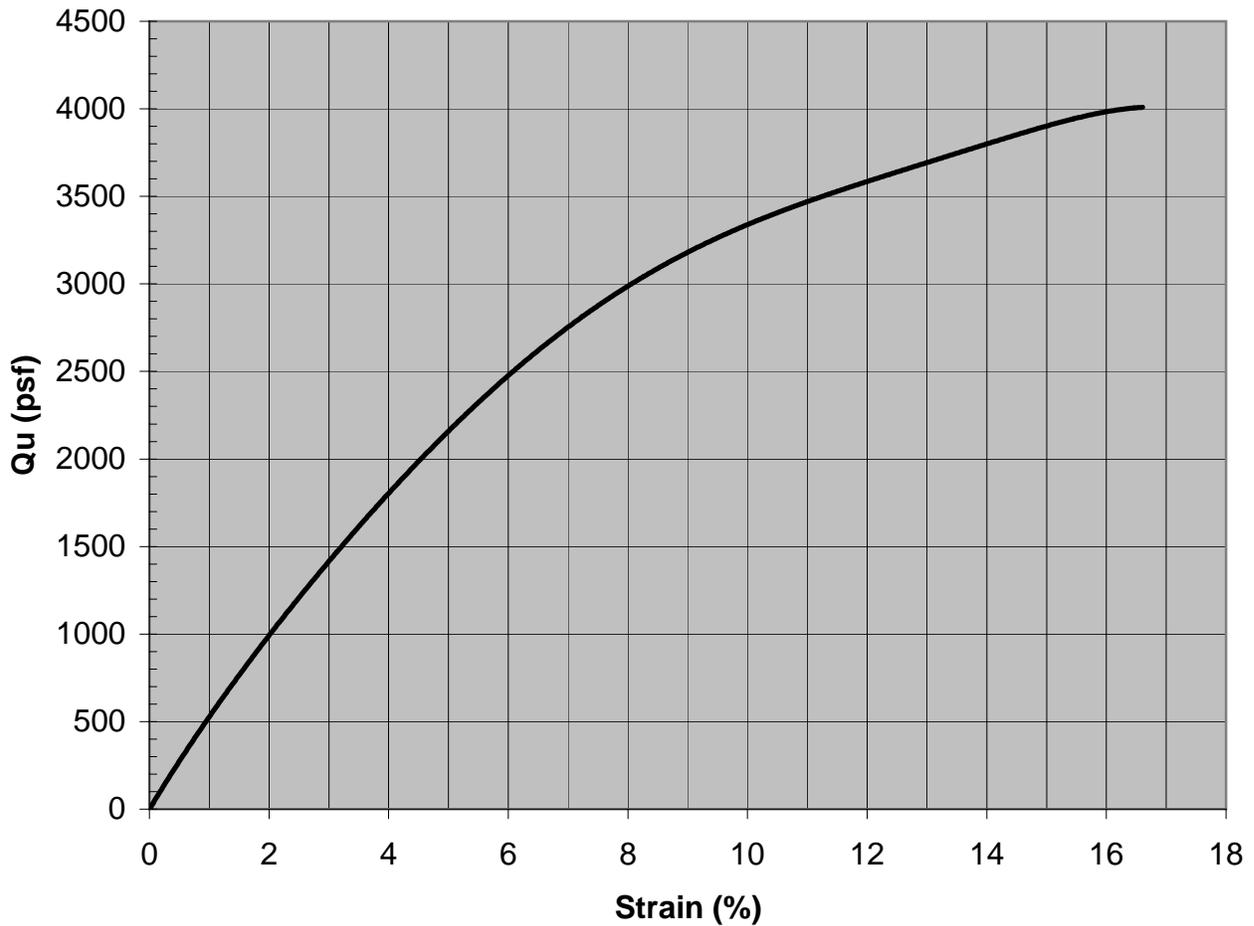


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DATE:
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Unconfined Compression Test



FAILURE SKETCH

Sample Location : B-22

Depth (ft) : 65-66.5 Moisture Content (%) : 17.6

Strain Rate : 0.03011 1.0% Dry Unit Weight (pcf) : 115.7

Soil Description : Grayish Brown Clay

Unconfined Compression Strength (psf) : 3,890

Failure Strain (%) : 15.0

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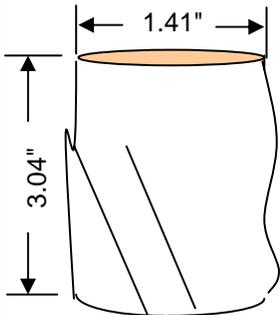
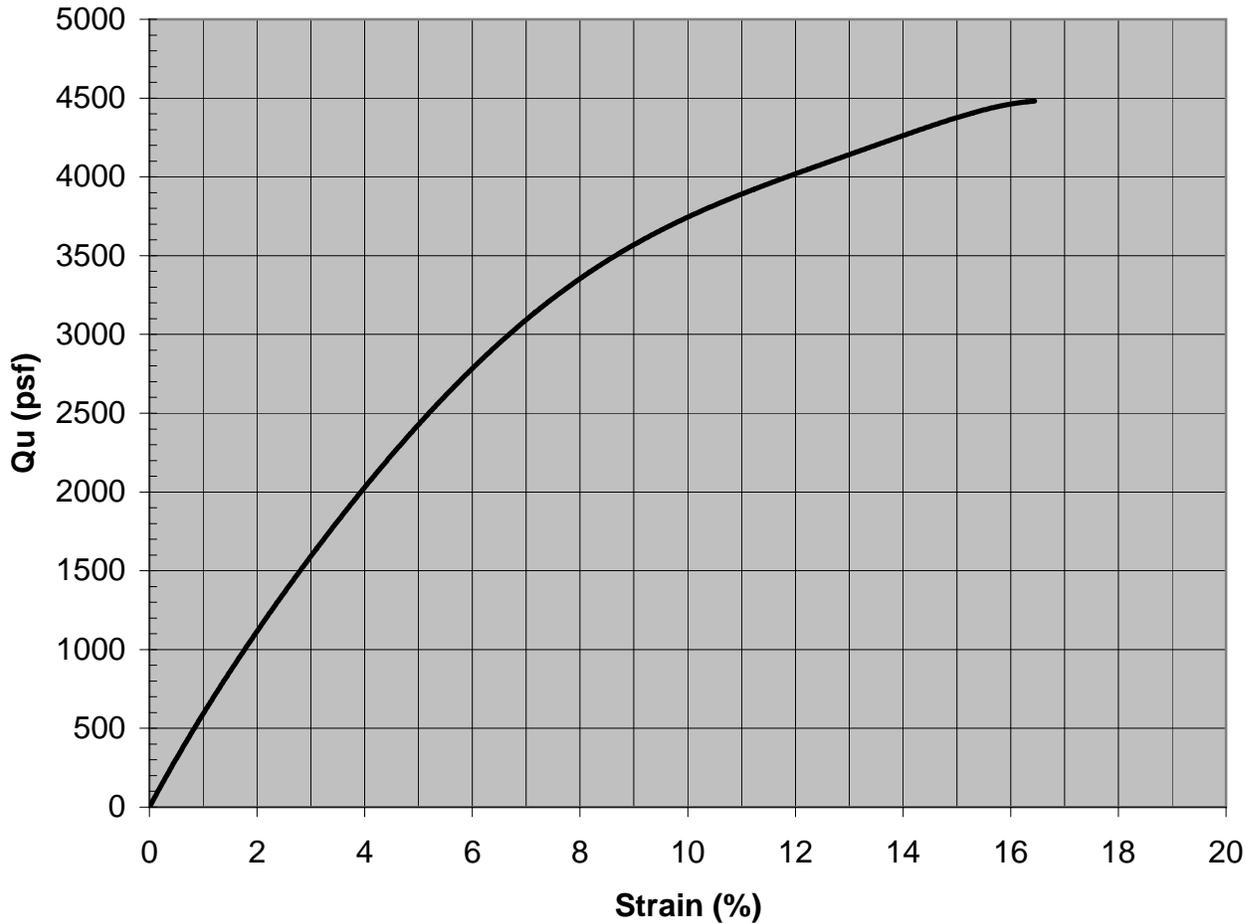


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Unconfined Compression Test



FAILURE SKETCH

Sample Location : B-22

Depth (ft) : 60-61.5 Moisture Content (%) : 14.6

Strain Rate : 0.03041 1.0% Dry Unit Weight (pcf) : 121.9

Soil Description : Grayish Brown Clay

Unconfined Compression Strength (psf) : 4,370

Failure Strain (%) : 15.0

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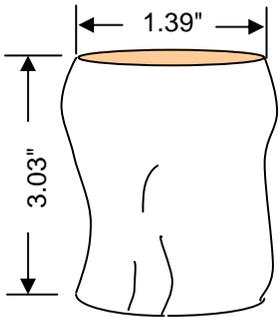
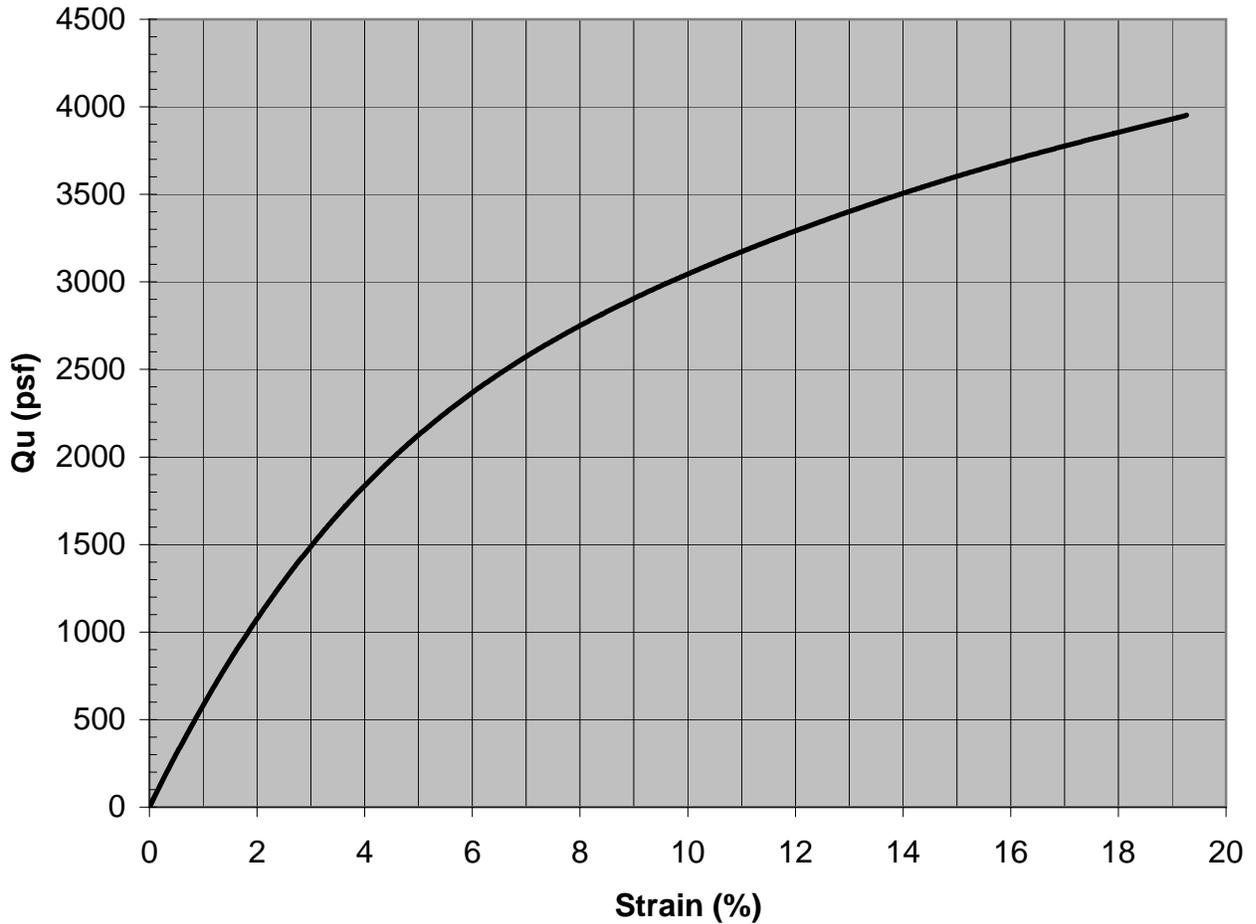


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DATE:
July 16, 2010

Unconfined Compression Test



FAILURE SKETCH

Sample Location : B-22

Depth (ft) : 75-77 Moisture Content (%) : 18.1

Strain Rate : 0.03026 1.0% Dry Unit Weight (pcf) : 114.0

Soil Description : Grayish Brown Clay

Unconfined Compression Strength (psf) : 3,600

Failure Strain (%) : 15.0

PREPARED FOR: :
URS Corporation Great Lakes
Grand Rapids, Michigan

PROJECT NAME :
M-20 over Schrader Creek
Morton Twp., Mecosta Co., Michigan

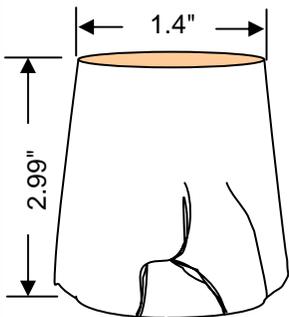
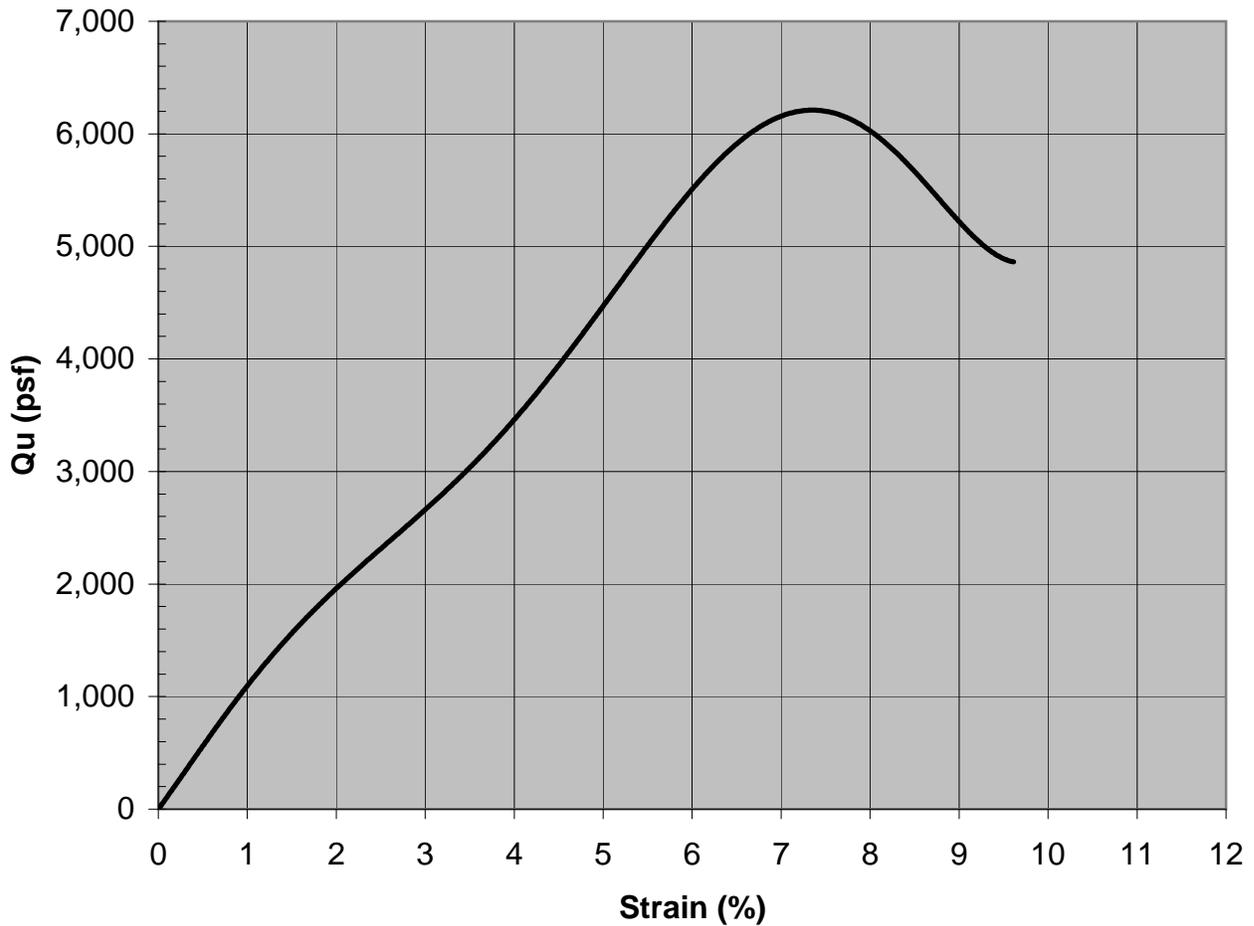


