Stormwater Site Plan

WSECU CHEHALIS
Chehalis, WA

Prepared For:
Thomas Architecture Studios
525 Columbia St SW
Olympia, WA 98501

Prepared By:
SCJ Alliance
8730 Tallon Lane NE, Suite 200
Lacey, WA 98516
360-352-1465

July 2021

SCJ ALLIANCE
CONSULTING SERVICES

Stormwater Site Plan

Project Information

Project:	**WSECU Chehalis**
Prepared for:	**Thomas Architecture Studios** 525 Columbia St SW Olympia, WA 98501 Contact Name: Michael Kershisnik, AIA Contact Phone: 360.915.8775

Reviewing Agency

Jurisdiction:	City of Chehalis

Project Representative

Prepared by:	**SCJ Alliance** 8730 Tallon Lane NE, Suite 200 Lacey, WA 98516 360.352.1465 scjalliance.com
Contact:	Jared VerHey, PE
Project Reference:	SCJ #1835.24 Path: N:\Projects\1835 Thomas Architecture Studio, Inc\1835.24 Chehalis WSECU\Phase 03 - Civil Construction Drawings\Design\Storm\Stormwater Site Plan\2021-xxxx Stormwater Site Plan.docx

PROJECT ENGINEER'S CERTIFICATION

I hereby certify that this Stormwater Site Plan for the WSECU Chehalis project has been prepared by me or under my supervision and meets the minimum standards of the City of Chehalis and normal standards of engineering practice. I hereby acknowledge and agree that the jurisdiction does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities designed by me.

07-02-2021

Prepared by: Ronald Boursaw, EIT
Ronald.Boursaw@scjalliance.com
(360) 352-1465

Date

07-02-2021

Approved by: Jared VerHey, PE
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Date

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1. PROJECT OVERVIEW

The following report was prepared for the WSECU Chehalis project in Chehalis, WA. This report was prepared to comply with the minimum technical standards and requirements that are set forth in the *2014 Department of Ecology Stormwater Management Manual for Western Washington (SWMMWW).*

Project Proponent:	Thomas Architecture Studios
Parcel Numbers:	005605082015
Total Parcel Area:	2.74 Acres
Current Zoning:	Commercial Retail
Required Permits:	Grading, Utility, Paving, Building, etc.
Site Address:	1700 NW Louisiana Blvd
Section, Township, Range:	Section 19, Township 14N, Range 02

The proposed WSECU Chehalis site is located on one parcel that contains 2.74 acres total. The project is located at the north side of NW Arkansas Way and Louisiana Blvd in Chehalis, WA. The proposed construction includes the WSECU building, as well as associated parking lot, utilities, and stormwater improvements disturbing approximately 1.38 acres. Specifically, the proposed site improvements/construction activities for this project include the following:

- Site preparation, grading, and erosion control activities
- Demolition of existing gravel areas
- Construction of WSECU Building
- Construction of parking lot
- Construction/installation of on-site conveyance facilities
- Extension of available utilities (i.e., water, sewer, etc.)

A site vicinity map of the proposed project location is enclosed herein as **Appendix 1**.

1.1 SUMMARY OF COMPLIANCE ON-SITE

The stormwater design complies with the 9 minimum requirements as follows:

Minimum Requirement #1 – Preparation of Stormwater Site Plans – The Stormwater Site Plan is prepared per the 2014 SWMMWW.

Minimum Requirement #2 – Construction Stormwater Pollution Prevention – A pollution prevention plan will be completed at the time of civil permit submittal and attached herein as **Appendix 7**. Further, an erosion control plan has been prepared and included as part of the engineering construction plan set in **Appendix 4**. The contractor may need to amend and update these plans as part of development and/or management of the SWPPP. The contractor will be responsible for preparing the full SWPPP which shall comply with all of the required elements

and the Washington Department of Ecology requirements for coverage under the NPDES Construction Stormwater General Permit.

Minimum Requirement #3 – Source Control of Pollution – BMPs listed below are the minimum required for the site, additional BMPs not listed here may need to be implemented the meet the minimum requirements discussed in the 2014 SWMMWW.

- S411 BMPs for Landscaping and Lawn/Vegetation Management
- S417 BMPs for Maintenance of Stormwater Drainage and Treatment Systems

Minimum Requirement #4 – Preservation of Natural Drainage Systems and Outfalls – Currently, stormwater runoff throughout the site sheet flows to the south of the parcel. The stormwater runoff then enters catch basins and continues to flow south to a treatment facility. After construction, the stormwater runoff from the proposed improvements will be collected and conveyed to the existing off-site treatment facility.

Minimum Requirement #5 – On-site Stormwater Management – In accordance with Minimum Requirement #7, this project is flow control exempt. All stormwater runoff from the proposed development will be collected and conveyed to an existing off-site treatment facility.

Minimum Requirement #6 – Runoff Treatment – The proposed project will construct over 5,000 s.f. of pollution-generating impervious surface, therefore a stormwater treatment facility is required. The proposed project is not considered a high-use site and therefore does not require oil control. Phosphorus control is not required by the jurisdiction. The proposed project is not an industrial, or multi-family residential project and therefore does not require enhanced treatment. Therefore, basic treatment is required for this project. Basic treatment will be provided for the project through the existing off-site treatment facility.

Minimum Requirement #7 – Flow Control – See Section 4 of this report for more information.

Minimum Requirement #8 – Wetlands Protection – There are no wetlands on the project site nor does the project site currently discharge into a wetland.

Minimum Requirement #9 – Operation and Maintenance – An operations and maintenance manual will be completed as part of the civil permit submittal and will be attached herein as **Appendix 6**.