PREPARED BY:
Wilcox Professional Services, LLC
Cadillac, Michigan

PROJECT NO :
22621.00005

DATE:
June 16, 2010

Unconfined Compression Test



FAILURE SKETCH

Sample Location : B-34

Depth (ft) : 103-105 Moisture Content (%) : 10.8

Strain Rate : 0.02986 1.0% Dry Unit Weight (pcf) : 128.8

Soil Description : Gray Sandy Clay

Unconfined Compression Strength (psf) : 6,470

Failure Strain (%) : 7.2

PREPARED FOR :
URS Corporation Great Lakes
Grand Rapids, Michigan

PROJECT NAME :
M-20 Over Schrader Creek
Morton Twp., Mecosta Co., Michigan

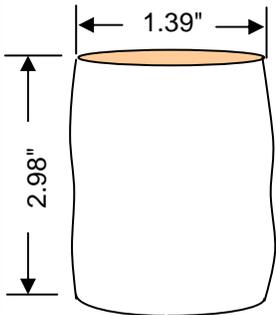
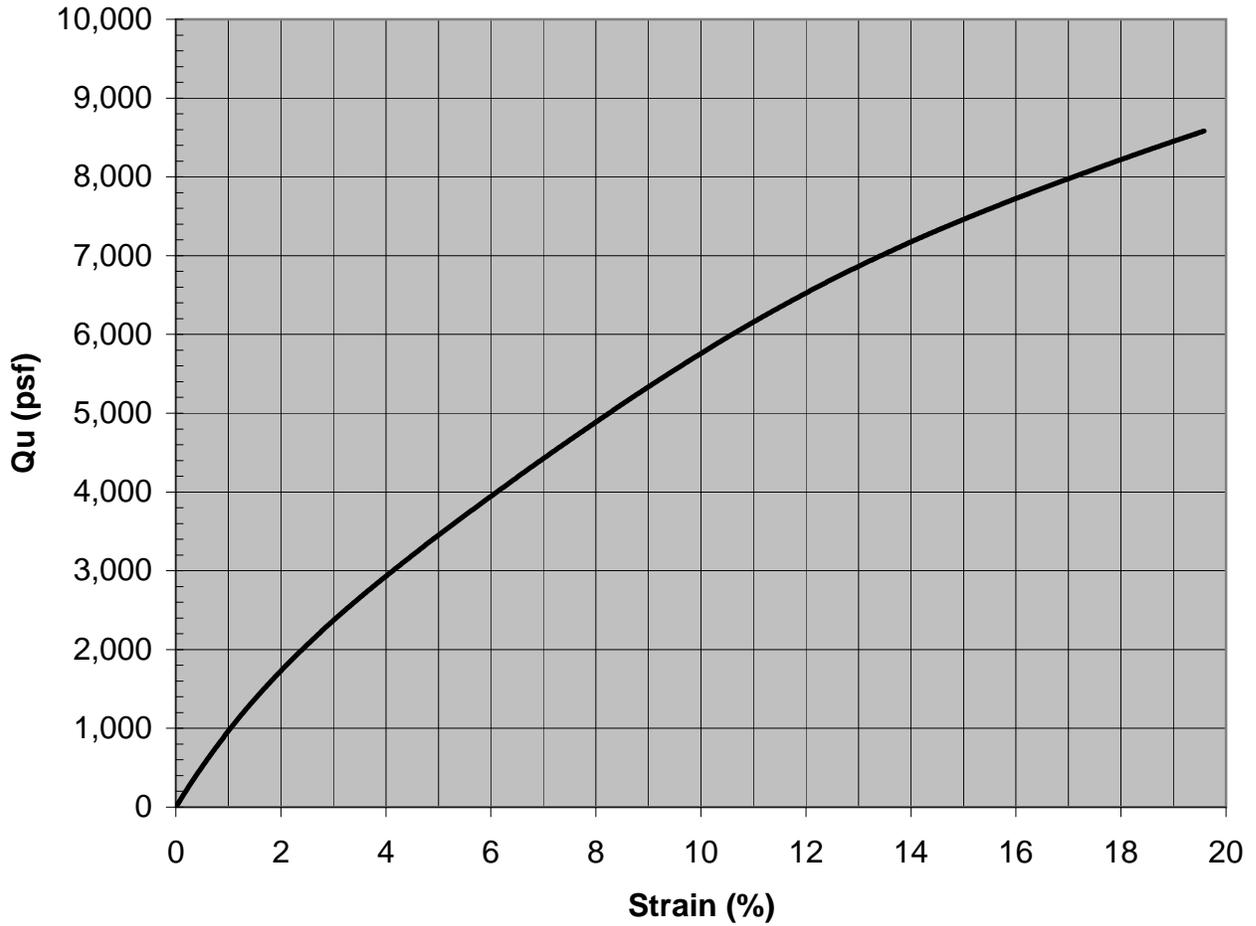


PREPARED BY:
Wilcox Professional Services, LLC
Cadillac, Michigan

PROJECT NO :
22621.00005

DATE:
November 19, 2010

Unconfined Compression Test



FAILURE SKETCH

Sample Location : B-34

Depth (ft) : 118-120 Moisture Content (%) : 13.8

Strain Rate : 0.02982 1.0% Dry Unit Weight (pcf) : 122.9

Soil Description : Gray Clay Trace Sand

Unconfined Compression Strength (psf) : 7,440

Failure Strain (%) : 15.0

PREPARED FOR: :
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Grand Rapids, Michigan

PROJECT NAME :
M-20 Over Schrader Creek
Morton Twp., Mecosta Co., Michigan

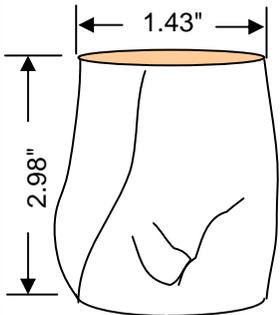
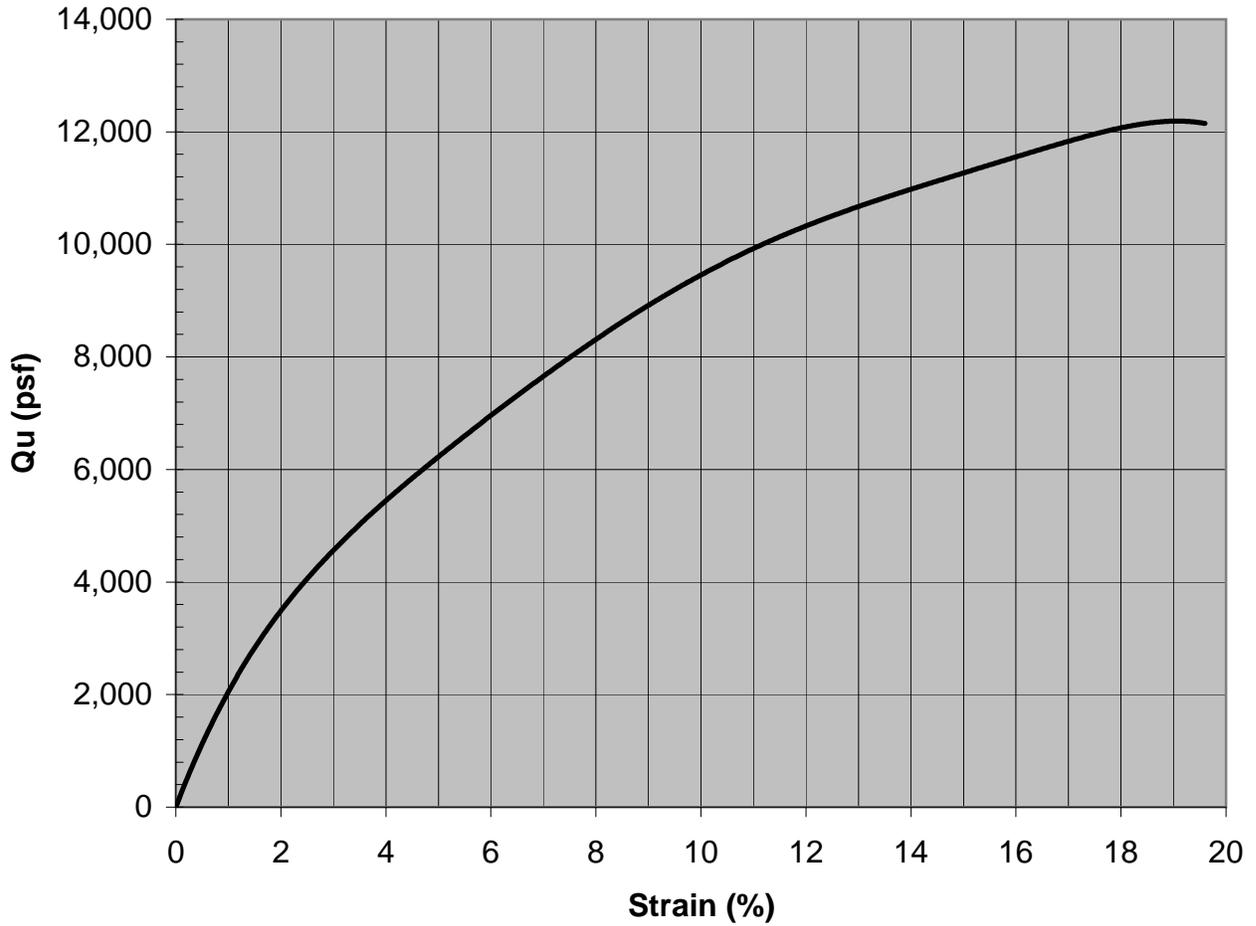


PREPARED BY:
Wilcox Professional Services, LLC
Cadillac, Michigan

PROJECT NO :
22621.00005

DATE:
November 19, 2010

Unconfined Compression Test



FAILURE SKETCH

Sample Location : B-35

Depth (ft) : 118-120 Moisture Content (%) : 13.8

Strain Rate : 0.0298 1.0% Dry Unit Weight (pcf) : 120.1

Soil Description : Gray Clay

Unconfined Compression Strength (psf) : 11,320

Failure Strain (%) : 15.0

PREPARED FOR :
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Grand Rapids, Michigan

PROJECT NAME :
M-20 Over Schrader Creek
Morton Twp., Mecosta Co., Michigan

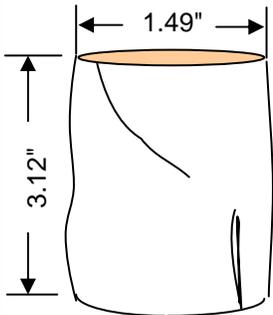
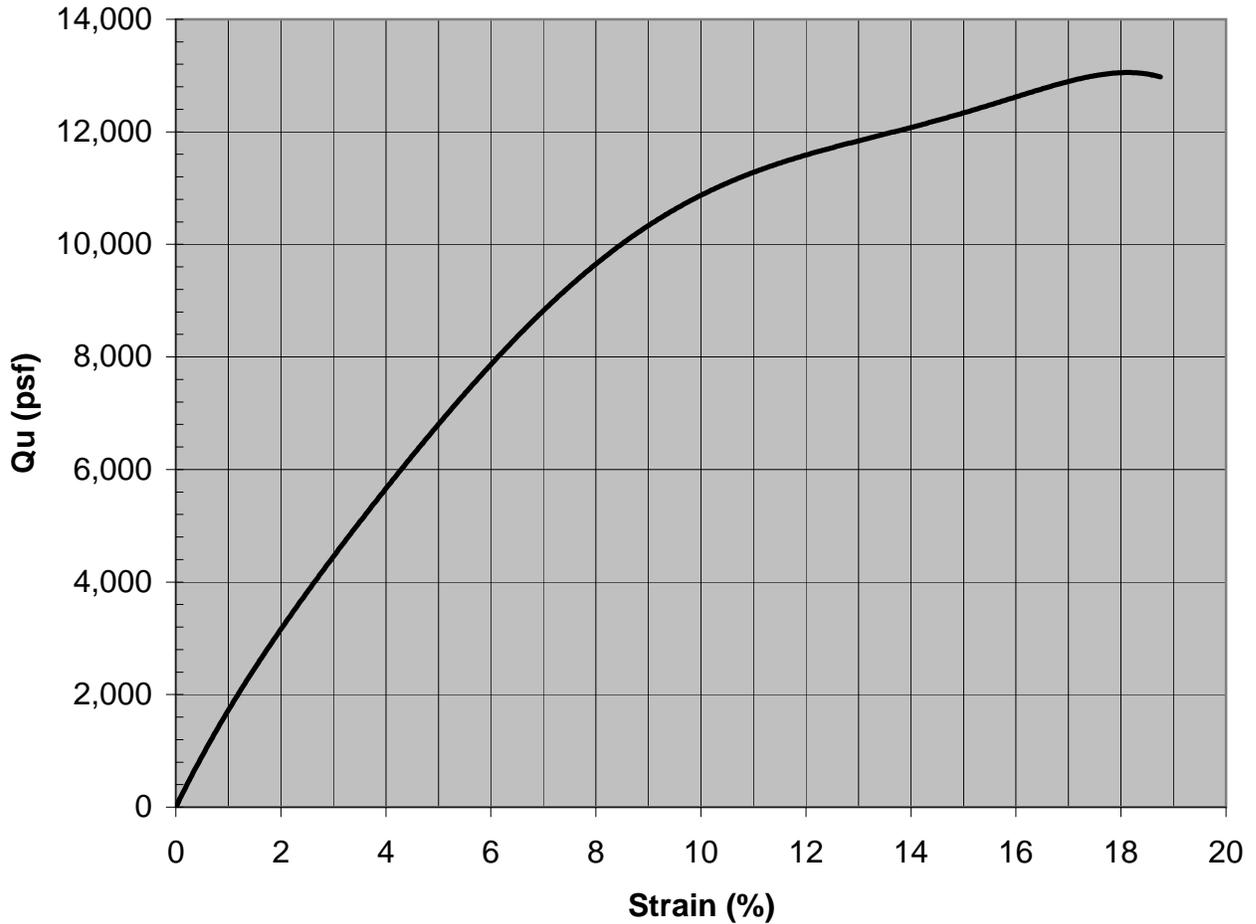


PREPARED BY:
Wilcox Professional Services, LLC
Cadillac, Michigan

PROJECT NO :
22621.00005

DATE:
November 15, 2010

Unconfined Compression Test



FAILURE SKETCH

Sample Location : B-35

Depth (ft) : 123-125 Moisture Content (%) : 18.4

Strain Rate : 0.03115 1.0% Dry Unit Weight (pcf) : 112.0

Soil Description : Gray Clay

Unconfined Compression Strength (psf) : 12,380

Failure Strain (%) : 15.0

PREPARED FOR :
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Grand Rapids, Michigan

PROJECT NAME :
M-20 Over Schrader Creek
Morton Twp., Mecosta Co., Michigan

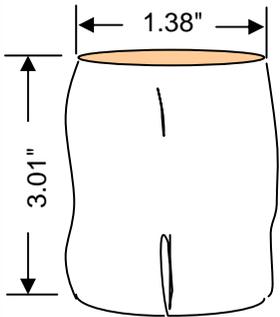
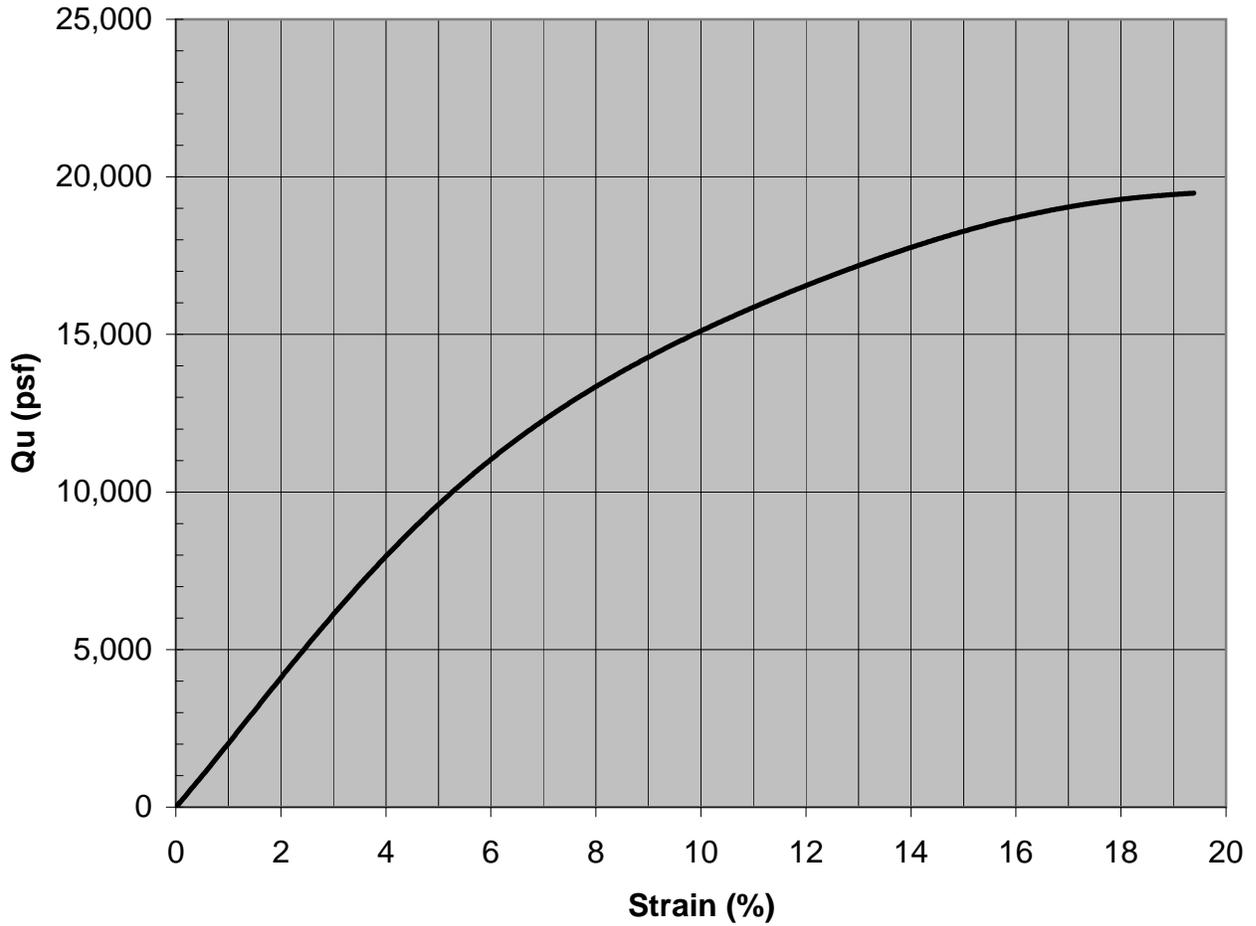


PREPARED BY:
Wilcox Professional Services, LLC
Cadillac, Michigan

PROJECT NO :
22621.00005

DATE:
November 15, 2010

Unconfined Compression Test



FAILURE SKETCH

Sample Location : B-35
 Depth (ft) : 143-145 Moisture Content (%) : 8.0
 Strain Rate : 0.03012 1.0% Dry Unit Weight (pcf) : 138.1
 Soil Description : Brown Sandy Clay
 Unconfined Compression Strength (psf) : 18,270
 Failure Strain (%) : 15.0

PREPARED FOR: :
 URS Corporation Great Lakes
 Grand Rapids, Michigan

PROJECT NAME :
 M-20 Over Schrader Creek
 Morton Twp., Mecosta Co., Michigan

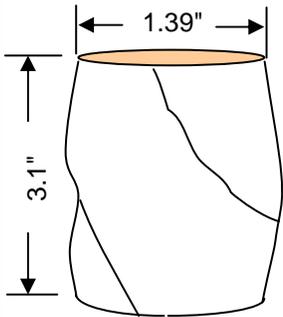
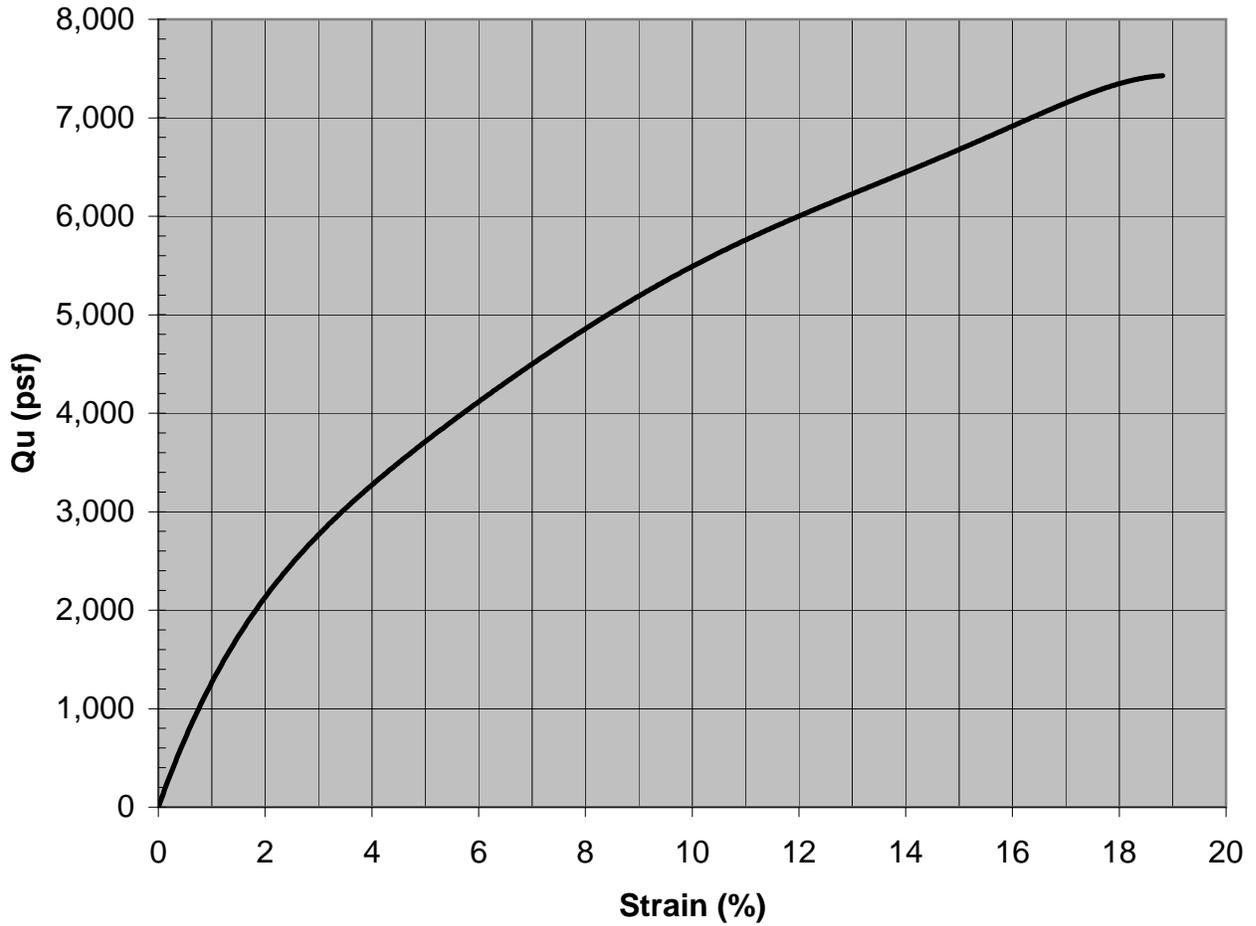


PREPARED BY:
 Wilcox Professional Services, LLC
 Cadillac, Michigan

PROJECT NO :
 22621.00005

DATE:
 November 16, 2010

Unconfined Compression Test



FAILURE SKETCH

Sample Location : B-36

Depth (ft) : 114-116 Moisture Content (%) : 19.6

Strain Rate : 0.03104 1.0% Dry Unit Weight (pcf) : 111.8

Soil Description : Gray Clay

Unconfined Compression Strength (psf) : 6,650

Failure Strain (%) : 15.0

PREPARED FOR :
URS Corporation Great Lakes
Grand Rapids, Michigan

PROJECT NAME :
M-20 Over Schrader Creek
Morton Twp., Mecosta Co., Michigan



PREPARED BY:
Wilcox Professional Services, LLC
Cadillac, Michigan

PROJECT NO :
22621.00005

DATE:
November 17, 2010



Analytical Laboratory Report
Laboratory Project Number: 42852
Laboratory Sample Number: 42852-001

Order: 42852
Date: 01/14/11

Client Identification: **Wilcox Professional Services LLC - Cadillac** Sample Description: **B-8, 8.5-10 FT** Chain of Custody: **96240**
Client Project Name: **M-20 Over Schrader Creek** Sample No: **1** Collect Date: **01/07/11**
Client Project No: **22621.00005** Sample Matrix: **Soil/Solid** Collect Time: **NA**

Sample Comments: **Soil results have been calculated and reported on a dry weight basis unless otherwise noted.**

Definitions: Q: Qualifier (see definitions at end of report) NA: Not Applicable NN: Parameter not included in NELAC Scope of Analysis.

Dry Weight Determination (ASTM D 2974-87)				Aliquot ID: 42852-001			Matrix: Soil/Solid		Analyst: BMG
Parameter(s)	Result	Q	Units	Reporting Limit	Dilution	Prep Date	Prep Batch	Analysis Date	Analysis Batch
1. Percent Moisture (Water Content) (NN)	17		%	0.1	1.0	01/12/11	MC110112	01/13/11	MC110112

Corrosivity (Waste Characterization) (EPA 9045C)				Aliquot ID: 42852-001			Matrix: Soil/Solid		Analyst: DMS
Parameter(s)	Result	Q	Units	Reporting Limit	Dilution	Prep Date	Prep Batch	Analysis Date	Analysis Batch
1. pH	7.73		pH Units	NA	1.0	NA	NA	01/14/11 08:38	WD11A14B

Inorganic Anions by IC (EPA 0300.0/EPA 9056)				Aliquot ID: 42852-001			Matrix: Soil/Solid		Analyst: CML
Parameter(s)	Result	Q	Units	Reporting Limit	Dilution	Prep Date	Prep Batch	Analysis Date	Analysis Batch
1. Chloride	U		mg/kg	100	1.0	01/14/11 10:53	PW11A14B	01/14/11 11:25	WC11A14A
2. Sulfate	18		mg/kg	10	1.0	01/14/11 10:53	PW11A14B	01/14/11 11:25	WC11A14A

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F: (231) 775-8584



Analytical Laboratory Report
Laboratory Project Number: 42852
Laboratory Sample Number: 42852-002

Order: 42852
Date: 01/14/11

Client Identification: **Wilcox Professional Services LLC - Cadillac** Sample Description: **B-8, 23.5-25 FT** Chain of Custody: **96240**
Client Project Name: **M-20 Over Schrader Creek** Sample No: **2** Collect Date: **01/07/11**
Client Project No: **22621.00005** Sample Matrix: **Soil/Solid** Collect Time: **NA**

Sample Comments: **Soil results have been calculated and reported on a dry weight basis unless otherwise noted.**

Definitions: Q: Qualifier (see definitions at end of report) NA: Not Applicable NN: Parameter not included in NELAC Scope of Analysis.

Dry Weight Determination (ASTM D 2974-87)				Aliquot ID: 42852-002			Matrix: Soil/Solid		Analyst: BMG	
Parameter(s)	Result	Q	Units	Reporting Limit	Dilution	Prep Date	Prep Batch	Analysis Date	Analysis Batch	
1. Percent Moisture (Water Content) (NN)	64		%	0.1	1.0	01/12/11	MC110112	01/13/11	MC110112	

Corrosivity (Waste Characterization) (EPA 9045C)				Aliquot ID: 42852-002			Matrix: Soil/Solid		Analyst: DMS	
Parameter(s)	Result	Q	Units	Reporting Limit	Dilution	Prep Date	Prep Batch	Analysis Date	Analysis Batch	
1. pH	7.49		pH Units	NA	1.0	NA	NA	01/14/11 08:42	WD11A14B	

Inorganic Anions by IC (EPA 0300.0/EPA 9056)				Aliquot ID: 42852-002			Matrix: Soil/Solid		Analyst: CML	
Parameter(s)	Result	Q	Units	Reporting Limit	Dilution	Prep Date	Prep Batch	Analysis Date	Analysis Batch	
1. Chloride	U		mg/kg	100	1.0	01/14/11 10:53	PW11A14B	01/14/11 11:38	WC11A14A	
2. Sulfate	2400		mg/kg	41	3.0	01/14/11 10:53	PW11A14B	01/14/11 12:31	WC11A14A	

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Analytical Laboratory Report
Laboratory Project Number: 42852
Laboratory Sample Number: 42852-003

Order: 42852
Date: 01/14/11

Client Identification: **Wilcox Professional Services LLC - Cadillac** Sample Description: **B-18, 25-31 FT** Chain of Custody: **96240**
Client Project Name: **M-20 Over Schrader Creek** Sample No: **3** Collect Date: **01/07/11**
Client Project No: **22621.00005** Sample Matrix: **Soil/Solid** Collect Time: **NA**

Sample Comments: **Soil results have been calculated and reported on a dry weight basis unless otherwise noted.**

Definitions: Q: Qualifier (see definitions at end of report) NA: Not Applicable NN: Parameter not included in NELAC Scope of Analysis.

Dry Weight Determination (ASTM D 2974-87)				Aliquot ID: 42852-003			Matrix: Soil/Solid		Analyst: BMG	
Parameter(s)	Result	Q	Units	Reporting Limit	Dilution	Prep Date	Prep Batch	Analysis Date	Analysis Batch	
1. Percent Moisture (Water Content) (NN)	63		%	0.1	1.0	01/12/11	MC110112	01/13/11	MC110112	

Corrosivity (Waste Characterization) (EPA 9045C)				Aliquot ID: 42852-003			Matrix: Soil/Solid		Analyst: DMS	
Parameter(s)	Result	Q	Units	Reporting Limit	Dilution	Prep Date	Prep Batch	Analysis Date	Analysis Batch	
1. pH	7.40		pH Units	NA	1.0	NA	NA	01/14/11 08:44	WD11A14B	

Inorganic Anions by IC (EPA 0300.0/EPA 9056)				Aliquot ID: 42852-003			Matrix: Soil/Solid		Analyst: CML	
Parameter(s)	Result	Q	Units	Reporting Limit	Dilution	Prep Date	Prep Batch	Analysis Date	Analysis Batch	
1. Chloride	U		mg/kg	100	1.0	01/14/11 10:53	PW11A14B	01/14/11 11:51	WC11A14A	
2. Sulfate	320		mg/kg	14	1.0	01/14/11 10:53	PW11A14B	01/14/11 11:51	WC11A14A	

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Analytical Laboratory Report
Laboratory Project Number: 42852
Laboratory Sample Number: 42852-004

Order: 42852
Date: 01/14/11

Client Identification: **Wilcox Professional Services LLC - Cadillac** Sample Description: **B-19, 8.5-15FT COMP.** Chain of Custody: **96240**
Client Project Name: **M-20 Over Schrader Creek** Sample No: **4** Collect Date: **01/07/11**
Client Project No: **22621.00005** Sample Matrix: **Soil/Solid** Collect Time: **NA**

Sample Comments: **Soil results have been calculated and reported on a dry weight basis unless otherwise noted.**

Definitions: Q: Qualifier (see definitions at end of report) NA: Not Applicable NN: Parameter not included in NELAC Scope of Analysis.

Dry Weight Determination (ASTM D 2974-87)				Aliquot ID: 42852-004			Matrix: Soil/Solid		Analyst: BMG	
Parameter(s)	Result	Q	Units	Reporting Limit	Dilution	Prep Date	Prep Batch	Analysis Date	Analysis Batch	
1. Percent Moisture (Water Content) (NN)	16		%	0.1	1.0	01/12/11	MC110112	01/13/11	MC110112	

Corrosivity (Waste Characterization) (EPA 9045C)				Aliquot ID: 42852-004			Matrix: Soil/Solid		Analyst: DMS	
Parameter(s)	Result	Q	Units	Reporting Limit	Dilution	Prep Date	Prep Batch	Analysis Date	Analysis Batch	
1. pH	7.63		pH Units	NA	1.0	NA	NA	01/14/11 08:45	WD11A14B	

Inorganic Anions by IC (EPA 0300.0/EPA 9056)				Aliquot ID: 42852-004			Matrix: Soil/Solid		Analyst: CML	
Parameter(s)	Result	Q	Units	Reporting Limit	Dilution	Prep Date	Prep Batch	Analysis Date	Analysis Batch	
1. Chloride	U		mg/kg	100	1.0	01/14/11 10:53	PW11A14B	01/14/11 12:04	WC11A14A	
2. Sulfate	U		mg/kg	10	1.0	01/14/11 10:53	PW11A14B	01/14/11 12:04	WC11A14A	

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Analytical Laboratory Report
Laboratory Project Number: 42852
Laboratory Sample Number: 42852-005

Order: 42852
Date: 01/14/11

Client Identification: **Wilcox Professional Services LLC - Cadillac** Sample Description: **B-19, 28.5-35FT COMP.** Chain of Custody: **96240**
Client Project Name: **M-20 Over Schrader Creek** Sample No: **5** Collect Date: **01/07/11**
Client Project No: **22621.00005** Sample Matrix: **Soil/Solid** Collect Time: **NA**

Sample Comments: **Soil results have been calculated and reported on a dry weight basis unless otherwise noted.**

Definitions: Q: Qualifier (see definitions at end of report) NA: Not Applicable NN: Parameter not included in NELAC Scope of Analysis.

Dry Weight Determination (ASTM D 2974-87)				Aliquot ID: 42852-005			Matrix: Soil/Solid		Analyst: BMG	
Parameter(s)	Result	Q	Units	Reporting Limit	Dilution	Prep Date	Prep Batch	Analysis Date	Analysis Batch	
1. Percent Moisture (Water Content) (NN)	45		%	0.1	1.0	01/12/11	MC110112	01/13/11	MC110112	

Corrosivity (Waste Characterization) (EPA 9045C)				Aliquot ID: 42852-005			Matrix: Soil/Solid		Analyst: DMS	
Parameter(s)	Result	Q	Units	Reporting Limit	Dilution	Prep Date	Prep Batch	Analysis Date	Analysis Batch	
1. pH	7.58		pH Units	NA	1.0	NA	NA	01/14/11 08:48	WD11A14B	

Inorganic Anions by IC (EPA 0300.0/EPA 9056)				Aliquot ID: 42852-005			Matrix: Soil/Solid		Analyst: CML	
Parameter(s)	Result	Q	Units	Reporting Limit	Dilution	Prep Date	Prep Batch	Analysis Date	Analysis Batch	
1. Chloride	U		mg/kg	100	1.0	01/14/11 10:53	PW11A14B	01/14/11 12:18	WC11A14A	
2. Sulfate	2000		mg/kg	27	3.0	01/14/11 10:53	PW11A14B	01/14/11 12:44	WC11A14A	

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Definitions/ Qualifiers:

- A:** Spike recovery or precision unusable due to dilution.
- B:** The analyte was detected in the associated method blank.
- E:** The analyte was detected at a concentration greater than the calibration range, therefore the result is estimated.
- J:** The concentration is an estimated value.
- U:** The analyte was not detected at or above the reporting limit.
- X:** Matrix Interference has resulted in a raised reporting limit or distorted result.
- W:** Results reported on a wet-weight basis.
- *:** Value reported is outside QA limits

Exception Summary:



Accreditation Number:

E-10395



Client:	Wilcox Professional Services
Project:	M-20 Over Schrader Creek
Location:	---
GTX#:	10543
Test Date:	02/10/11
Tested By:	ema
Checked By:	jdt

**Laboratory Measurement of Soil Resistivity Using
the Wenner Four-Electrode Method by ASTM G 57**

Sample ID	Depth, ft.	Sample Description	Electrical Resistivity, ohm-cm	Electrical Conductivity, (ohm-cm) ⁻¹
B-4,5,6,7,8,9,10 Comp	---	Moist, olive gray silt	1,194	8.38E-04
B-15,16,17,18,19,20 Comp	---	Moist, very dark brown silty with gravel and organics	1,293	7.73E-04
B-16,17,19,20,21 Comp	---	Moist, grayish brown silt with organics	2,089	4.79E-04

Comments: Test Equipment: Nilsson Model 400 4-pin Soil Resistance Meter, MC Miller Soil Box
 Electrical Conductivity is calculated as inverse of Electrical Resistivity (per ASTM G 57)
 Test conducted in standard laboratory atmosphere: 68-73 F

TEST HOLE B-26	TEST HOLE B-27	TEST HOLE B-28	TEST HOLE B-29	TEST HOLE B-30	TEST HOLE B-31	TEST HOLE B-32	TEST HOLE B-33
<p>TEST HOLE B-26 OFFSET: 15.0 FT RT OF WB WB M=20 CL N:767500.337,E:12669911.344</p> <p>0.0 GRAVEL (9) 0.8 LOOSE BROWN GRAY FINE TO MEDIUM SAND 2.0 GRAY SANDY LOAM 3.5 BLACK MODERATELY COMPRESSED MUCK AND PEAT 5.0 LIGHT GRAY MARL 6.5 SATURATED GRAY FINE TO MEDIUM SAND 7.5 LIGHT GRAY MARL WITH SHELLS 9.0 DARK COMPRESSED BROWN MUCK AND PEAT 10.0 SATURATED BROWN FINE TO MEDIUM SAND 17.0 SATURATED BROWN SILT 18.0 SATURATED BROWN FINE TO MEDIUM SAND 20.0</p> <p>BORING DATE 7/19/10 WATER LEVEL 4.8</p>	<p>TEST HOLE B-27 OFFSET: 15.0 FT RT OF WB WB M=20 CL N:767479.686,E:12669913.048</p> <p>0.0 GRAVEL SHOULDER (9) 0.8 BROWN SLIGHTLY LOAMY FINE TO MEDIUM SAND TRACE FINE GRAVEL 4.0 BLACK BROWN MUCK AND PEAT 5.5 LIGHT GRAY MARL 6.0 MARL PEAT MIX 7.0 SATURATED GRAY FINE TO MEDIUM SAND WITH FINE GRAVEL 16.5 STIFF GRAY SILTY CLAY 20.0</p> <p>BORING DATE 7/19/10 WATER LEVEL 3.7</p>	<p>TEST HOLE B-28 OFFSET: 15.0 FT RT OF WB WB M=20 CL N:767426.357,E:12669910.783</p> <p>0.0 GRAVEL SHOULDER (9) 0.8 BROWN SLIGHTLY LOAMY FINE TO MEDIUM SAND 3.7 BLACK MUCK 4.7 SATURATED GRAY SLIGHTLY LOAMY FINE TO MEDIUM SAND 8.5 SATURATED BROWN LOAMY FINE TO MEDIUM SAND 10.0 BORING DATE 7/19/10 CAVE IN 4.1'</p>	<p>TEST HOLE B-29 OFFSET: 15.0 FT RT OF WB WB M=20 CL N:767179.046,E:12669907.918</p> <p>0.0 GRAVEL (9) 0.8 BROWN FINE TO MEDIUM SAND 2.0 GRAY FINE TO COURSE SAND WITH GRAVEL 2.5 GRAY LOAMY SAND TRACE FINE GRAVEL 3.6 DARK BROWN MUCK AND PEAT 5.5 BROWN FINE TO MEDIUM SAND 11.0 STIFF GRAY CLAY 11.5 SATURATED BROWN FINE TO MEDIUM SAND 14.0 STIFF BROWN CLAY 15.0 SATURATED BROWN FINE TO MEDIUM SAND 20.0</p> <p>BORING DATE 7/19/10 WATER LEVEL 5.4</p>	<p>TEST HOLE B-30 OFFSET: 15.0 FT RT OF WB WB M=20 CL N:767151.343,E:12669908.468</p> <p>0.0 GRAVEL (9) 0.8 BROWN FINE TO MEDIUM SAND 2.0 GRAY SLIGHTLY LOAMY SAND 3.2 DARK BROWN MUCK AND PEAT 6.0 SATURATED BROWN FINE TO MEDIUM SAND 17.5 STIFF GRAY SILTY CLAY 20.0</p> <p>BORING DATE 7/19/10 WATER LEVEL 4.1</p>	<p>TEST HOLE B-31 OFFSET: 15.0 FT RT OF WB WB M=20 CL N:766817.9,E:12669904.788</p> <p>0.0 GRAVEL (9) 0.8 BROWN FINE TO MEDIUM SAND 2.2 BROWN LOAMY FINE TO MEDIUM SAND TRACE FINE GRAVEL SATURATED AT 6.4' 10.0 STIFF BROWN SILTY CLAY 12.0 BROWN SILTY LOAM 13.5 SATURATED BROWN LOAMY FINE TO MEDIUM SAND 16.0 STIFF BROWN SILTY CLAY 16.0 STIFF GRAY CLAY 20.0</p> <p>BORING DATE 7/19/10 WET HOLE COLLAPSE 6.4'</p>	<p>TEST HOLE B-32 OFFSET: 15.0 FT RT OF WB WB M=20 CL N:768118.821,E:12669913.794</p> <p>0.0 GRAVEL (9) 0.8 BROWN FINE TO MEDIUM SAND WITH FINE GRAVEL 2.5 BROWN LOAMY FINE TO MEDIUM SAND SATURATED AT 6.7' 7.5 MEDIUM STIFF BROWN CLAY 8.5 SATURATED BROWN FINE TO MEDIUM SAND 17.0 MEDIUM STIFF GRAY SILTY CLAY 20.0</p> <p>BORING DATE 7/19/10 WET HOLE COLLAPSE 5.7'</p>	<p>TEST HOLE B-33 OFFSET: 15.0 FT RT OF WB WB M=20 CL N:768086.794,E:12669914.103</p> <p>0.0 GRAVEL (11) 0.8 BROWN SLIGHTLY LOAMY FINE TO MEDIUM SAND TRACE ORGANICS AT 3.5' (LESS THAN 10%) 3.5 BROWN FINE TO MEDIUM SAND SATURATED AT 5.9'</p>

SOIL BORING SHEET

DATE	SCALE	COMT. SEC.	JOB NO.	DESIGN UNIT	SHEET NO.
7/20/10	NTS	54022	73737C		



THE SOIL BORING REPRESENTS POINT INFORMATION. PRESENTATION OF THIS INFORMATION IN NO WAY IMPLIES THAT SUBSURFACE CONDITIONS ARE THE SAME AT LOCATIONS OTHER THAN THE EXACT LOCATION OF THE BORING. GROUNDWATER LEVELS MAY FLUCTUATE AND MAY BE DIFFERENT AT THE TIME OF CONSTRUCTION.