2. EXISTING CONDITIONS SUMMARY

2.1 EXISTING ON-SITE CONDITIONS

The subject site is +/- 2.74 acres in size. Topography within the property is generally flat throughout sloping to the south at slopes between 0 and 5%. The site was an airport landing strip until sometime in 1990 and 2003 when a neighboring development removed half of the air strip. By 2005, the remaining air strip was removed and a larger development to the north, Home Depot, was built along with NW Louisiana Ave and NW Arkansas Way and has sat largely unchanged since then. Vegetation appears to be minimal, with some grasses. No developments have been added since then. See the figures below.

Figure 1: Existing Conditions (1990)

Figure 2: Existing Conditions (2018)

2.1.1 Flood Hazard Zone

Flood Zones: The project parcel is located within Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panel No. 5301041361C. According to the FIRM Map, the parcel is determined to be in Zone AE, an area without a base flood elevation. See **Appendix 8** for the FIRM Map.

2.1.2 On-Site Soils Information

Soils testing was conducted by Materials Testing & Consulting, Inc. in February, 2014. Quality Geo was provided the original report and performed their own soils investigation. The site is almost entirely covered in gravel. The site is entirely covered by depths up to 24 inches of structural fill with a geofabric providing separation from the underlying soils of native silt that was observed to be soft and wet. See **Appendix 5** for the geotechnical report.

3. OFFSITE ANALYSIS REPORT

3.1 QUALITATIVE UPSTREAM ANALYSIS

The parcel area and the surrounding parcels appear to be relatively flat. It is not anticipated that there is any off-site run-on from the adjacent parcels.

3.2 QUALITATIVE DOWNSTREAM ANALYSIS

After construction, stormwater runoff from the project areas will sheet flow across the site and collected in catch basins and then conveyed out to the existing off-site stormwater treatment system. In the event that the system fails or overflows, stormwater runoff will sheet flow directly to the southwest and onto the neighboring parcel.

4. PERMANENT STORMWATER CONTROL PLAN

4.1 SUMMARY SECTION

The proposed project follows the development requirements stated in the 2014 SWMMWW. See Appendix 4 for the proposed stormwater conveyance system and details. Table 1: Land Type Designations Existing vs. Proposed

below illustrates the existing and proposed impervious and pervious areas of the disturbed areas (See Appendix 3 for the basin maps).

LAND TYPE DESIGNATIONS	AREA (ACRES)	% OF TOTAL AREA
Existing Areas	**1.38**	**100**
Impervious	0.96	69.56
Pervious	0.42	30.44
Proposed Areas	**1.38**	**100**
Roof	0.11	7.97
Asphalt	0.56	40.58
Sidewalk	0.08	5.80
Landscape	0.63	45.65

Table 1: Land Type Designations Existing vs. Proposed

4.1.1 Performance Standards and Goals

All of the stormwater runoff from the proposed project improvements will be collected and conveyed off-site to an existing treatment facility. Flow control is not required for this project.

4.1.2 Flow Control System

Flow control is required for the proposed project and will be provided through an existing off-site treatment facility. A conveyance calculation was sized using WWHM2012 to verify the offsite outlet from the project site. See **Appendix 9** for the WWHM Report.

4.1.3 Water Quality System

Treatment will be provided using the existing off-site treatment facility that was previously sized to include this development.

4.1.4 Conveyance System Analysis and Design

The only on-site conveyance are the roof drain pipes that are 6” in diameter and a 12” storm drain pipe that conveys the site runoff to the storm treatment facility off-site. A conveyance analysis of a 12 inch pipe was done to ensure the total site runoff could be handled by a single 12 inch storm pipe. A 12 inch pipe at 0.5% slope at 95% full has a capacity of 3.5 cfs whereas the total site runoff at the 100-yr storm is 0.63 cfs. Total site runoff was calculated using WWHM2012 and this report can be found in **Appendix 9**.

5. CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN (C-SWPPP)

A SWPPP will be prepared with the civil permit submittal and included herein as **Appendix 7**.

6. SPECIAL REPORTS AND STUDIES

See **Appendix 5** for the geotechnical report. No other special reports or studies were required for this project.

7. OTHER PERMITS

Utility, paving, building, and grading permits may need to be secured prior to beginning construction activities. Coverage under Washington State Department of Ecology Phase II National Pollutant Discharge Elimination System Stormwater Permit will also need to be secured prior to beginning construction activities.

8. OPERATION AND MAINTENANCE MANUAL

The owner of the WSECU Chehalis will be responsible in maintaining all stormwater conveyance on-site. An operation and maintenance manual we be prepared as part of the civil permit submittal and included herein as **Appendix 6**.