NORTHING AND EASTING DETERMINED FROM GPS OBSERVATION. ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE NOTED.

POWER AUGER BORINGS
ON M-20 FROM SOUTH
OF RODNEY TO SOUTH
& WEST OF MEGOSTA

MARTIN
LOG
4-10-64

T.H.#1 54022

1st AREA SOUTH OF RODNEY
(COMBINATION SETTLEMENT & HEAVE)

Lt shoulder in middle of Settlement

0-2' GRAVEL
2-3.5' VERY LO. GRAVEL
3.5-6' LO. GR SAND
6-7.4' GRAY SAND & GRAVEL

T.H.#2 LOCATED ON RT
SHOULDER OPPOSITE T.H.#1

0-6' LO SAND & GRAVEL
6-7.7' GR SAND & GRAVEL

T.H.#8 LT SHOULDER
IN MIDDLE OF SWAMP
SOUTH OF CULVERT

0-2' LO GRAVEL
2-3' MED. SAND
6-9' MUCK
9-10' BOTTOM

T.H.#3 (HEAVED AREA) LEFT SHOULDER

0-2.5' GRAVEL
2.5-6.5' MUCK
6.5-8.4' GRAY SAND

T.H.#9 LT SHOULDER
ACROSS FROM T.H.#8

0-2' LO GRAVEL
2-5' YEL SAND
5-10' MUCK
10-15' GRAY RED SA BOT.

T.H.#4 RT SHOULDER
OPPOSITE T.H.#3

0-3' LO SAND & GRAVEL
3-8' MUCK
8-4' FIRM BOTTOM

T.H.#5 LT SHOULDER (HEAVED AREA)

0-2.5' LO GRAVEL
2.5-7' GRAY SANDY LOAM
7-9' SAND

T.H.#6 RT SHOULDER
OPPOSITE T.H.#5

0-4' LO SAND & GRAVEL
4-5.5' GRAY SANDY LOAM
5.5-8.7' YEL SAND

T.H.#7 DOWN HILL NEXT
TO CULVERT LT SHOULDER

0-2.5' LO SAND & GRAVEL
2.5-8' GR SAND OLD PART
LENSE (O.K.) (GRIFFIN)

M-20
POWER AUGER BORINGS
NEXT SWAMP SOUTH
OF MEGOSTA
5402Z

MARTEL
COLE
4-10-59

RT SHOULDER

0-12' FILL
12-15 FIB PEAT
15-23+ MARLY SED. PEAT

RT SHOULDER

0-15' FILL
15-18 FIB PEAT
18-27+ MARLY SED. PEAT

LT SHOULDER

0-26' SAND LOAM FILL
26-28+ PEBBLY GR. CLAY

SWAMP JUST WEST OF 60th ST.

0-7' LT SHOULDER
0-7' FILL
7-10' MUCKY FIB. PEAT
10-30' MARLY SED. PEAT
30-35' VERY SOFT BL/CLAY
35-38+ GREY SAND BOTTOM

RT SHOULDER

0-5' FILL
5-20' FIB. PEAT
20-27' MARLY PEAT
27-29' VERY SOFT BL/CL
29-30+ GREY SAND BOT

RT SHOULDER

0-7' FILL
7-30+ MUCKY PEAT

MARTIS
COLL
7-10-69

POWER AUGER BORINGS
SOUTH OF MELOSTA ON
M-20. (LOW AREA WHERE
3 TUBES ARE UNDER RD.)
54032

RT. SHOULDER T.H. "A"

0'-12' FILL
12'-20' MUCK & PEAT
20'-22' SOFT BL/CLAY

T.H. "B" LT. SHOULDER

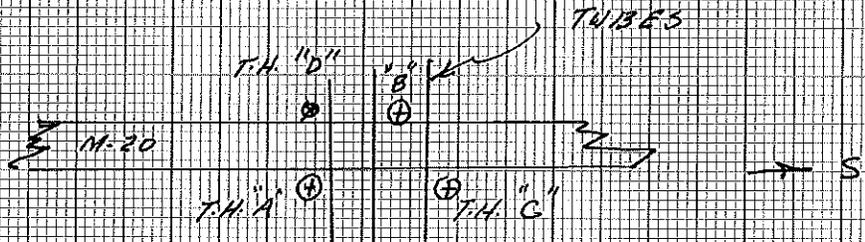
0'-18' FILL
18'-22' SAND BOTTOM

T.H. # "C"

0'-12' FILL
12'-22' MUCK & PEAT
22' SAND BOT

T.H. "D"

0'-15' FILL
15'-18' MUCK
18'-20' LOAM
20'-22' MUCK
22' BOT TOM



(APPROX. LOC. BORINGS)

54022 M20 SOUTH OF MELOSTA GROUND PROFILES

ELEV
14+00
15+00
16+00
17+00
18+00
19+00
20+00

10 LT 100.0'

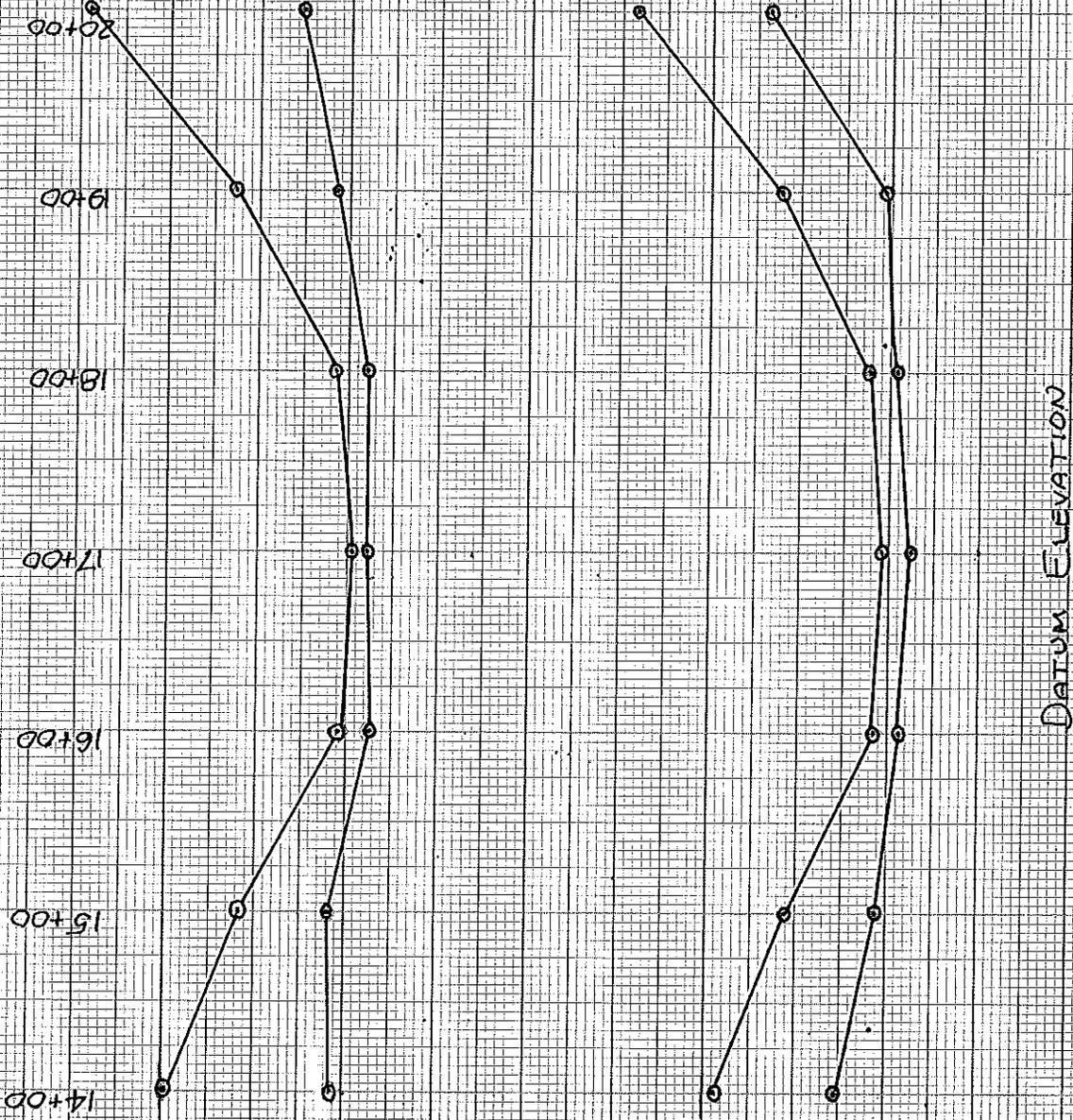
23 LT 96.0'

92.0'

10 RT 100.0'

23 RT 96.0'

92.0'



DATUM ELEVATION
STA 14+00 = 100.0'

100' L

50' L
3+50

SHLD. L 15'

Edge of Swamp

0-7 muck & Peat
7+ Sand

4+00
0-7 muck & Peat
7+ Sand

0-9 Loamy, Sand Fill
9-13 Muck & Fib Peat
13-14 Marl
14-17 Sand Bott.

0-4 Muck
4-8 V. Soft Marl & Sed Peat
8+ Sand

4+50
0-5 muck
5-9 V. Soft Marl
9+ Sand

0-8 Loamy Sand Fill
8-12 Muck & Fib Peat
12-21 V. Soft Marl
21-22 Sand Bot

0-7 Muck & Fib Peat
7-23 V. Soft Marl & Sed Peat
23+ Sand

5+00
0-11 Muck & Fib Peat
11-28 Very Soft Marl & Sed Peat
28+ Sand

0-10 Loamy Sand Fill
10-13 Muck & Fib Peat
13-18 V. Soft Marl & Sed Peat
18-29 1/2 V. Soft Marl
29 1/2-34 Sand
34-35 Clay

0-7 Muck & Fib Peat
7-32 V. Soft Marl & Sed Peat
32+ Sand

5+50
0-7 Muck & Fib Peat
7-32 1/2 V. Soft Marl & Sed Peat
32+ Sand

0-19 Loamy Sand Fill
19-22 Muck & Fib Peat
22-40 V. Soft Marl & Sed Peat
40-42 Sand Bott.

0-4 Muck & Fib Peat
4-23 Marly V. Soft sed Peat
23 Sand

6+00
0-6 Muck & Fib Peat
7-32 V. Soft Marl & Sed Peat
32 Gray Sand

0-19 Loamy Sand Fill
19-30 Muck & Fib Peat
30-40 Soft Sed of Sand, Silt Clay
40-42 Sand Bott.

0-4 Muck & Fib Peat
4-24 1/2 Marly Sed Peat
24 Sand

6+50
0-4 Muck & Fib Peat
4-28 1/2 Marly Sed Peat
28 Sand

0-19 Loamy Sandy Fill
19-26 Muck & Fib Peat
26-30 1/2 Marly Sed Peat
30-34 Soft Sed of Sand, Clay, Silt, Peat
34-37 1/2 Marly Sed Peat
37-42 Sand Bott.

Order of Pre. left side west side First

- | | |
|---------|--------|
| ① 15+50 | ① 5+00 |
| ② 14+00 | ② 7+50 |
| ③ 13+00 | ③ 8+00 |

15-20/190
25-2/19
35-23/218

42-381 50 SHEETS 3 SQUARE
42-382 100 SHEETS 3 SQUARE
42-383 100 SHEETS 3 SQUARE



SHLD. R 15'

50'R

100'R

3+50
Edge of Swamp

0-7½ Fill Sand & Sandy Clay
7½-11½ Muck & Fib Peat
11½-13 Marl v.s.
13-14 Sand & Gravel Bot
14-16 Firm-Staff Clay

4+00
0-8 Muck & Fib Peat
5-10 ½ Marl sed Peat
10+ Sand Bot

0-5 Muck & Fib Peat
5+ Sand Bott.

Lo/so & Sa Lo Fill
0-8 ~~Sandy~~ Sa Lo Fill
8-11½ Fib Peat
11½-20 v. soft Marl
20-22 Comp Med. Cons. Sand

4+50
0-6 Muck & Fib Peat
6-18 Marly sed Peat v.s.
18' Sand Bot

0-6 Muck & Fib Peat
6-16 Marly sed Peat v.s.
16+ Sand Bott

0-12 Loamy, Sand & Grav. Fill
12-15 Fib Peat
15-22 Marly Sed Peat v.s.
22-32 v. soft Marl
32-37 Sandy Bott

5+00
0-8 Muck & Fib Peat
8-22 Marly sed Peat v.s.
22+ Sand Bott.

0-6 Muck & Fib Peat
6-21 Marly sed. Peat v.s.
21+ Sand Bott.

0-17 Sandy, Lo. Fill
17-19 Fill & Wood
19-24 Fib Peat & Sed Peat
24-27 Marly Sed Peat v.s.
27-38½ Marl v.s.
38½-42 Sand Bott

5+50
0-8 Muck & Fib Peat
8-30 Marly sed Peat v.s.
30 Sand Bott

0-12 Muck & Fib Peat
12-36 Marly sed Peat v.s.
36 Sand Bott

0-22 Sandy, Loamy, Pebb Fill
22-27 Buried Logs @ 27

6+00
0-12 Muck & Fib Peat
12-30 Marly sed Peat v.s.
30-44 Slightly Comp Marly
Sed Peat

0-12 Muck & Fib Peat
12-36 Marly sed ~~Peat~~, Peat v.s.
36 Sand Bott.

0-17 Peb, Sand, Lo Fill
17-28 Peb Fill & Wood Mix
28-44 Fib & Sed Peat
44-52 Sand & Gravel Bott

6+50
0-9 Muck & Fib Peat
9-36 Marly Sed Peat (soft)
36-45 Comp Marly Sed Peat
45 Sand

0-11 Muck & Fib Peat
11-34 Marly Sed Peat v.s.
34-40 Comp Marly Sed Peat
40 Sand

42 SHEETS 3 SQUARE
43 SHEETS 3 SQUARE
44 SHEETS 3 SQUARE
NATIONAL

100'L

0-5 Muck & Fib Peat
5-24 Marly Sed Peat VS
24 Sand

0-5 Muck & Fib Peat
5-21 Marly Sed Peat VS
21 Sand

0-5 Muck & Fib Peat
5-10 1/2 Marly Sed Peat
10 Sand

0-3 Muck & Fib Peat
3 Sand Bott

0-2 Muck & Fib Peat
2 Sand Bott

9+75

Edge of Swamp

50'L

7+00

0-6 Muck & Fib Peat
7-28 1/2 Marly Sed Peat
28 Sand

7+50
0-6 Muck & Fib Peat
6-28 1/2 Marly Sed Peat
28 Sand Bott

8+00
0-5 Muck & Fib Peat
5-12 1/2 Marly Sed Peat
12 Sand

8+50
0-4 Muck & Fib Peat
4 Sand Bott

9+00
0-1 Muck & Fib Peat
1 Sand Bott

9+40

Edge of Swamp

SHLD. L 15'

0-11 1/2 Loamy Sand Fill
11 1/2-14 Muck & Fib Peat
14-34 Marly Sed Peat VS
34-38 1/2 Sand
38 1/2-40 Clay

0-5 Loamy Gravel, Sand Fill
5-12 1/2 Muck & Fib Peat
12 1/2-29 Marly Sed Peat VS
29-32 Sand

0-3 1/2 Loamy Sand Fill
3 1/2-10 Muck & Fib Peat
10-20 V. Soft Marl
20-21 Sand Bott
21 Sandy Clay

0-2 Loamy Sand Fill
2-5 Muck & Fib Peat
5-10 V. Soft Sed Peat
10-12 Sand Bott

0-2 1/2 Loamy Sand Fill
2 1/2-4 1/2 Muck & Fib Peat
4 1/2 Gravel, Sand Bott.