END OF STORMWATER SITE PLAN

APPENDIX 1
SITE VICINITY MAP

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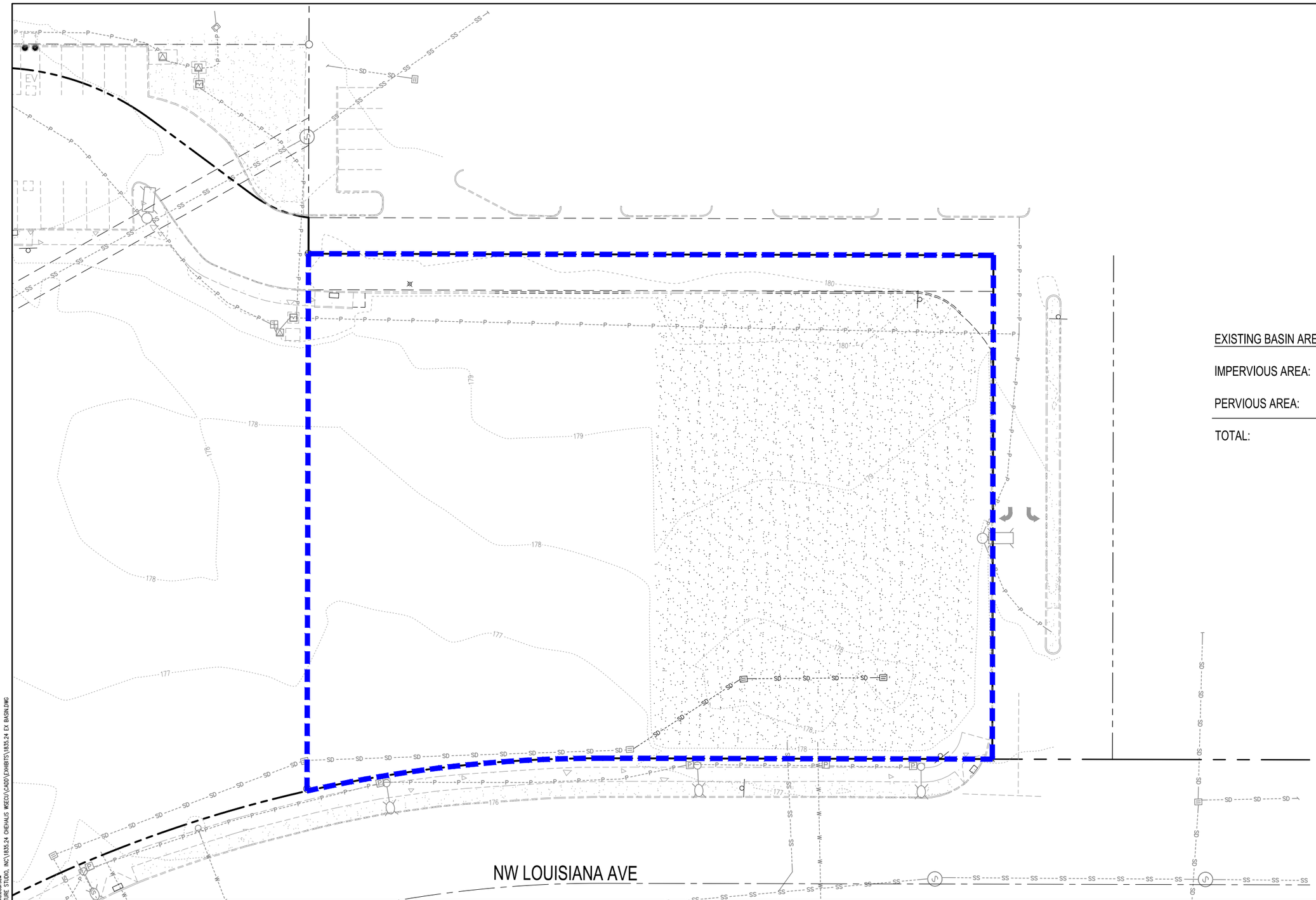
APPENDIX 2

NOT USED

APPENDIX 3
BASIN MAP EXHIBITS



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SCALE IN FEET

EXISTING BASIN AREAS:

IMPERVIOUS AREA:	0.96 ACRES
PERVIOUS AREA:	0.42 ACRES
TOTAL:	1.38 ACRES

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HORIZONTAL SCALE: 1"=20'