5-31/298
15-3/28
20-5/47

42 SHEETS 3 SQUARE
42 SHEETS 3 SQUARE
42 SHEETS 3 SQUARE



SHW R 15'

0-9 Peaty Fill
9-11 Fib Peat
11-17 1/2 Marly Sed Peat
17-32 1/2 v. soft Marl
32 1/2-39 Sand
39-47 Clay

0-4 1/2 Fill
4 1/2-12 Muck & Fib Peat
12-27 1/2 1/2 Marly Sed Peat
27 1/2-31 Sed Peat
31-36 Sand
36-37 Firm Clay

0-3 Fill
3-8 Fib Peat
8-10 1/2 Marly Peat
10-23 1/2 1/2 Marl
23 1/2-29 Sand
29-32 Clay

0-2 Fill
2-7 Muck & Fib Peat
7-14 1/2 Marly Sed Peats
14-22 Sand w/clay layers @
14-22

0-3 Fill
3-7 1/2 Muck & Fib Peat
7 1/2-12 Sand Bott

0-2 1/2 Fill
2 1/2-3 Muck ?
3-7 Gray Mot Sand

50'R
7+00
0-6 Muck & Fib Peat
6-33 Marly Sed Peat VS.
33 Sand

7+50
0-6 Muck & Fib Peat
6-30 v.s. Marly Sed Peat
30 Sand

8+00
0-4 Muck & Fib Peat
4-25 1/2 Marly Sed Peat
25 Sand

8+50
0-4 Muck & Fib Peat
4-14 1/2 Marly Sed Peat
14 Sand Bott

9+00
0-5 Muck & Fib Peat
5 Sand Bott

9+50
0-2 Muck & Fib Peat
2 Sand

10+00
0-1 Muck & Fib Peat
1 Sand Bott

10+25

Edge of Swamp

100'R
0-6 Muck & Fib Peat
6-31 v. soft Marly Sed Peat
31 Sand

0-4 Muck & Fib Peat
4-29 Marly Sed Peat VS
29 Sand

0-7 Muck & Fib Peat
7-30 Marly Sed Peat VS
30-36 Comp Sed Peat
36 Sand

0-4 Muck & Fib Peat
4-16 Marly Sed Peat VS
16 Sand Bott.

0-4 Muck & Fib Peat
4-6 1/2 Marly Sed Peat
6 Sand Bott.

0-4 Muck & Fib Peat
4 Sand

0-1 Muck & Fib Peat
1 Sand Bott

10+50

Edge of Swamp

42, 881 50 SHEETS 5 SQUARE
42, 882 100 SHEETS 5 SQUARE
42, 889 200 SHEETS 5 SQUARE
NATIONAL

100' L
11+00

Edge of Swamp

0-4 Muck & Fib Peat
4+ Sand

0-4 Muck & Fib. Peat
4-15^{1/2} Marly Sed Peat
15 Sand Bott.

0-1 Muck & Fib Peat
1-15 Marly Sed Peat $\frac{1}{2}$
15 Sand Bott

0-1 Muck & Fib Peat
1-13 Marly Sed Peat $\frac{1}{2}$
13 Sand Bott

0-1 Muck & Fib Peat
1-16 Marly Sed Peat $\frac{1}{2}$
16 Sand Bott

0-12 Muck & Fib Peat
12-28^{1/2} Marly Sed Peat
28 Sand Bott

0-12 Muck & Fib Peat
12-34^{1/2} Marly Sed Peat
34 Sand Bott.

50' L
11+15

Edge of Swamp

11+50
0-1 Muck & Fib Peat
1 Sand

12+00
0-3 Muck & Fib Peat
3-9 Marly Sed Peat $\frac{1}{2}$
9 Sand Bott

12+50
0-3 Muck & Fib Peat
3-10 Marly Sed Peat $\frac{1}{2}$
10 Sand Bott

13+00
0-1 Muck & Fib Peat
1-10^{1/2} Marly Sed Peat
10-11 Sand Layer
11-14 Marly Sed Peat
14 Sand Bott

13+50
0-1 Muck & Fib Peat
1-12 Marly Sed Peat $\frac{1}{2}$
12-20 Sand Bott

14+00
0-12 Muck & Fib Peat
12-32 V.S. Marl Sed Peat
32 Sand Bott

14+50
0-12 Muck & Fib Peat
12-38 Marly Sed Peat $\frac{1}{2}$
38 Sand Bott.

SHLD. L 15'

0-4 Loamy Sand Fill
4-8 Muck & Fib Peat
8-12 Gray Sand Bott.

0-3^{1/2} Loamy Sand Fill
3^{1/2}-5 Muck & Fib Peat
5-8 Marly Sed Peat $\frac{1}{2}$
8-9 Sand
9-12 Soft Marl
12-18 Sand
18-22 Clay

0-3 Pebb. Sandy Loam Fill
3-4^{1/2} Muck & Fib Peat
4^{1/2}-18 V. Soft Marl
18-27 Med Sand Bott

0-4^{1/2} Pebb. Sandy loam & Clay Fill
4^{1/2}-12 Muck & Fib Peat
12-19 Marly Sed. Peat $\frac{1}{2}$
19-22 Sand & Gravel Bott.

0-7 Pebb, Sandy, Loam & Clay Fill
7-15 Muck & Fib Peat
15-24 Sed. Peat $\frac{1}{2}$
24-28 V.S. Marly Sed Peat
28-35 Sand Bott

0-9 Pebb, Sandy, Loam & Clay Fill
9-15 Muck & Fib Peat
15-25 Sed Peat $\frac{1}{2}$
25-38 V.S. Marly Sed Peat
38-41 S. Sed. of Sand, Silt, Peat & Cl.
41-45 Gravel Bott



SHLD. R 15'

50'R

100'R

12+15

Edge of Swamp

12+00

Edge of Swamp

- 0-3 Fill
- 3-3½ Muck Wash
- 3½-6 muck & Marl
- 6-7 Gravel Sand

- 12+50
- 0-2 Muck & Fib Peat
 - 2-10 Marly Sed Peat VS
 - 10 Sand Bott

- 0-2 Muck & Fib Peat
- 2-7 Marly Sed Peat VS
- 7 Sand Bott

- 0-3 Sand Fill & Wash
- 3-24 Muck & Marl
- 24-27 Comp grav sand & grav

- 13+00
- 0-2 Muck & Fib Peat
 - 2-24 Marly sed Peat VS
 - 24 Sand Bott

- 0-2 Muck & Fib Peat
- 2-18 Marly Sed Peat VS
- 18 Sand Bott

- 0-3½ Loamy, Sand Fill & Wash
- 3½-19½ Muck & Marly Peat
- 19½-23 Sand Bott.
- 23-25 Plas & Firm Clay

- 13+50
- 0-2 Muck & Fib Peat
 - 2-18 Marly Sed. Peat VS
 - 18 Sand Bott.

- 0-2 Muck & Fib Peat
- 2-14 Marly Sed. Peat VS
- 14 Sand Bott.

- 0-5½ Fill
- 5½-24½ Muck & Marly Peat
- 24½-32 Sand Bott.

- 14+00
- 0-6 Muck & Fib. Peat
 - 6-16 Marly Sed. Peat VS
 - 16 Sand Bott.

- 0-6 Muck & Fib Peat
- 6-16 Marly Sed Peat VS
- 16-18 Sand Bott

- 0-7 Sand, Loam Fill
- 7-40 Muck & Marly Peat
- 40-45 Sand & Gravel Bott.

- 14+50
- 0-4 Muck & Fib Peat
 - 4-36 Marly Sed Peat VS
 - 36 Sand Bott

- 0-4 Muck & Fib Peat
- 4-16 Marly sed Peat VS
- 16 Sand Bott

42 SHEETS 50 SHEETS 5 SQUARE
42 SHEETS 100 SHEETS 5 SQUARE
NATIONAL

L. MARTIS
L. CHESEBRO
D. PHILLIPS
D. DOLPH

4-18-78

M-20 SCHRADER CREEK
C.S. 54022

PAGE 7-8

100' L

0-12 muck & Fib Peat
12-36 1/2 Marly Sed Peat
36 Sand Bott.

0-12 muck & Fib Peat
12-29 1/2 Marly Sed Peat
29 Sand Bott.

0-12 muck & Fib Peat
12-27 1/2 Marly Sed Peat
27 Sand Bott.

0-12 muck & Fib Peat
12-28 1/2 Marly Sed Peat
28 Sand Bott.

0-10 Mat. Fib Peat
10-28 Marly Sed Peat 1/2
28 Sand Bott.

0-4 muck & Fib Peat
4-5 Marly Sed Peat 1/2
5 Sand Bott.

0-3 muck & Fib Peat
3+ Sand Bott.

18+25

Edge of Swamp

50' L
15+00

0-12 muck & Fib Peat
12-35 Marly sed Peat 1/2
35 Sand Bott.

15+50
0-12 muck & Fib Peat
12-32 Marly Sed Peat 1/2
32 Sand Bott.

16+00
0-12 muck & Fib Peat
12-33 Marly Sed Peat 1/2
33 Sand Bott.

16+50
0-12 muck & Fib Peat
12-29 Marly Sed Peat 1/2
29 Sand Bott.

17+00
0-7 muck & Fib Peat
7-30 Marly Sed Peat 1/2
30 Sand Bott.

17+50
0-6 muck & Fib Peat
6-17 Marly sed Peat 1/2
17 Sand Bott.

18+00
0-3 muck & Fib Peat
3+ Sand Bott.

18+30

Edge of Swamp

SHLD. L. 15'

0-9 Pebb, Sandy, Loam, Clay Fill
9-15 Muck & Fib Peat
15-35 Sed Peat 1/2
35-36 Sand Peat Mix
36-40 Sand & Gravel Bott.

0-7 1/2 Sand, Loam, sand clay f.
7 1/2-10 Muck & Fib Peat
10-3 1/2 Sed Peat 1/2
3 1/2-35 Sand & Gravel Bott.

0-5 1/2 Sand, loam, & clay loam Fill
5 1/2-8 Loss & muck
8-30 Fib & Marly Peat 1/2
30-35 Sand & Gravel Bott.

0-8 Lo & Sand & clay Fill
8-30 Fib & Marly Peat 1/2
30-32 Sand Bott.

0-5 1/2 Fill Loam sand & sandy cl.
5 1/2-28 1/2 Fib & Marly Peat 1/2
28 1/2-32+ Sand & gravel Bott.

0-9 1/2 Fill sand & clay
9 1/2-17 Fib & Marly Peat 1/2
17-22 Sand Bott.

0-9 1/2 Fill
9 1/2-8 Muck & Fib Peat
8-10 Peat & Sand Layers
10-15 Sand Bott.

42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE
NATIONAL

SHLD. R 15'

50' R
 15+00

100' R

0-6 Pebb. Sand loam Fill
 6-15 Fill & Muck Mix
 13-17 Muck & Fib Peat
 17-35 Sed Peat VS
 35-40 Sand & Gravel Bott

0-6 Muck & Fib Peat
 6-36 Marly Sed Peat VS
 36 Sand Bott

0-4 Muck & Fib Peat
 4-36 Marly Sed Peat VS
 36 Sand Bott

0-2 1/2 Sand, Loam Fill
 2 1/2-5 Comp Muck
 5-6 Loam/sand
 6-17 muck & Fib Peat
 17-20 Sed Peat VS
 20-28 Marly Sed Peat VS
 28-32 Sand & Gravel Bott

15+50
 0-6 muck & Fib Peat
 6-28 Marly Sed. Peat VS
 28 Sand Bott

0-4 muck & Fib Peat
 4-25 Marly Sed Peat VS
 25 Sand Bott.

0-6 Fill
 6-29 Fib & Sed Peat VS
 29-32 Sand & Gravel Bott

16+00
 0-6 muck & Fib Peat
 6-25 Marly Sed Peat VS
 25 Sand Bott

0-6 Muck & Fib Peat
 6-28 Marly Sed Peat VS
 28 Sand Bott.

0-5 Pebb, Sand, loam Fill
 5-28 Fib & Sed Peat VS
 28-32 Sand & gravel Bott.

16+50
 0-6 muck & Fib Peat
 6-28 1/2 Marly & sed Peat
 28 Sand Bott.

0-6 Muck & Fib Peat
 6-28 Marly Sed Peat VS
 28 Sand Bott

0-4 Fill
 4-29 Fib & Marly Peat VS
 29-32 Sand & gravel Bott

17+00
 0-6 muck & Fib Peat
 6-29 Marly Sed Peat VS
 29 Sand Bott.

0-6 Muck & Fib Peat
 6-25 Marly Sed Peat VS
 25 Sand Bott

0-6 Fill muck
 6-17 1/2 ~~VS~~ & Marly Peat VS
 17 1/2-22+ Sand & gravel Bott.

17+50
 0-3 muck & Fib Peat
 3-13 1/2 Marly sed Peat VS
 13 1/2 Sand Bott.

0-3 muck & Fib Peat
 3-18 Marly Sed Peat VS
 18 Sand Bott.

0-5 Fill
 5-10 1/2 Fib Peat
 10 1/2-15+ Sand & gravel Bott

18+00
 0-3 muck & Fib Peat
 3-7 Marly Sed. Peat VS
 7+ Sand Bott.

0-3 muck & Fib Peat
 3-8 Marly Sed Peat VS
 8 Sand Bott.

18+40

Edge of Swamp

18+30

Edge of Swamp

42,381 50 SHEETS 3 SQUARE
 42,382 100 SHEETS 3 SQUARE
 42,383 200 SHEETS 3 SQUARE
 NATIONAL

Attachment D

Monitoring Well Data

Last Data Collection: May 12, 2011

DISCLAIMER

The documents in this attachment are being provided as a courtesy to its users. They may contain interpretative information and should be considered informational only.

M-20 over Schrader Creek, Monitoring Well Readings

* Height readings are from top of quick connect.

B-34, Screen from 133 -138 ft				B-36, Screen from 100-105 ft			
Height of H ₂ O (ft)	Elevation	Date	Time	Height of H ₂ O (ft)	Elevation	Date	Time
16.35	983.3	11/11/2010	12:55 PM	5.90	971.6	11/11/2010	1:10 PM
16.48	983.4	11/17/2010	2:45 PM	5.53	971.2	11/17/2010	2:00 PM
16.47	983.4	11/23/2010	5:05 PM	5.44	971.1	11/23/2010	4:36 PM
16.79	983.7	12/9/2010	9:08 AM	5.55	971.3	12/9/2010	9:24 AM
16.59	983.5	12/13/2010	1:00 PM	5.55	971.3	12/13/2010	1:15 PM
16.60	983.5	12/20/2010	2:11 PM	5.56	971.3	12/20/2010	2:30 PM
16.80	983.7	12/28/2010	2:00 PM	5.50	971.2	12/28/2010	2:30 PM
16.65	983.6	1/6/2011	1:00 PM	5.52	971.2	1/6/2011	1:30 PM
16.68	983.6	1/10/2011	2:00 PM	5.51	971.2	1/10/2011	2:27 PM
17.05	984.0	2/28/2011	9:43 AM	5.70	971.4	2/28/2011	10:18 AM
17.06	984.0	3/4/2011	3:12 PM	5.62	971.3	3/4/2011	3:28 PM
17.06	984.0	3/11/2011	2:13 PM	5.68	971.4	3/11/2011	2:32 PM
17.09	984.0	3/18/2011	11:29 AM	5.81	971.5	3/18/2011	11:50 AM
17.09	984.0	3/25/2011	11:30 AM	6.16	971.9	3/25/2011	11:13 AM
17.43	984.3	4/1/2011	10:43 AM	6.15	971.9	4/1/2011	10:32 AM
17.51	984.4	4/7/2011	1:32 PM	6.70	972.4	4/7/2011	1:18 PM
17.61	984.5	4/15/2011	2:51 PM	6.53	972.2	4/15/2011	2:42 PM
17.80	984.7	4/29/2011	11:48 AM	7.09	972.8	4/29/2011	11:59 AM
17.82	984.7	5/12/2011	11:30 AM	6.81	972.5	5/12/2011	11:20 AM
B-34B, Screen from 73-78 ft				B-36B, Screen from 70-75 ft			
Height of H ₂ O (ft)	Elevation	Date	Time	Height of H ₂ O (ft)	Elevation	Date	Time
6.20	972.6	11/5/2010	-	4.83	971.3	11/3/2010	-
4.75	971.2	11/11/2010	12:58 PM	5.14	971.6	11/11/2010	1:13 PM
4.75	971.2	11/17/2010	2:52 PM	5.10	971.6	11/17/2010	2:05 PM
4.71	971.1	11/23/2010	5:03 PM	5.12	971.6	11/23/2010	4:40 PM
4.97	971.4	12/9/2010	9:05 AM	5.18	971.7	12/9/2010	9:20 AM
4.76	971.2	12/13/2010	1:04 PM	5.16	971.7	12/13/2010	1:19 PM
4.74	971.1	12/20/2010	2:14 PM	5.17	971.7	12/20/2010	2:34 PM
4.71	971.1	12/28/2010	2:12 PM	5.13	971.6	12/28/2010	2:35 PM
4.77	971.2	1/6/2011	1:10 PM	5.13	971.6	1/6/2011	1:35 AM
4.81	971.2	1/10/2011	2:08 PM	5.12	971.6	1/10/2011	2:32 AM
4.95	971.4	2/28/2011	9:47 AM	5.31	971.8	2/28/2011	10:11 AM
4.95	971.4	3/4/2011	3:08 PM	5.20	971.7	3/4/2011	3:24 PM
5.09	971.5	3/11/2011	2:09 PM	5.20	971.7	3/11/2011	2:28 PM
5.24	971.6	3/18/2011	11:22 AM	5.46	972.0	3/18/2011	11:45 AM
5.55	972.0	3/25/2011	11:23 AM	5.88	972.4	3/25/2011	11:07 AM
5.47	971.9	4/1/2011	10:40 AM	5.72	972.2	4/1/2011	10:30 AM
6.13	972.5	4/7/2011	1:30 PM	6.28	972.8	4/7/2011	1:16 PM
5.84	972.2	4/15/2011	2:49 PM	6.15	972.7	4/15/2011	2:40 PM
6.52	972.9	4/29/2011	11:46 AM	6.67	973.2	4/29/2011	11:56 AM
5.95	972.4	5/12/2011	11:28 AM	6.42	972.9	5/12/2011	11:18 AM
B-34C, Screen from 45-50 ft				B-36C, Screen from 43-48 ft			
Height of H ₂ O (ft)	Elevation	Date	Time	Height of H ₂ O (ft)	Elevation	Date	Time
1.80	968.4	11/3/2010	-	4.50	971.2	11/2/2010	-
1.90	968.5	11/11/2010	1:00 PM	4.00	970.7	11/3/2010	-
1.32	967.9	11/17/2010	2:48 PM	4.27	971.0	11/11/2010	1:16 PM
1.50	968.1	11/23/2010	5:00 PM	3.90	970.6	11/17/2010	2:08 PM
1.02	967.6	12/9/2010	9:00 AM	4.21	970.9	11/23/2010	4:45 PM
1.09	967.7	12/13/2010	1:08 PM	4.07	970.8	12/9/2010	9:17 AM
1.09	967.7	12/20/2010	2:18 PM	4.10	970.8	12/13/2010	1:23 PM
1.03	967.6	12/28/2010	2:18 PM	4.09	970.8	12/20/2010	2:39 PM
1.06	967.7	1/6/2011	1:15 PM	4.07	970.8	12/28/2010	2:40 PM
1.06	967.7	1/10/2011	2:18 PM	4.11	970.8	1/6/2011	1:40 PM
1.15	967.8	2/28/2011	9:53 AM	4.13	970.8	1/10/2011	2:38 PM
1.19	967.8	3/4/2011	3:05 PM	4.28	971.0	2/28/2011	10:05 AM
1.21	967.8	3/11/2011	2:03 PM	4.20	970.9	3/4/2011	3:20 PM
1.26	967.9	3/18/2011	11:15 AM	4.21	970.9	3/11/2011	2:22 PM
1.23	967.8	3/25/2011	11:20 AM	4.42	971.1	3/18/2011	11:39 AM
1.28	967.9	4/1/2011	10:38 AM	4.83	971.5	3/25/2011	11:01 AM
1.42	968.0	4/7/2011	1:27 PM	4.67	971.4	4/1/2011	6:43 AM
1.33	967.9	4/15/2011	2:47 PM	5.06	971.8	4/7/2011	1:14 PM
1.45	968.1	4/29/2011	11:43 AM	4.90	971.6	4/15/2011	2:38 PM
1.28	967.9	5/12/2011	11:26 AM	5.32	972.0	4/29/2011	11:54 AM
				4.99	971.7	5/12/2011	11:16 AM

Attachment E

Informational and/or Interpretative Engineering Data

M-20 over Schrader Creek Geotechnical Subsurface Investigation Summary by Wilcox

Soil Profiles by Wilcox

Conceptual M-20 Road Plans and Profiles by URS

DISCLAIMER

The documents in this attachment are being provided as a courtesy to its users. They may contain interpretative information and should be considered informational only.



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continuously improving our
quality of service to meet
and exceed our
clients' expectations.

July 29, 2010 – Revised December 3, 2010

Mr. Mike Guter
URS Corporation Great Lakes
3950 Sparks Drive, SE
Grand Rapids, MI 49546

**RE: Geotechnical Subsurface Investigation
M-20 over Schrader Creek
Mecosta County, Michigan
CS: 54022, JN: 73737C**

Dear Mr. Guter,

Wilcox Professional Services, LLC (Wilcox) has conducted a subsurface investigation on the above referenced project. Initially, a subsurface investigation was conducted during the months of June and July with results submitted July 29, 2010. Upon review of these results, it was decided to perform an additional investigation to better delineate the deeper geology and to install monitoring wells for determining the level of artesian head at various locations throughout the project. It is our pleasure to provide you with a copy of our revised letter report incorporating updates from this latter subsurface investigation.

PROJECT UNDERSTANDING

The purpose of this field investigation was to determine the subsurface conditions existing at the site, and to establish construction and soil related engineering properties for use by the contractor and bridge design engineers. The proposed project consists of constructing two bridges across two swamp locations on M-20 just south of Mecosta, Michigan. It is estimated that each bridge will have a length of 500 to 600 feet (ft). Minimal roadway reconstruction will also be conducted at each side of the bridge.

FIELD INVESTIGATION

Scope

The scope of work included geotechnical drilling at each proposed bridge location, providing traffic control, installing piezometers, initial monitoring of the piezometers, and surveying the boring locations upon completion. The boring locations of the initial investigation were selected by URS and MDOT and staked by URS personnel prior to the commencement of drilling activities. Soil borings conducted during the second phase were determined by the URS, MDOT, and Wilcox.

Wilcox initially conducted a total of eight road borings and 17 bridge borings from June 1 to July 20, 2010. MDOT conducted eight road borings on July 19, 2010. Road borings were drilled to depths ranging from 5 to 20 ft below ground surface (bgs) and the bridge borings ranged in depth from 80 to 101.5 ft bgs. The second



phase consisted of drilling three deeper bridge borings ranging in depth from 140 to 150 ft bgs. In addition, two sets of three piezometers were installed at soil boring locations B-34 and B-36. Screen intervals ranged between 43 and 138 ft bgs. The main focus of these additional borings was to better define the deeper strata (100 to 150 ft bgs) and to obtain peizometric data on the artesian conditions encountered at various depths throughout the project. For more detailed information on each soil boring or monitoring well, please refer to the attached Soil Boring and Monitoring Well Logs.

Drilling and Sampling Procedure

The borings were drilled with a Diedrich D-90 ATV, Gus Pech Brat 22R, CME 75 or CME 1050 ATV drill rigs equipped with rotary heads. Conventional, continuous flight 3.25, 4.25, and 8.25 inch diameter hollow-stem augers and various mud rotary techniques were utilized to advance the borings to termination depth. Due to the amount of soil cuttings generated from each hole and the sensitive environmental nature of the project area, mud rotary techniques were predominantly utilized to advance each borehole. Soil sampling was conducted at 2.5 ft, 5 ft and 10 ft intervals to the boring termination depths. Representative samples were obtained employing split-barrel and thin-walled (Shelby Tube) sampling techniques in general accordance with ASTM Procedures D-1586 and D-1587, respectively. Bag samples of the subbase were also collected at various locations. After completion of the borings, the holes were backfilled with bentonite grout and chips, neat cement, soil cuttings and asphalt patched as appropriate.

Field Tests and Measurements

Standard Penetration Tests - During the sampling procedure, Standard Penetration Tests (SPT) were performed at each sampling depth previously indicated. The standard penetration value is defined as the number of blows a 140 lb hammer, falling 30 inches, required to advance the split-spoon sampler 12 inches into the soil. The results of the standard penetration tests indicate the relative density and comparative consistency of the soils, and thereby provide a basis for estimating the relative strength and compressibility of the soil. These results are located on the attached boring logs.

Hand Penetrometer Tests (Q_p) – These tests were conducted on cohesive samples throughout the investigation. This test provides an approximate estimation of the unconfined compressive strength of cohesive (clay and silt) soil. The instrument can test soil up to 4.5 tons/ft² (431 kPa) by measuring the resistance encountered by a small, spring calibrated cylinder. The hand penetrometer has been carefully tested and correlated with laboratory unconfined compression tests thereby providing a quick and simple procedure for estimating soil strength data.

Water Level Measurements - Groundwater level observations were made during boring operations and are noted on the boring logs.



LABORATORY TESTING

The laboratory testing program consisted of visual classification, unconfined compression tests, moisture content tests, one-dimensional consolidation test, hydrometer tests, and plastic and liquid limits on select Shelby Tube and split-spoon samples. Additional testing included grain size distribution on the collected sand subbase samples. The results of these tests are provided on the soil boring logs or individual testing sheets appended to this letter. Soil samples obtained from SPT testing were placed in sealed glass sample jars and are stored at the Wilcox office in Cadillac, MI. The soil samples will be retained for one year after the issue of this report; after this date the soil samples will be discarded unless requested otherwise.

DESCRIPTION OF SUBSURFACE CONDITIONS

The types of foundation materials and groundwater encountered at each test boring location have been visually classified and are described in detail on the appended Soil Boring Logs. The lines delineating the changes in strata on the log represents an approximate boundary between the various soil classifications. It must be recognized that the soil descriptions are considered representative for the specific test hole location and variations may occur between the sampling intervals and other boring locations. A more detailed description and supporting data for each boring location can be found on the Soil Boring Logs appended to this letter.

Soil Conditions

In general, the ground surface at the boring locations mainly consists of asphalt or gravel. Asphalt thicknesses range from 5 to 21 inches while the gravel base ranged from 5 to 24 inches.

- **Stratum 1 (Fill):** Beneath the asphalt and gravel, brown, moist to wet, sand and gravel fill with various amounts of silt and clay was encountered up to depths of 19.5 ft bgs. N-values obtained within this layer indicate a relative density of very loose to medium dense.
- **Stratum 2 (Peat):** Within the bridge and several road borings, very soft, black peat was observed below the fill. The peat layers ranged from thin lenses (<4") to 31 ft thick. Predominantly amorphous peat was observed with occasional semi-fibrous to fibrous layers noted. Moisture contents range from 28 to 471 percent.
- **Stratum 3 (Marl):** Gray, moist to wet marl was typically encountered beneath the peat. This layer is extremely soft with visual observation of several split-spoon samples indicating a thick liquid consistency. This layer extended to depths between 7 and 44.5 ft bgs. Moisture contents range from 30 to 267 percent.
- **Stratum 4 (Sand & Gravel):** Brown to gray, wet sand and gravel layers were observed at various depths during drilling operations. The sand size ranged from silty fine sand to coarse sand with gravel. The gravel layers ranged from fine to



coarse with some observed split-spoon samples consisting of only fine gravel sizes. Occasional cobbles were also noted by the driller at various depths. SPT's conducted in this layer shallower than 100 ft bgs predominantly indicate a relative density of loose to medium dense while SPT's below 100 ft bgs indicate a relative between medium to very dense. It should also be noted that these layers in certain borings generated artesian conditions when penetrated.

- **Stratum 5 (Clay):** The brown and gray clay with various amounts of sand was encountered in all the soil borings. Generally, there seems to be an upper clay layer observed in all the soil borings and a deeper clay layer encountered in soil borings B-3, B-15, B-16, B-18 through B-22, and B-34 through B-36. The shallower clay layer has a consistency of medium stiff to hard while the deeper clay layer can be characterized as stiff to very hard. Unconfined compression tests conducted on split-spoon and Shelby tube samples within this stratum range from 1,500 to 18,000 pounds per square foot (psf).

Groundwater Observations

Groundwater was encountered in all the soil borings except B-1 and B-24, the borings at the north and south ends of the project, respectively. Specific groundwater depths at each boring location can be found on each individual boring log appended to this report. It should be noted that the depth to groundwater will fluctuate, depending upon normal seasonal variations in precipitation and surface runoff. The low sections of the proposed construction area are very susceptible to flooding shortly after major rain events. During drilling operations, there were days where the groundwater was at the same level as the roadway in these lower sections. Additionally, it has been reported that MDOT has closed the road several times within the last couple years due to flooding of the roadway.

At soil borings B-7, B-10, B-15, B-16, and B-34 through B-36, artesian flow was observed during drilling operations. Two sets of three monitoring wells were installed at B-34 and B-36 to determine the piezometric head above the ground surface. The flow while drilling was estimated at 1 to 5 gallons per minute (gpm) and controlled as necessary with drilling mud and weighting agent. At soil boring B-7, the hole was drilled to 100 ft bgs and 8 hrs later it was flowing at approximately 40 to 50 gpm. Similar flowing conditions were also observed at this depth while drilling B-34 through B-36. At B-34, drilling stopped for the day in the hard clay layer at 103 ft. Upon return the next day, the borehole had collapsed to a depth of 72 ft bgs. When penetrating the sand stratum between the depths of 126 to 135.5 at soil boring location B-34, a significant pressure (head) increase was observed during drilling operations. Drilling mud weighing approximately 15.5 pounds per gallon was utilized to prevent artesian flow and terminating the boring at 140 ft bgs. Individual Monitoring Well Logs providing more detailed well construction are attached to this letter. Water level readings of the monitoring wells are also summarized and appended to this letter. MDOT will continue to monitor these wells in the upcoming months.



SUMMARY

This geotechnical field and laboratory investigation was conducted to provide existing subsurface information for the proposed M-20 construction over Schrader Creek in Mecosta County. The geotechnical study has been conducted in a manner consistent with the level of care ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions. No other representations, expressed or implied, and no warranty or guarantee is included or intended in this report.

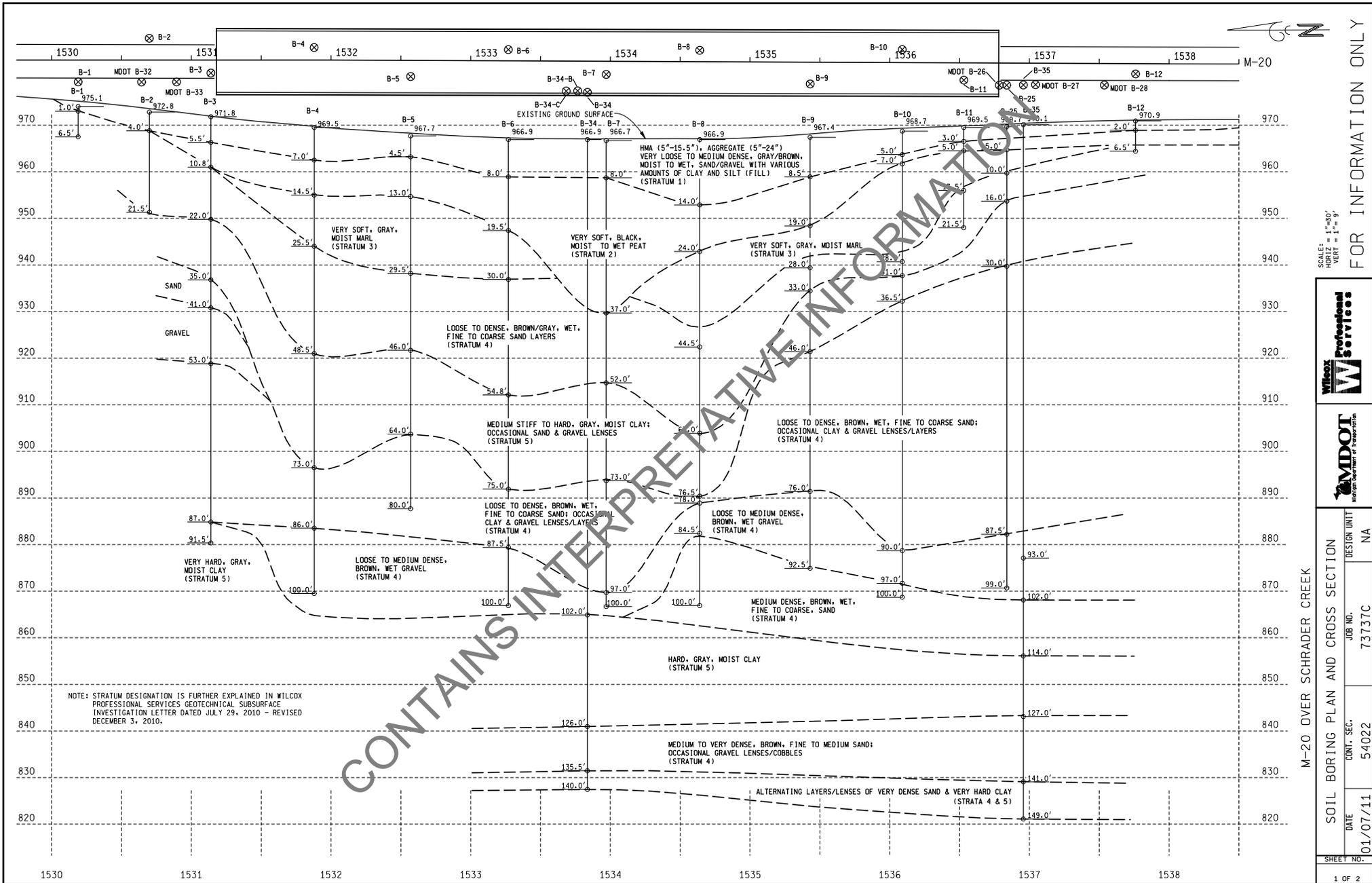
If any questions arise regarding the observations and results in this letter or during construction, please feel free to contact our office.

Sincerely,
WILCOX PROFESSIONAL SERVICES, LLC

Chris D. Johnnecheck, P.E.
Geotechnical Project Manager

Erron J. Peuse, P.E.
Geotechnical Engineer

CONTAINS INTERPRETATIVE INFORMATION



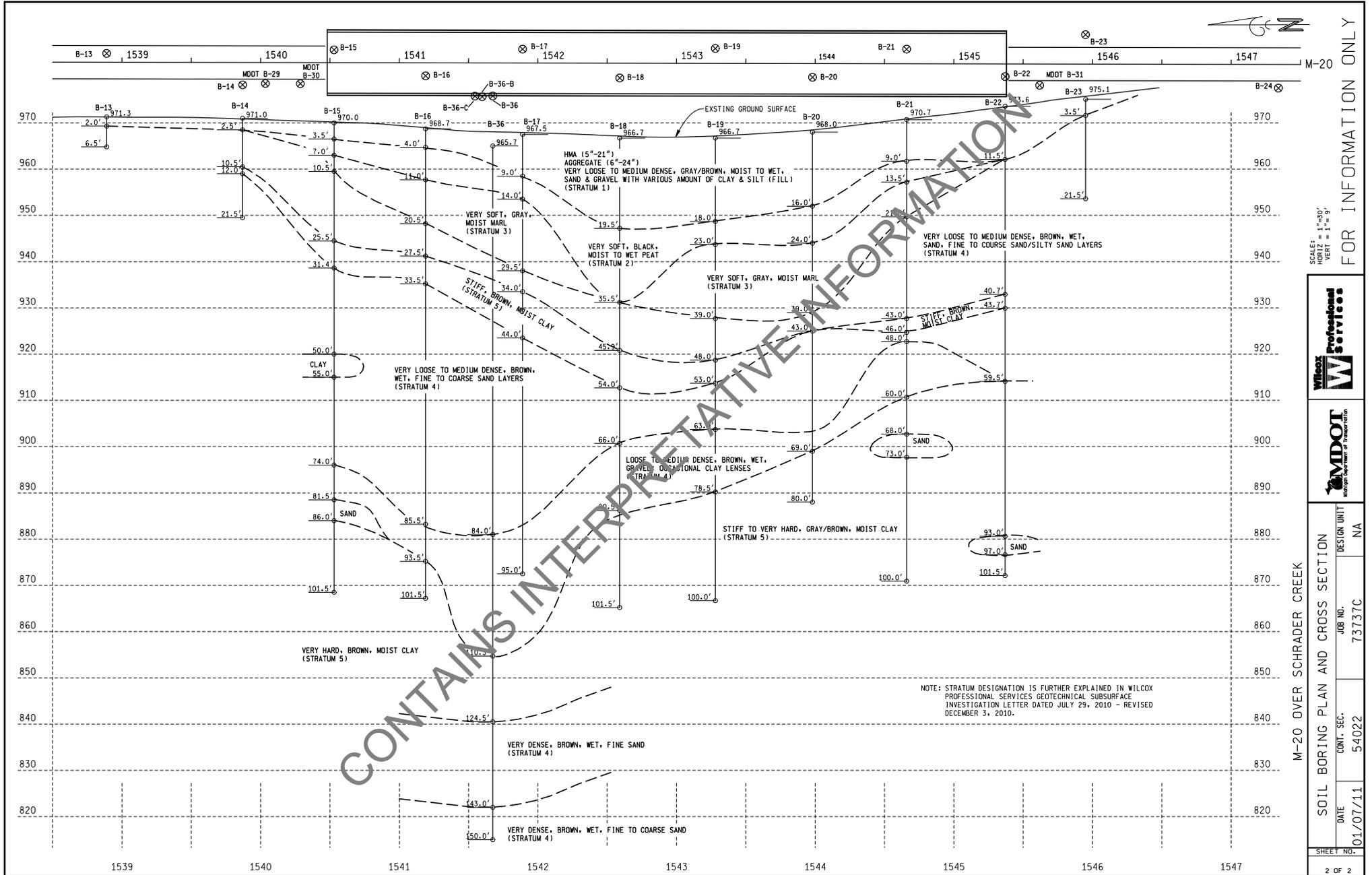
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 VERT. = 1" = 9'