DATE: JULY, 2021

JOB No.: 1835.24

DRAWING FILE No.: 1835.24 Ex Basin.dwg

EXISTING CONDITIONS MAP

WSECU CHEHALIS, CHEHALIS, WA

EXHIBIT No: EX-01

SHEET No: 1

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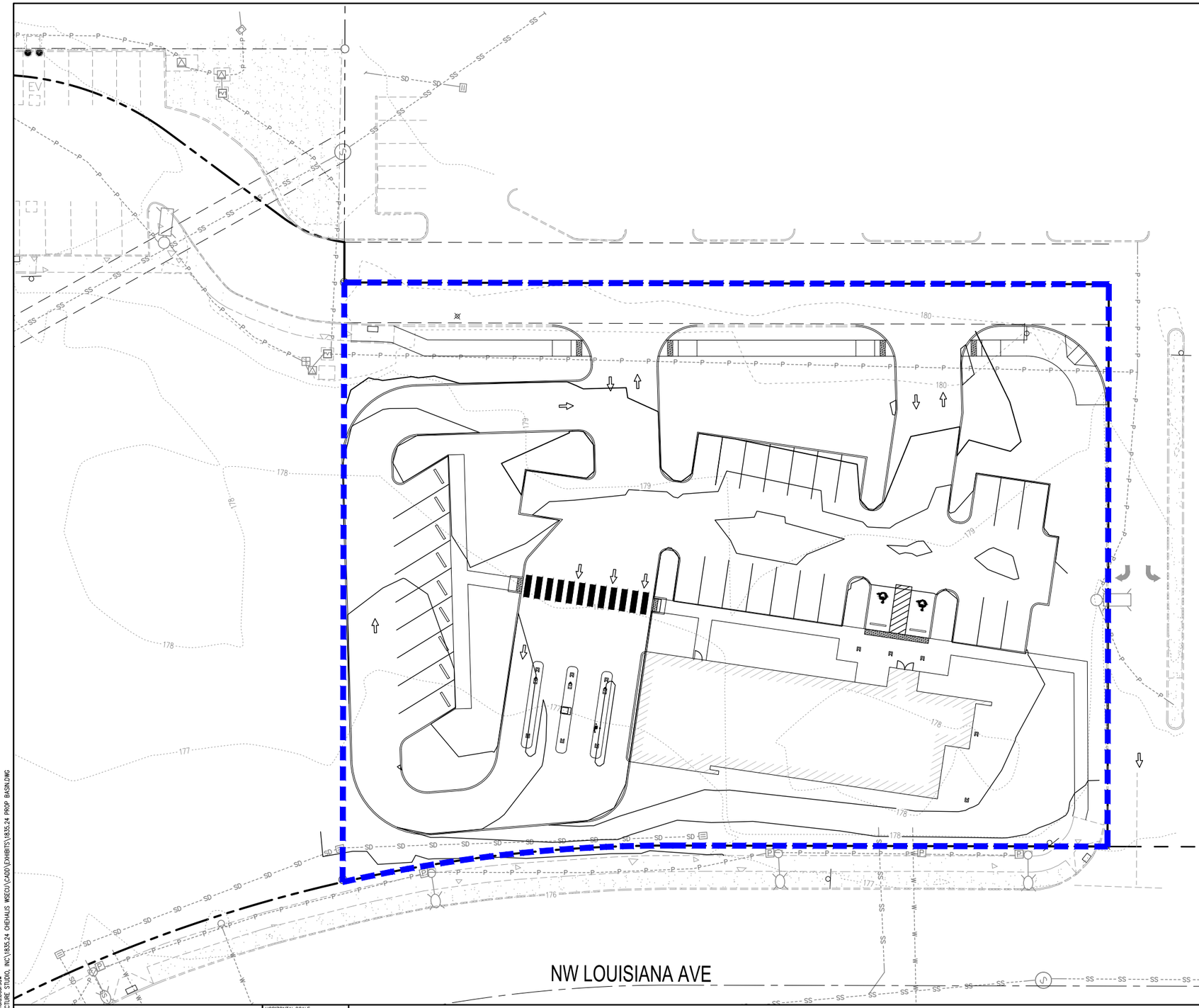

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SCALE IN FEET

PROPOSED BASIN AREAS:

ASPHALT AREA:	0.56 ACRES
CONCRETE AREA:	0.08 ACRES
ROOF AREA:	0.11 ACRES
PERVIOUS AREA:	0.63 ACRES
TOTAL:	1.38 ACRES

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HORIZONTAL SCALE:	1"=20'
DATE:	JULY, 2021
JOB No.:	1835.24
DRAWING FILE No.:	1835.24 Prop Basin.dwg

PROPOSED CONDITIONS MAP
WSECU CHEHALIS, CHEHALIS, WA

EXHIBIT No: **EX-02**

SHEET No: **2**

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APPENDIX 4
CONSTRUCTION PLANS

APPENDIX 5
GEOTECHNICAL REPORT

Materials Testing & Consulting, Inc.

Geotechnical Engineering & Consulting ● Special Inspection ● Materials Testing ● Environmental Consulting

March 20, 2014

Allyn J. Roe
Discover! Children's Museum
P.O. Box 147
Chehalis, WA 98532
Sent via email: aroe@flycls.com

RE: Discover! Children's Museum Final Geotechnical Engineering Report (MTC #14S032)
NW Louisiana Avenue, Chehalis, WA

Mr. Roe:

This letter transmits our Final Preliminary Geotechnical Engineering Report for the above-referenced project. Materials Testing & Consulting, Inc. (MTC) performed this cursory exploration in accordance with our proposal dated February 20, 2014, and executed contract dated February 26, 2014. The following report is the final version for you and your project team.

The site soils encountered are suitable for the proposed development if the provisions provided within this report are followed. The underlying site soil is predominantly fill material overlying native alluvial soil. Perched groundwater was observed in exploration location P-3 at approximately 2 feet below the existing ground surface.

We appreciate the opportunity to provide preliminary geotechnical services for this project. We would be pleased to continue our role as your geotechnical engineering consultants during the project planning and construction. We will be pleased to meet with you at your convenience to discuss these services. If you have questions regarding this report or if we can provide assistance with other aspects of the project, please contact me at (360) 534-9777.

Respectfully Submitted,

Materials Testing & Consulting, Inc.

Lance G. Levine, P.E.
Professional Geotechnical Engineer

Attachment: Final Preliminary Geotechnical Engineering Report

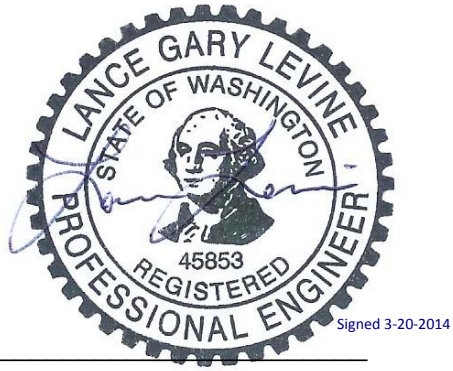
Final Geotechnical Engineering Report

Discover! Children's Museum
Chehalis, Washington

Prepared for:

Allyn J. Roe
Discover! Children's Museum
P.O. Box 147
Chehalis, WA 98532

Prepared by:



Lance G. Levine, P.E.
SW Region Engineering Division Manager

MATERIALS TESTING & CONSULTING, INC. (MTC)
2118 Black Lake Boulevard SW
Olympia, Washington 98512
Phone: (360) 534-9777
Fax: (360) 534-9779

March 20, 2014
MTC Project Number: 14S032

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1.0 INTRODUCTION

1.1. GENERAL

This report presents the findings and recommendations of Materials Testing & Consulting, Inc.'s (MTC's) geotechnical engineering study conducted in order to construct a children's museum. The project site is located on Louisiana Avenue in front of the Home Depot in Chehalis, Washington. The proposed development area is bound by bound by the Home Depot parking lot, the entrance to the Home Depot, NW Louisiana Avenue, and an undeveloped area adjacent to the access road between Walmart and the Home Depot. The location of the project site is shown in Figure 1 of Appendix A. These services were requested by Allyn J. Roe of Discover! Children's Museum. A proposal was provided to Mr. Roe on February 20, 2014.

The proposed project site is currently undeveloped. Currently, there is no drive access to the site. However, planned access will be from a new road along the northwest border of the site (adjacent to the Home Depot parking lot, connecting the entrance to the Home Depot with the access road between Walmart and the Home Depot).

1.2. PROJECT DESCRIPTION

It is our understanding the proposed development includes the construction of an approximate 15,000 ft^2 single-story children's museum and approximately 20,000 ft^2 of paved parking area. Building materials have not been specified at this time though concrete tilt-up construction is being considered. The site is generally flat and gently sloping to the southeast. No significant cut or retaining structures are anticipated; however, relatively significant fill activities (around 2 to 4 feet or more across the site) are proposed due to prior flood elevations.

1.3. PURPOSE AND SCOPE OF SERVICES

The purpose of our study was to explore subsurface conditions at the site and provide geotechnical engineering recommendations for design and construction of the proposed development. Our scope of services was consistent with our proposal dated February 20, 2014.

2.0 EXISTING SITE CONDITIONS

2.1. SURFACE CONDITION

Most of the project site is nearly cleared of vegetation and covered with up to 10 feet of imported undocumented fill material from raising the site to current grade. The project site is relatively flat and gently slopes to the southeast. No significant cut or retaining structures are anticipated. However, relatively significant fill activities (around 2 to 4 feet or more across the site) are proposed due to prior flood elevations.

Photo 1. Looking East near West Corner of site

Photo 2. Looking South near West Corner of Site

2.2. AREA GEOLOGY

The site is located in the Chehalis River Valley in Chehalis, Washington. The site soils are mapped as Reed Silty Clay Loam (173) formed in flood plains.[1] The soil is described as being deep with no restrictive horizon close to the surface. The soil is described as poorly drained and having a moderately low to moderately high capacity to transmit water. Groundwater is generally encountered within 1 to 3 feet of the surface. The results of our field and laboratory investigations indicate that site conditions are consistent with the published geology below the undocumented fill. The site is generally underlain by soft, wet uncontrolled sandy silt with gravel from an unknown source.

According to the *Geologic Map of Washington – Southwest Quadrant*, the site is mapped as Quaternary Alluvium (Qa). The material is relatively undissected silt, sand, and gravel deposited in streambeds.[2]

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[1] *Web Soil Survey (http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx)*; United States Department of Agriculture – Natural Resources Conservation Service

[2] *Geologic Map of Washington – Southwest Quadrant*; WA State Department of Natural Resources; Walsh et al; 1987

2.3. SOIL CONDITIONS

A general characterization of the site soil encountered during our exploration is presented in this section. The exploration logs in Appendix B present details of the soils encountered at each exploration location. As encountered in our test pits, the onsite soils are generally characterized as follows:

Fill – ML / SM: An undocumented fill layer up to 10 feet thick covered the site. The fill material was generally a brown to orange-brown silt with sand to sand with silt and minor gravel. The fill material was generally in a very loose to loose condition with varying moisture content.

Alluvium; Silty Sand with Gravel – SM: Soft alluvial soils were encountered below surficial soil at every test pit location. This soil unit was encountered at 10 below present grade and consisted of silty sand with gravel that was in a loose condition.

Photo 3. Typical surface fill soil.

2.4. GROUNDWATER CONDITIONS

Using the information available from the Washington State Department of Ecology (DOE), a review of the area uncovered several well logs for the vicinity.[3] Groundwater in the logs that were available was generally recorded at 15 feet below the surface or shallower. Outside of perched water, groundwater was not observed during our field exploration.

[3] Washington State Well Log Viewer (*http://apps.ecy.wa.gov/welllog/MapSearch*) *Washington State Department of Ecology*

3.0 SITE EXPLORATION AND LABORATORY TESTING

3.1. SITE EXPLORATION

We investigated the site on March 5, 2014, by attempting to excavate test pits, conducting hand augers, and advancing three penetration tests using a Wildcat Dynamic Cone Penetrometer (DCP) manufactured by Triggs Technologies, Inc. Test pit excavation was very limited due to the soft and slippery surficial soil conditions (equipment buried itself in the soft soil and had to be towed out).

The exploration location map is included as Figure 2 in Appendix A. During the exploration, the soils encountered were logged in accordance with the Unified Soil Classification System (USCS). Representative soil samples were collected, sealed in plastic bags, and transported to our laboratory for re-examination and testing.

The Wildcat DCP was utilized to determine the current bearing capacity of the soils. Blow counts were recorded for 10 centimeter increments as a 35-pound weight was dropped a distance of 15 inches. The DCP testing continued until groundwater was encountered and blow counts leveled off. Using a Triggs proprietary spreadsheet, the blow counts were then converted to resistance in kilograms per square centimeter (kg/cm^2), standard penetration blow counts (N'), and consistency descriptions. Our DCP logs are located in Appendix C of this report.