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M-20 OVER SCHRADER CREEK

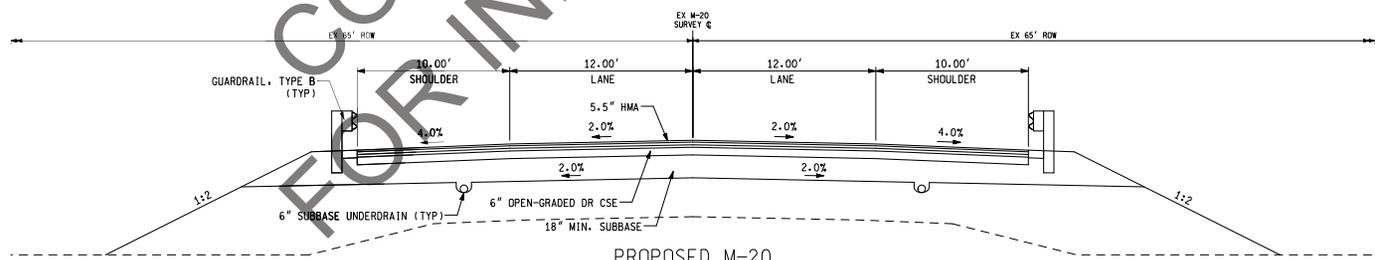
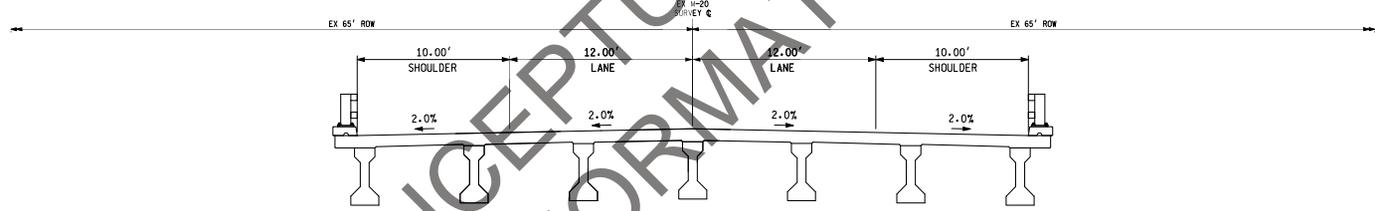
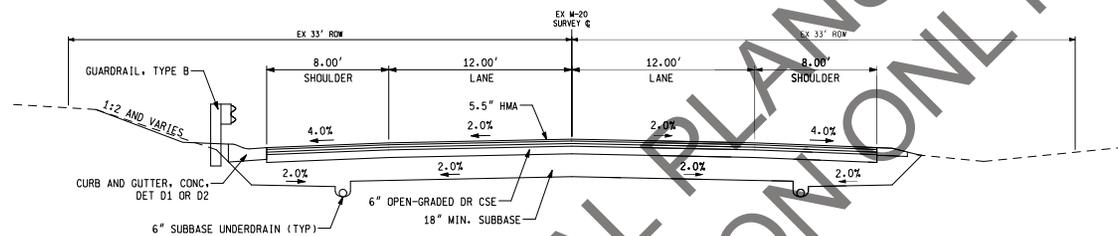
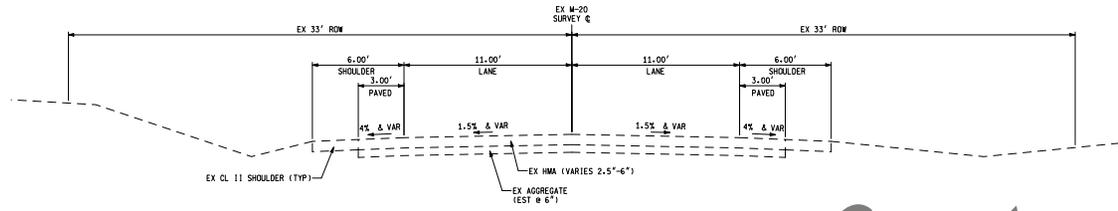


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AUTH	DATE	REVISION



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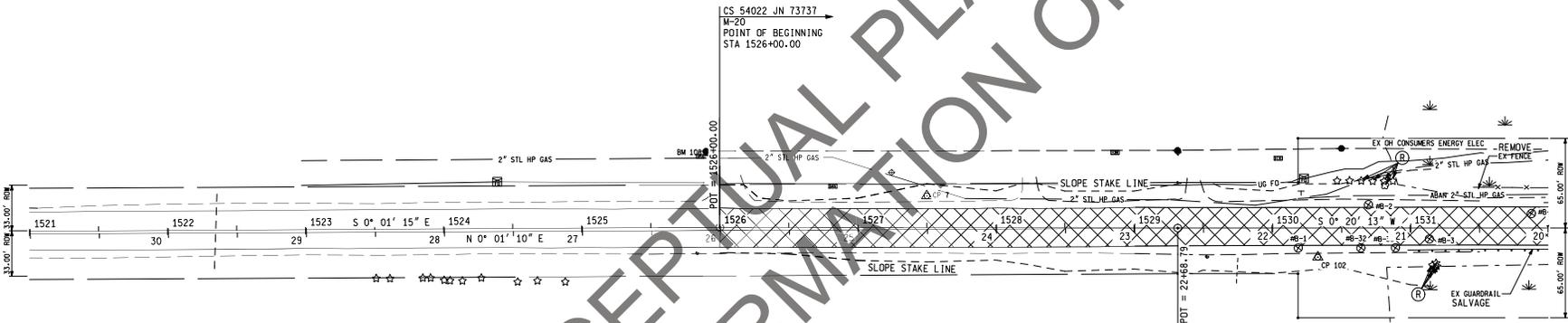
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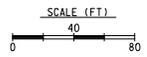
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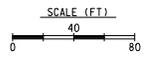
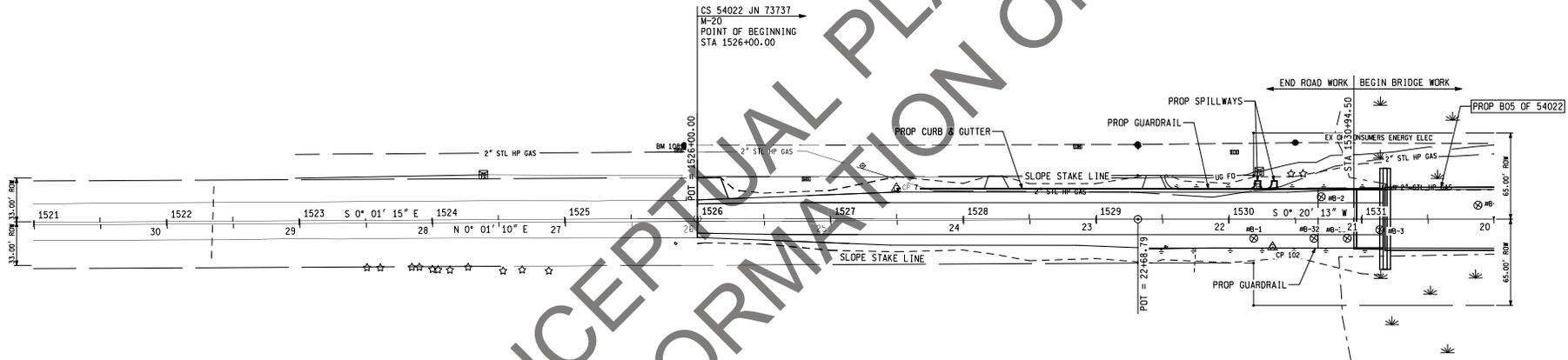
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CONCEPTUAL PLANS
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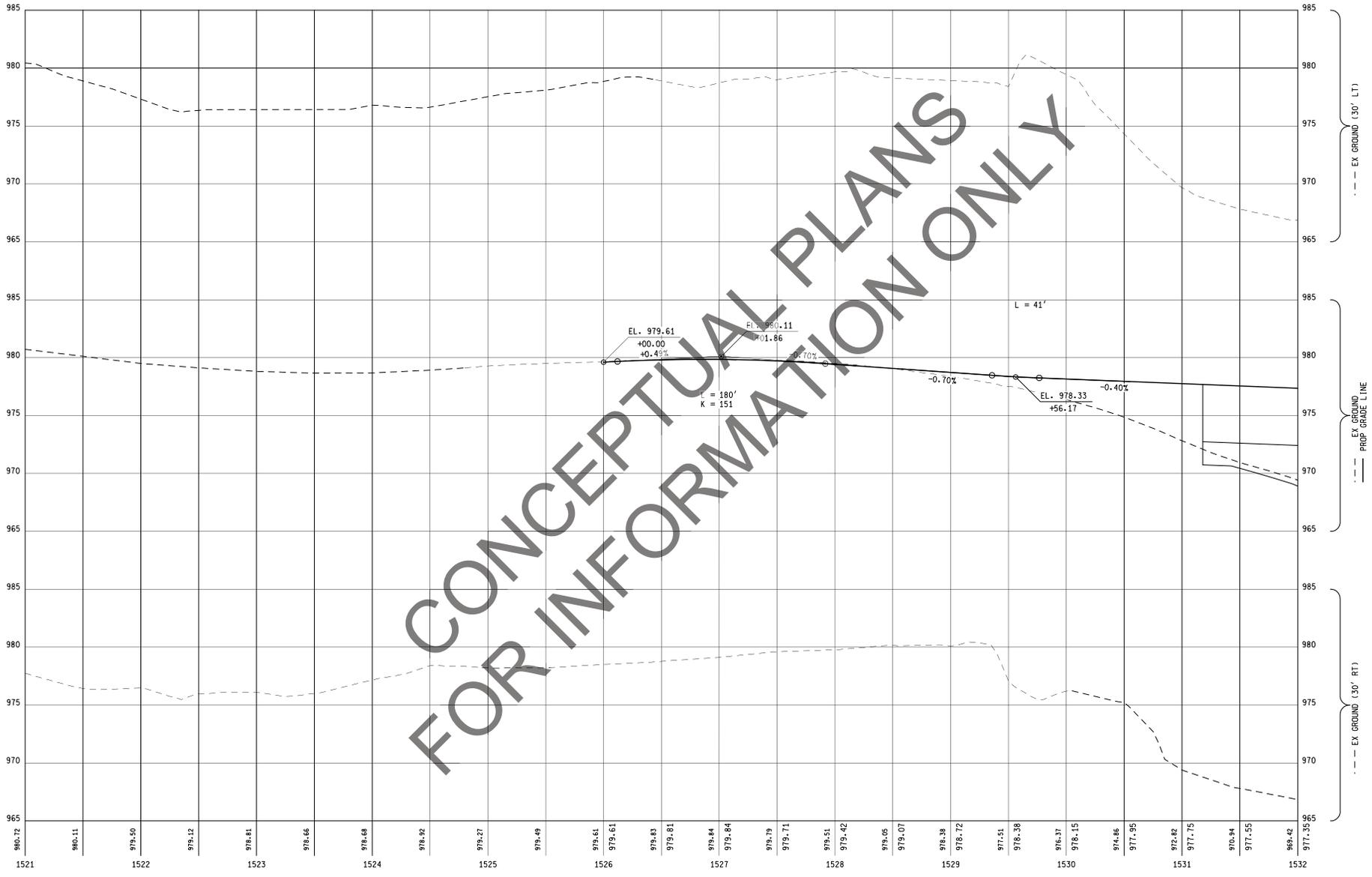


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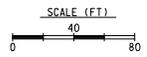
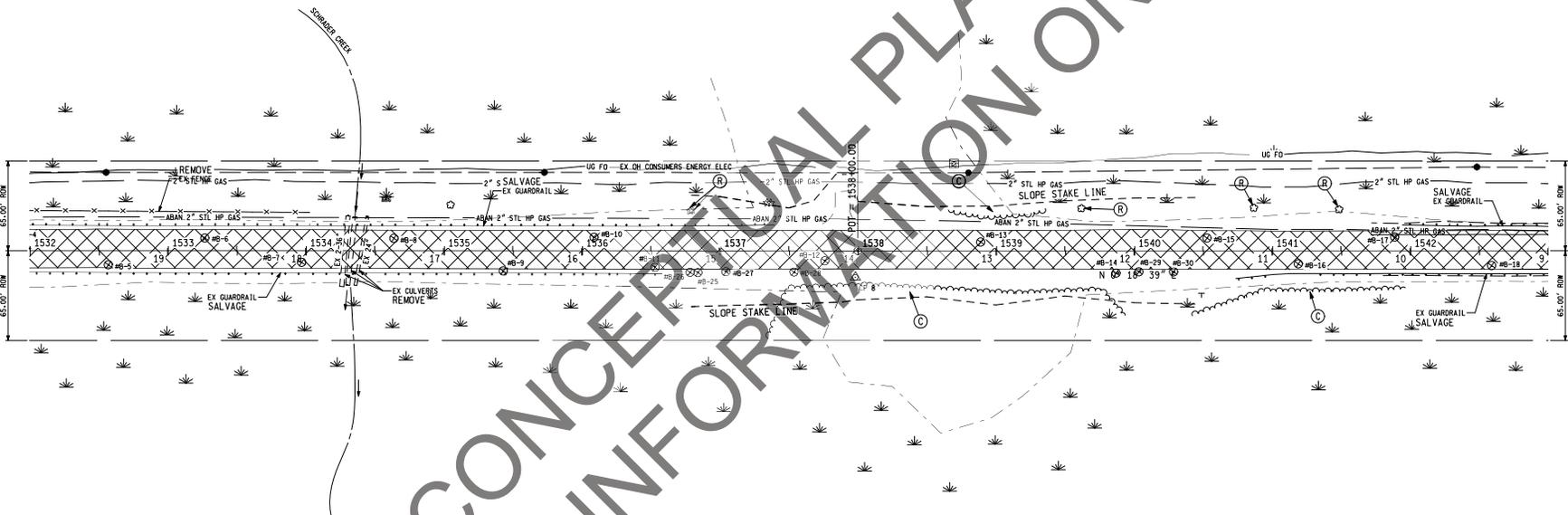
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CONCEPTUAL PLANS
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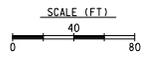
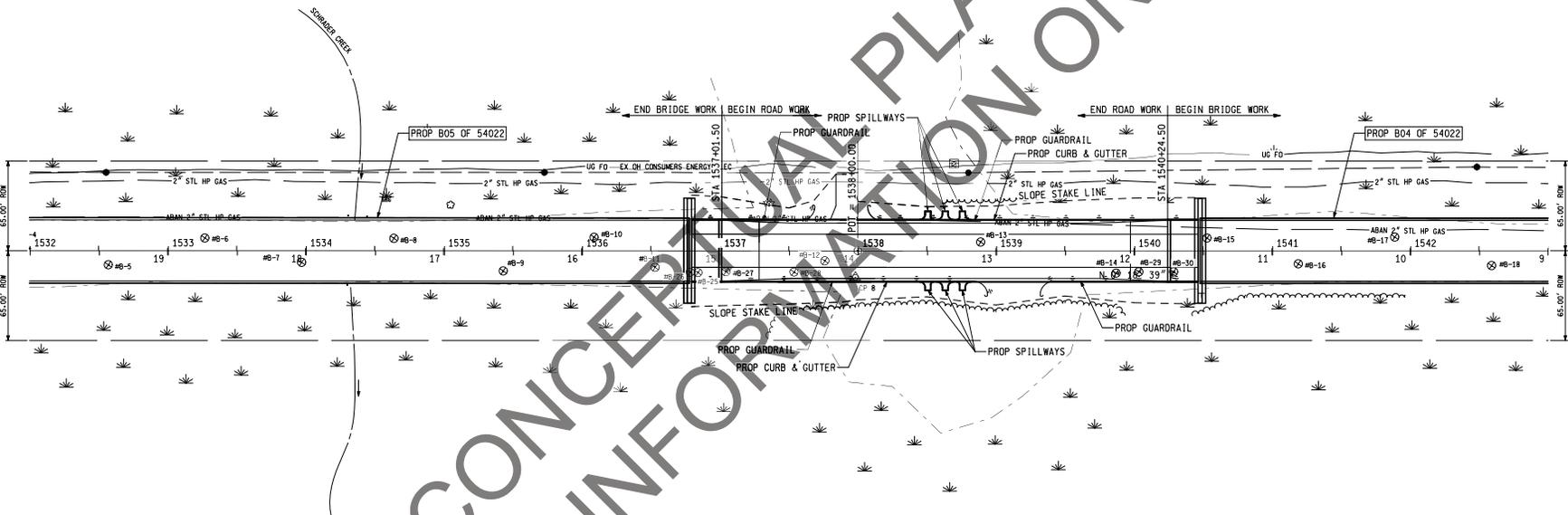
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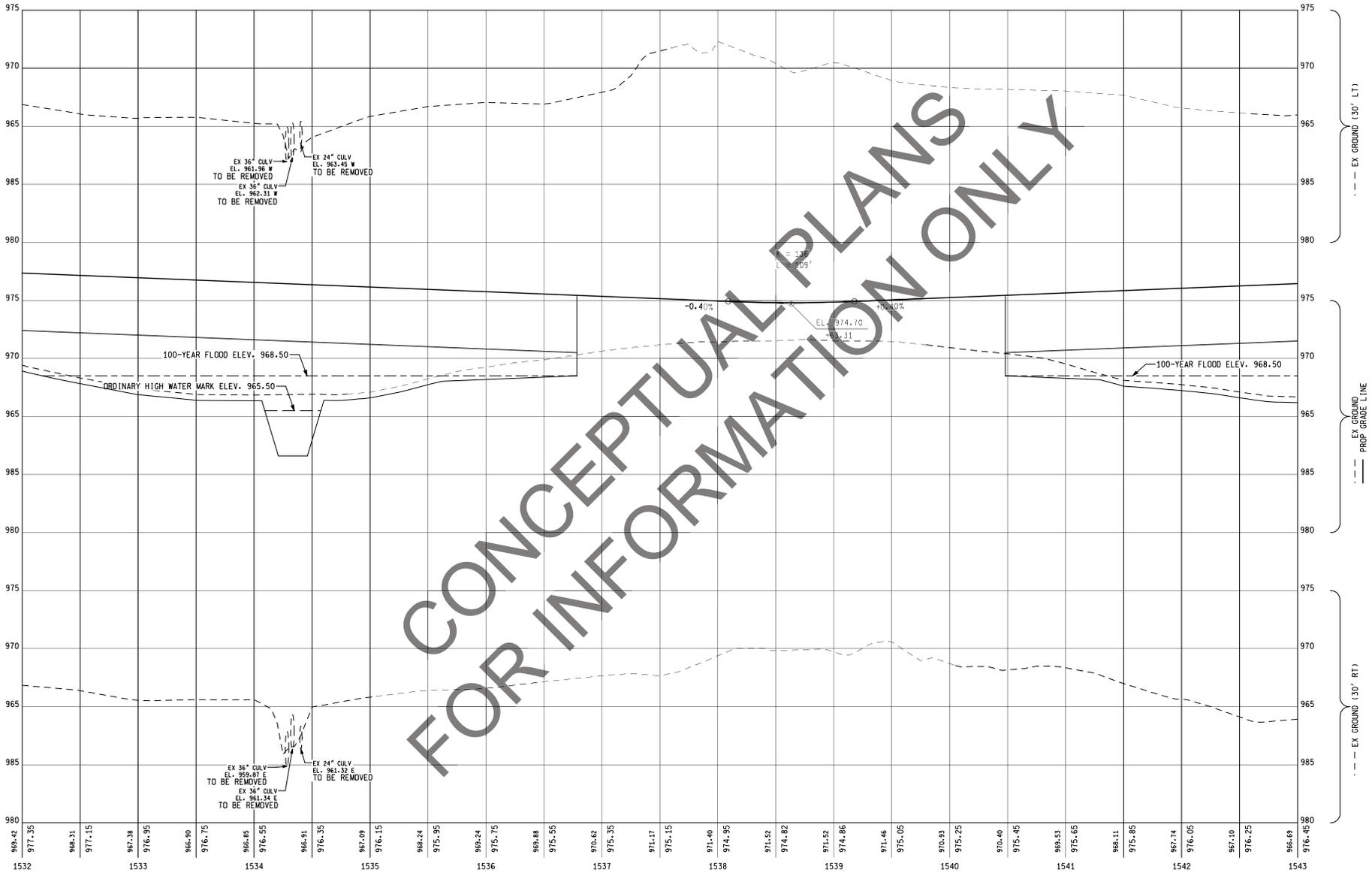