Photo 4. Excavation Equipment stuck in Soft Surficial Soil

Photo 5. DCP Testing at DCP location P-1

Additional information on the site exploration program is provided with our exploration logs for the test pits in Appendix B of this report.

3.2. LABORATORY TESTING

Laboratory tests were performed on selected soil samples in accordance with ASTM standards to determine index and engineering properties of the site soils. Laboratory testing included grain-size distribution and plasticity index. Laboratory test results are presented on the test reports included in Appendix D.

4.0 DESIGN RECOMMENDATIONS

4.1. FOUNDATION RECOMMENDATIONS

Two requirements must be fulfilled in the design of foundations. First, the load must be less than the ultimate bearing capacity of the foundation soils to maintain stability. Secondly, the differential settlement must not exceed an amount that will produce adverse behavior of the structure. The allowable settlement is usually exceeded before bearing capacity considerations become important; thus, the allowable bearing pressure is normally controlled by settlement considerations.

MTC recommends that shallow spread-footing foundation systems, mat foundation system, or slab-on grade foundation system proportioned according to the allowable soil bearing capacity provided below and as required for concrete strength be utilized for the proposed development. Final building materials have yet to be determined, but concrete foundations are assumed. Shallow spread-footing and mat foundations should bear at a minimum of 18 inches below the lowest adjacent finished grade. All footing or foundations shall be placed on a minimum of 24 inches of compacted structural fill placed over geotextile fabric due to soft existing soil conditions. For footings placed on a minimum of 48 inches of structural fill, the requirement for use of geotextile fabric may be waived.

- Allowable Soil Bearing Capacity: For footings placed on a minimum of 24 inches of compacted structural fill placed over geotextile fabric (or 48 inches of structural fill without geotextile fabric), compacted on undisturbed soils as recommended in Section 5.2 of this report, we recommend assuming an allowable bearing capacity 1,500 psf. The allowable bearing capacities may be increased by 1/3 for transient loading due to wind and seismic events.

- Minimum Footing Depth: For frost protection, all footings shall be embedded a minimum of 18 inches below the lowest adjacent finished grade. However, all footings must penetrate to the prescribed bearing stratum and no footing shall be founded in or above organic or loose soils.

- Minimum Footing Width: Footings should be proportioned to meet the stated bearing capacity and shall not be less than required by the International Building Code. Interior or isolated column footings should be a minimum of 24 inches wide. Continuous strip footings shall be a minimum of 16 inches wide.

- Estimated Settlements: Anticipated settlement of foundations founded as above and designed with the specified allowable bearing capacity should be on the order of 1 inch or less with a differential settlement of ½ inch measured over a span of 50 feet or between independent spans of less distance. Settlement will most likely occur at the time the load is applied.

- Lateral Load Resistance: Resistance to lateral loads may be calculated by multiplying the buried portion of foundation elements by an equivalent fluid pressure of 100 pounds per cubic foot (pcf). Unless the adjacent ground surface is protected by slabs or pavement, neglect the upper one foot.

- Sliding resistance between a compacted structural fill subgrade and foundations should be evaluated using an allowable coefficient of friction of 0.30. This value assumes concrete cast on compacted structural fill and includes a factor of safety of 1.5.

- The subgrade modulus (k) for site soils will be in the range of 50 to 100 pci (NAVFAC).[4]

4.2. IMPERVIOUS PAVEMENT DESIGN RECOMMENDATIONS

The pavement subgrade should be proof-rolled to confirm that the subgrade does not contain soft or deflecting areas. Areas of excessive yielding should be excavated and backfilled with properly compacted structural fill as described in Section 5.2. The subgrade shall be proved by a representative of the geotechnical engineer.

Based on a properly prepared subgrade and subbase with a minimum cumulative California Bearing Ratio (CBR) of 15 (resilient modulus = 14,450 psi per AASHTO, MTC recommends a minimum pavement structural section of 2.5 inches of hot mix asphalt (HMA) over 4 inches of crushed surfacing base course (CSBC) over 2 feet of structural fill on a geotextile fabric for all site parking, drives, or entries that utilize hot mixed asphalt.

The structural fill shall conform to the material, placement, and compaction requirements of structural fill detailed in Section 5 of this report. Prior to placement of structural fill, Geotextile fabric for stabilization of weak subgrades (e.g. Mirafi 600X Woven) shall be placed in all areas.

[4] *Soil Mechanics Design Manual 7.01*; Naval Facilities Engineering Command; 1986

5.0 CONSTRUCTION RECOMMENDATIONS

5.1. EARTHWORK

5.1.1. Excavation

Excavation of the onsite soils can generally be performed with conventional earthmoving equipment such as bulldozers and excavators. Difficult excavations should not be completed in excessively wet soil or near the water table without proper dewatering. If encountered, excavations below the water table will be unstable and will result in an unstable subgrade which may not provide proper support to utilities, structural fill, or foundations.

Where possible, excavations should be made within about one foot of finished subgrade level. We recommend using smooth edged buckets to minimize subgrade disturbance.

5.1.2. Clearing and Grubbing

Preparation of the prospective project site will need to consist of removing the existing grass, root zone, and soil surficial soils. Typical stripping depths will likely be on the order of 12 inches. During the proposed site grading, any vegetation and other debris within the proposed development locations shall be removed and properly disposed. The final exposed subgrade should be inspected by a representative of the geotechnical engineer to verify that all deleterious material has been removed. Any soft or deflecting areas should be removed to firm unyielding soils and replaced with structural fill.