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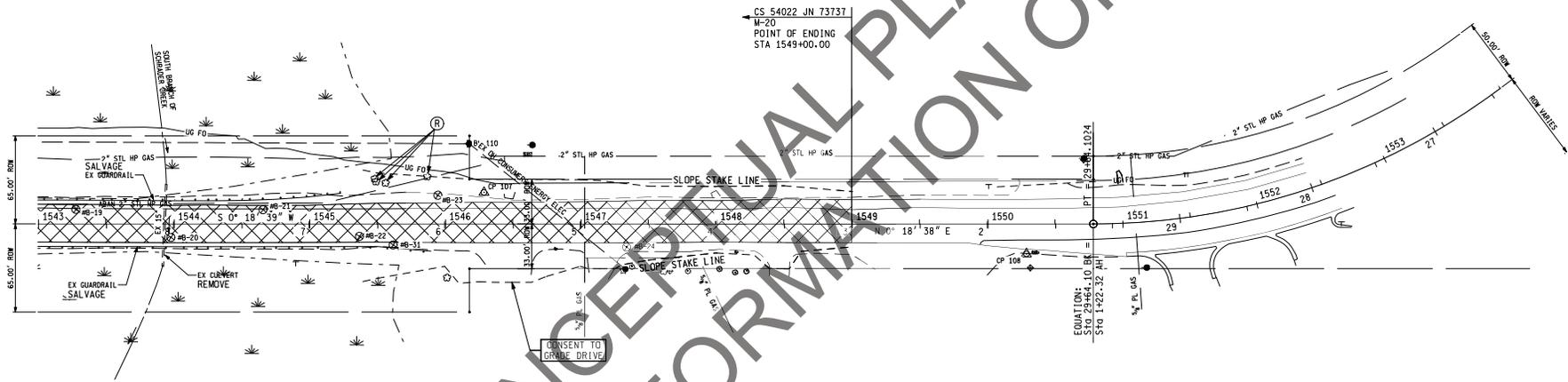
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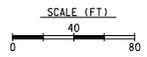
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M-20 STA 1543+00 TO POE

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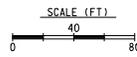
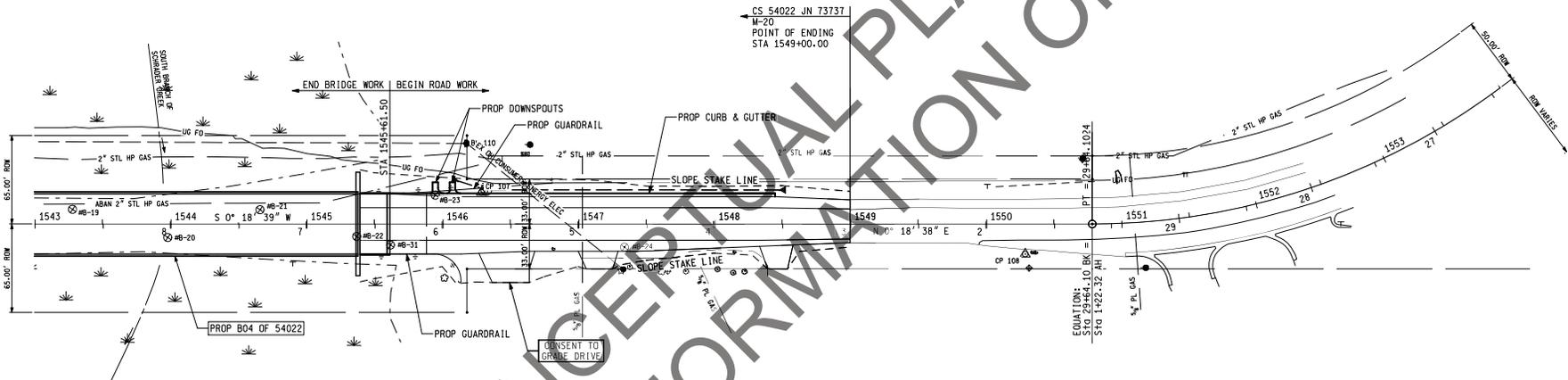
DATE: 11/30/10

FILE NAME: 73737-1543.DGN

FINAL R.O.W.		
AUTH	DATE	REVISION



M-20



CONSTRUCTION SHEET

M-20 STA 1543+00 TO POE

URS Surface Transportation Grand Rapids - Farmington Hills - Troy, MI	 Michigan Department of Transportation	DATE	SCALE	CONT. SEC.	JOB NO.	DESIGN UNIT	SHEET NO.
		11/30/10	1" = NONE	54022	73737	HOWARD CITY TSC	R.O.W CONST. 9

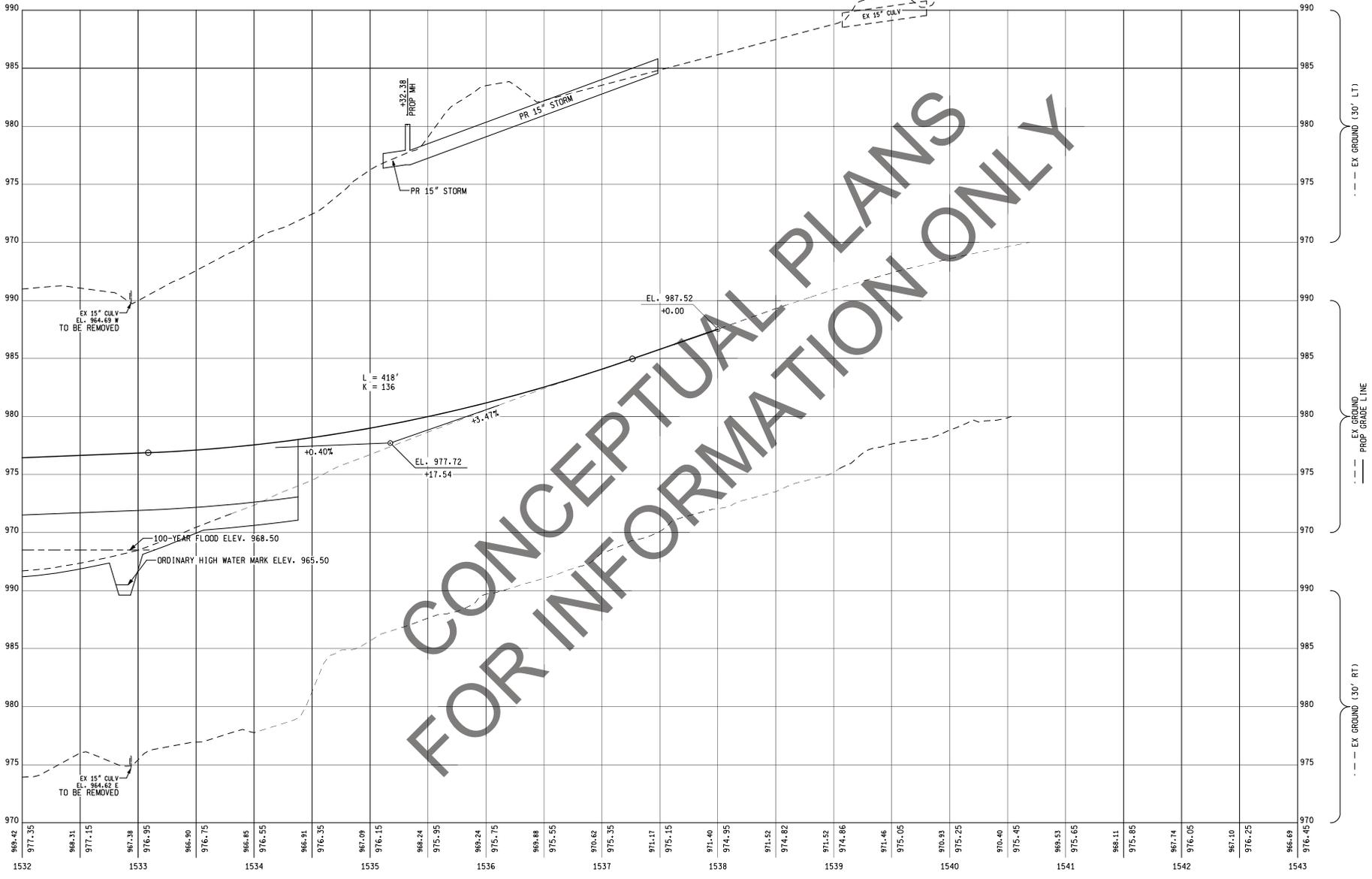
M-20

DATE: 11/30/10

CHECKED BY: TRW

MARKED ON BY: TRW

FILE NAME: 73737-1543.DGN



CONCEPTUAL PLANS
FOR INFORMATION ONLY

 <small>MICHIGAN DEPARTMENT OF TRANSPORTATION</small>	M-20 STA 1543+00 TO POE	DESTROY UNIT HOWARD CITY, MI	DATE: 11/30/10 JOB NO. 73737 CONT. SEC. 54022 WORKED ON BY: TRM CHECKED BY: TRM
SHEET NO. R.O.W CONST. 10		FILE NAME: 73737-1543-PRF	

URS
 Surface Transportation
 Grand Haven, Michigan

DATE: 11/30/10

FINAL E.O.W.	DATE	NO.	REVISION

40 SCALE
 0 20 40
 2 4

Attachment F

Preliminary RID DVD Index

This attachment includes the Preliminary RID DVD Index only.

The actual DVD is available upon request by contacting:

Charlie Stein, P.E.
Michigan Department of Transportation
Muskegon TSC
2225 Olthoff Drive
Muskegon, MI 49444

Phone: 231-777-7281

E-mail: steinc@michigan.gov

REFERENCE INFORMATION DOCUMENTS DVD INDEX

**MICHIGAN DEPARTMENT OF TRANSPORTATION
Grand Region
Design-Build Project**

M-20 at Schrader Creek

**Job Number: 73737
Control Section: 54022
Federal Project Number:
Federal Item Number:**

**DRAFT
May 27, 2011**



Index of Reference Information Documents

*These documents are provided in .pdf format on a DVD.

**These documents are provided in .pdf format and are also available in other formats (i.e. .tif, .xls, .dgn, .TSS, .etc.) on a DVD.

***These documents are provided in a format other than .pdf on a DVD.

DVD's may be obtained by contacting Charlie Stein, MDOT Project Manager at – steinc@michigan.gov

RID AS-BUILTS
(Descriptions of as-builts are provided for information only and may not be entirely accurate)
<u>Road As-Builts</u>
M-20
54022-56703A * M-20 Cold Milling and Resurfacing – 2008
54022-14776 * - Never Built M-20 Swamp Treatment, Grading and Resurfacing – Never Built
RID BASE AND CONCEPT PLANS AND DATA
<u>Concept Plans</u>
73737_concept_plans*
<u>CADD Reference Files</u>
73737_align: road alignment file***
73737_construct: proposed roadway design file***
73737_profile: road centerline elevation design file***
73737_proposed: proposed bridge design file***
73737_row: existing right-of-way file***
73737_survey: survey file***
73737_wetland: wetland file***
73737_xsec: cross-section design file***
<u>GEOPAK Files</u>
i96ex.tin: digital terrain model TIN file***

RID MISCELLANEOUS REFERENCE	
<u>Geotechnical</u>	
	MDOT Muck Depth Graphic (2008, 2009)*
	MDOT Opinion on Soil Conditions (2010)*
	MDOT Soil Boring Survey (July 2010)**
	MDOT Soil Boring Survey Coordinates *
	MDOT Swamp Soundings (1969, 1978)*
	MDOT Vane Shear Test (1988)*
	Wilcox Geotechnical Summary Letter (December 2010)*
	Wilcox Soil Profiles (January 2011)*
<u>Hydraulics</u>	
	HEC-RAS files ***
	MDOT 100 Year Flood Elevation Estimate (December 2009)*
	MDOT Stream Survey (1979)*
	Precipitation Data (May 2010 to July 2010)*
	Schrader Creek Water Elevations (2009, 2010) *
<u>Survey</u>	
	Hydraulic Survey ***
	Road Survey ***
<u>Utility</u>	
	Consumers Energy Gas As-Built (October 2010)
	Consumers Energy Gas Relocation Plan (July 2010)*
	Utility Company Responses (CenturyLink, Charter, Consumers Energy Electric, Consumers Energy Gas Transmission, Consumers Energy Gas, Consumes Energy High Voltage, Great Lakes Energy, ITC Holdings, Kentucky Data Link, Mecosta County Drain Commissioner)*

Attachment G

MDOT Form 5100H

The Michigan Department of Transportation (MDOT) is seeking professional services for the project contained in the attached scope of services.

If your firm is interested in providing services, please indicate your interest by submitting a Proposal, Proposal/Bid Sheet or Bid Sheet as indicated below. The documents must be submitted in accordance with the latest "Consultant/Vendor Selection Guidelines for Service Contracts" and "Guideline for Completing a Low Bid Sheet(s)", if a low bid is involved as part of the selection process. **Referenced Guidelines are available on MDOT's website under Doing Business > Vendor/Consultant Services > Vendor/Consultant Selections.**

RFP SPECIFIC INFORMATION

BUREAU OF HIGHWAYS

BUREAU OF TRANSPORTATION PLANNING **

OTHER

THE SERVICE WAS POSTED ON THE ANTICIPATED QUARTERLY REQUESTS FOR PROPOSALS

NO

YES

DATED _____

THROUGH _____

Prequalified Services – See page ___ of the attached Scope of Services for required Prequalification Classifications.

Non-Prequalified Services - If selected, the vendor must make sure that current financial information, including labor rates, overhead computations, and financial statements, if overhead is not audited, is on file with MDOT's Office of Commission Audits. This information must be on file for the prime vendor and all sub vendors so that the contract will not be delayed. **(Form 5100J Required with Proposal)**

Qualifications Based Selection – Use Consultant/Vendor Selection Guidelines

For all Qualifications Based Selections, the section team will review the information submitted and will select the firm considered most qualified to perform the services based on the proposals. The selected vendor will be contacted to confirm capacity. Upon confirmation, that firm will be asked to prepare a priced proposal. Negotiations will be conducted with the firm selected.

****For RFP's that originate in Bureau of Transportation Planning only**, a priced proposal must be submitted at the same time as, but separate from, the proposal. Submit directly to the Contract Administrator/Selection Specialist, Bureau of Transportation Planning (see address list, page 2). The priced proposal must be submitted in a sealed envelope, clearly marked "**PRICE PROPOSAL.**" The vendor's name and return address **MUST** be on the front of the envelope. The priced proposal will only be opened for the highest scoring proposal. Unopened priced proposals will be returned to the unselected vendor(s). Failure to comply with this procedure may result in your priced proposal being opened erroneously by the mail room.

For a cost plus fixed fee contract, the selected vendor must have a cost accounting system to support a cost plus fixed fee contract. This type of system has a job-order cost accounting system for the recording and accumulation of costs incurred under its contracts. Each project is assigned a job number so that costs may be segregated and accumulated in the vendor's job-order accounting system.

Qualifications Review / Low Bid - Use Consultant/Vendor Selection Guidelines. See Bid Sheet Instructions for additional information.

For Qualification Review/Low Bid selections, the selection team will review the proposals submitted and post the date of the bid opening on the MDOT website. The notification will be posted at least two business days prior to the bid opening. Only bids from vendors that meet proposal requirements will be opened. The vendor with the lowest bid will be selected. The selected vendor may be contacted to confirm capacity.

Best Value - Use Consultant/Vendor Selection Guidelines. See Bid Sheet Instructions below for additional information. The bid amount is a component of the total proposal score, not the determining factor of the selection.

Low Bid (no qualifications review required - no proposal required.) See Bid Sheet Instructions below for additional instructions.

BID SHEET INSTRUCTIONS

A bid sheet(s) must be submitted in accordance with the "Guideline for Completing a Low Bid Sheet(s)" (available on MDOT's website). The Bid Sheet(s) is located at the end of the Scope of Services. Submit bid sheet(s) separate from the proposal, to the address indicated below. The bid sheet(s) must be submitted in a sealed manila envelope, clearly marked "**SEALED BID.**" The vendor's name and return address **MUST** be on the front of the envelope. Failure to comply with this procedure may result in your bid being opened erroneously by the mail room and the bid being rejected from consideration.

PROPOSAL SUBMITTAL INFORMATION

REQUIRED NUMBER OF COPIES FOR PROJECT MANAGER	PROPOSAL/BID DUE DATE	TIME DUE
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PROPOSAL AND BID SHEET MAILING ADDRESSES

Mail the multiple proposal bundle to the MDOT Project Manager or Other indicated below.

MDOT Project Manager

MDOT Other

Mail one additional stapled copy of the proposal to the Lansing Office indicated below.

Lansing Regular Mail	OR	Lansing Overnight Mail
Secretary, Contract Services Div - B470 Michigan Department of Transportation PO Box 30050 Lansing, MI 48909		Secretary, Contract Services Div - B470 Michigan Department of Transportation 425 W. Ottawa Lansing, MI 48933
Contract Administrator/Selection Specialist Bureau of Transportation Planning B470 Michigan Department of Transportation PO Box 30050 Lansing, MI 48909		Contract Administrator/Selection Specialist Bureau of Transportation Planning B470 Michigan Department of Transportation 425 W. Ottawa Lansing, MI 48933

GENERAL INFORMATION

Any questions relative to the scope of services must be submitted by e-mail to the MDOT Project Manager. Questions must be received by the Project Manager at least four (4) working days prior to the due date and time specified above. All questions and answers will be placed on the MDOT website as soon as possible after receipt of the questions, and at least three (3) days prior to the RFP due date deadline. The names of vendors submitting questions will not be disclosed.

MDOT is an equal opportunity employer and MDOT DBE firms are encouraged to apply. The participating DBE firm, as currently certified by MDOT’s Office of Equal Opportunity, shall be listed in the Proposal

MDOT FORMS REQUIRED AS PART OF PROPOSAL SUBMISSION

5100D – Request for Proposal Cover Sheet

5100J - Consultant Data and Signature Sheet (Required only for Non-Prequalified Work)

(These forms are not included in the proposal maximum page count.)