5.1.3. Subgrade Evaluation and Preparation

After excavations have been completed to the planned subgrade elevation and before placing fill or structural elements, the exposed subgrade soils should be evaluated by a representative of the geotechnical engineer. Where appropriate, subgrade should be proof-rolled with a minimum of two passes of fully loaded dump truck or water truck. In circumstances where this seems unfeasible, the representative of the geotechnical engineer may use alternative methods for subgrade evaluation, as appropriate.

Any loose soil should be compacted to a firm and unyielding condition and at least 95 percent of the modified Proctor maximum dry density per ASTM D1557. Any areas that are identified as being soft or yielding during subgrade evaluation should be over-excavated to a firm and unyielding condition or to the depth determined by the geotechnical engineer. Where over-excavation is performed below building footings, the over-excavation area should extend beyond the outside of the footing a distance equal to the depth of the over-excavation below the footing. The over-excavated areas should be backfilled with

properly compacted structural fill.

5.1.4. Wet Weather Construction

The existing onsite soil is moisture sensitive and will become soft and difficult to compact or traverse with construction equipment when wet. During wet weather, the contractor should take measures to protect the exposed subgrades and limit construction traffic. These measures could include, but are not limited to: placing a layer of crushed rock or lean concrete on the exposed subgrade, covering the exposed subgrade with a plastic tarp, and keeping construction traffic off the subgrade.

During wet weather, earthen berms or other methods should be used to prevent runoff from draining into excavations. All runoff should be collected and disposed of properly. Measures may also be required to remediate onsite soils in the event of wet weather. These measures can include:

- Selective drying by scarifying or windrowing surficial material during periods of dry or warm weather followed by recompaction.
- Removal of affected soils to expose a suitable bearing subgrade and replacement with suitable compacted structural fill.
- Mechanical stabilization with a crushed coarse aggregate compacted into the subgrade, possibly in conjunction with a geotextile.
- Soil-cement admixture stabilization.

The onsite soils will be difficult to work with during periods of wet weather. Since saturated and frozen soils are not suitable for use as structural fill, we recommend that earthwork activities generally take place in late spring, summer, or early fall.

5.2. STRUCTURAL FILL MATERIALS AND COMPACTION

5.2.1. Materials

All material placed below structures or pavement areas should be considered structural fill. Structural fill material should be free of deleterious material, have a maximum particle size of 6 inches, and be compactable to the required compaction level. There are no existing site soils that may be used as structural fill, all structural fill shall be imported to the site.

Imported structural fill material placed below structural elements and pavement areas shall conform to the most recent edition (at the time of construction) of WSDOT Section 9-03 in *Standard Specifications for Road, Bridge, and Municipal Construction (WSDOT Standard Specifications)*.[5] Frozen soil is not suitable for use as structural fill. Due to vapor emissions, do not use material specified as Recycled HMA under WSDOT 9-03.21(1) for building pads.

The contractor should submit samples of each of the required earthwork materials to the geotechnical engineer for evaluation and approval prior to use. The samples should be submitted at least 5 days prior to their use and sufficiently in advance of the work to allow the contractor to identify alternative sources if the material proves unsatisfactory.

5.2.2. Placement and Compaction

Prior to placement and compaction, structural fill should be moisture conditioned to within 3 percent of its optimum moisture content. Loose lifts of structural fill should not exceed 12 inches in thickness; thinner lifts (loose lifts less than 8 inches) will be required for walk-behind or hand operated compaction equipment.

All structural fill should be compacted to a dense and unyielding condition and to a minimum percent compaction of 95 percent based on its modified Proctor maximum dry density as determined per ASTM D1557. General compaction requirements are specified on the following page.

[5] *Standard Specifications for Road, Bridge, and Municipal Construction (WSDOT Standard Specifications)*; Washington State Department of Transportation; 2010

Structural fill shall be compacted to the indicated percent compaction:

Foundation and Slab Subgrades:	95 Percent
Impervious Pavement Subgrades (upper 2 feet):	95 Percent
Impervious Pavement Subgrades (below 2 feet):	90 Percent
Utility Trenches (upper 4 feet):	95 Percent
Utility Trenches (below 4 feet):	90 Percent
Landscaping:	85 Percent

We recommend the structural fill placement and compaction be observed by an MTC representative. A sufficient number of tests should be performed to verify compaction of each lift. The number of tests required will vary depending on the fill material, its moisture condition, and the equipment being used. Initially more frequent tests will be required while the contractor establishes the means and methods required to achieve proper compaction.

5.3. TEMPORARY EXCAVATIONS AND SLOPES

All excavations and slopes must comply with applicable local, state, and federal safety regulations. Construction site safety is the sole responsibility of the contractor, who shall also be solely responsible for the means, methods, and sequencing of construction operations. We are providing soil type information solely as a service to our client for planning purposes. Under no circumstances should the information be interpreted to mean that MTC is assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

Temporary excavations in existing native soils should be inclined no steeper than 1H:1V. Construction equipment, building materials, excavated soil, and vehicular traffic should not be allowed near the top of excavations. If stability of buildings, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning may be required to provide structural stability and protect personnel working within the excavation. Earth retention, bracing, or underpinning required for the project should be designed by a professional engineer registered in the State of Washington.

Temporary excavations and slopes should be protected from the elements by covering with plastic sheeting or other similar impermeable material. Sheeting sections should overlap 12 inches or more and be tightly secured with sandbags, staking, or other means to prevent exposure of soils under the sheeting.

5.4. UTILITY TRENCHES AND EXCAVATIONS

The contractor should be responsible for the safety of personnel working in utility trenches. We recommend all utility trenches, but particularly those greater than 4 feet in depth, be supported in accordance with state and federal safety regulations.

Pipe bedding material should conform to the manufacturer's recommendations and be worked around the pipe to provide uniform support. Cobbles exposed in the bottom of utility excavations should be covered with pipe bedding or removed to avoid inducing concentrated stresses on the pipe.

Trench backfill should be placed and compacted as structural fill as recommended in Section 5.2. Particular care should be taken to insure bedding or fill material is properly compacted to provide adequate support to the pipe. Jetting or flooding is not a substitute for mechanical compaction and should not be allowed.

6.0 LIMITATIONS

Recommendations contained in this report are based on our understanding of the proposed development and construction activities, our field observations and exploration, and our laboratory test results. It is possible that soil and groundwater conditions could vary and differ between or beyond the points explored. If soil or groundwater conditions are encountered during construction that vary or differ from those described herein, we should be notified immediately in order that a review may be made and supplemental recommendations provided. If the project scope or expected bearing loads of the proposed construction changes from that described in this report, our recommendations should also be reviewed.

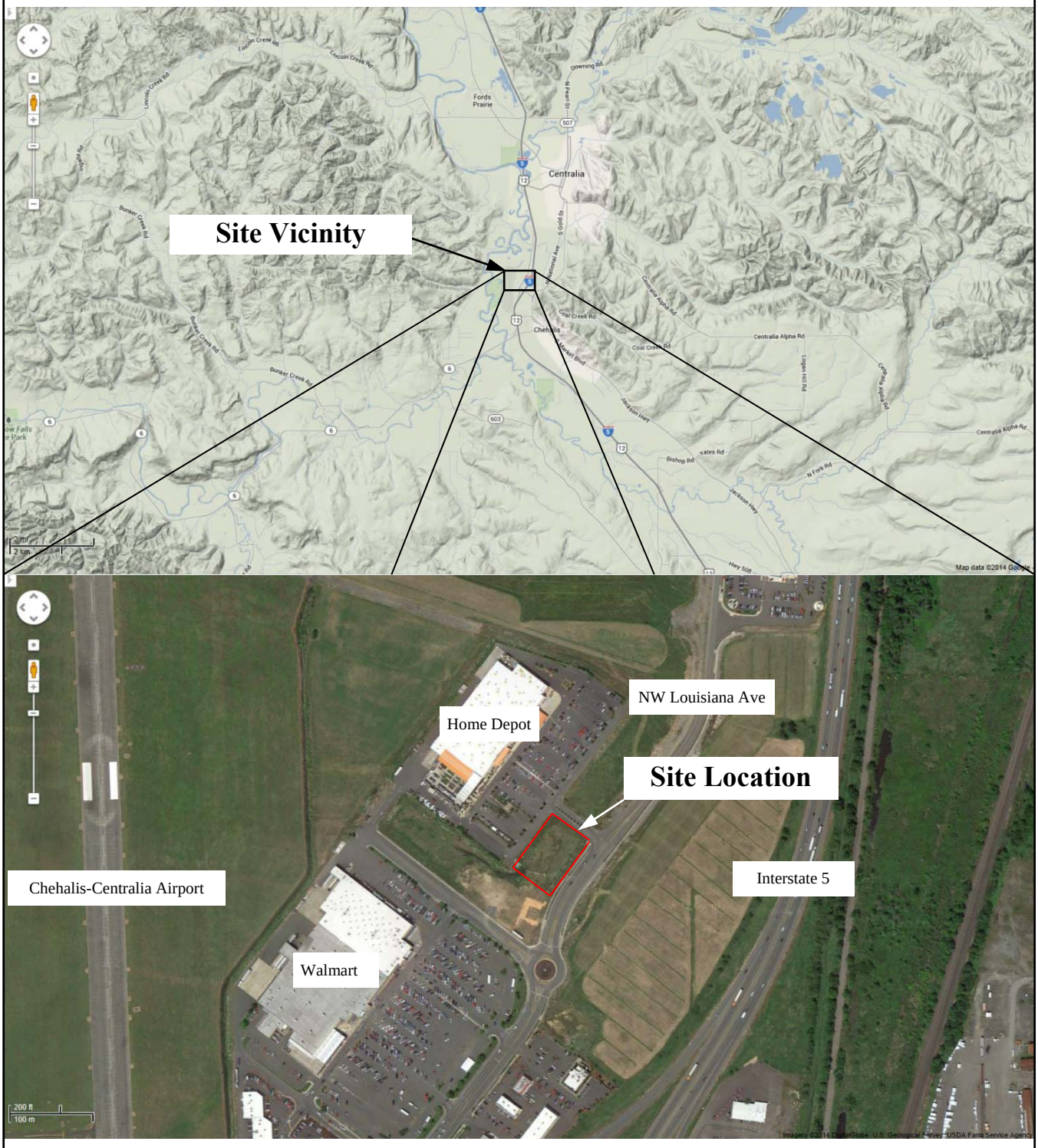
We have prepared this report in substantial accordance with the generally accepted geotechnical engineering practice as it exists in the site area at the time of our study. No warranty, expressed or implied, is made. The recommendations provided in this report are based on the assumption that an adequate program of tests and observations will be conducted by MTC during the construction phase in order to evaluate compliance with our recommendations. Other standards or documents referenced in any given standard cited in this report, or otherwise relied upon by the author of this report, are only mentioned in the given standard; they are not incorporated into it or "included by reference", as that latter term is used relative to contracts or other matters of law.

This report may be used only by Discover! Children's Museum and their design team and only for the purposes stated within a reasonable time from its issuance, but in no event later than 18 months from the date of the report.

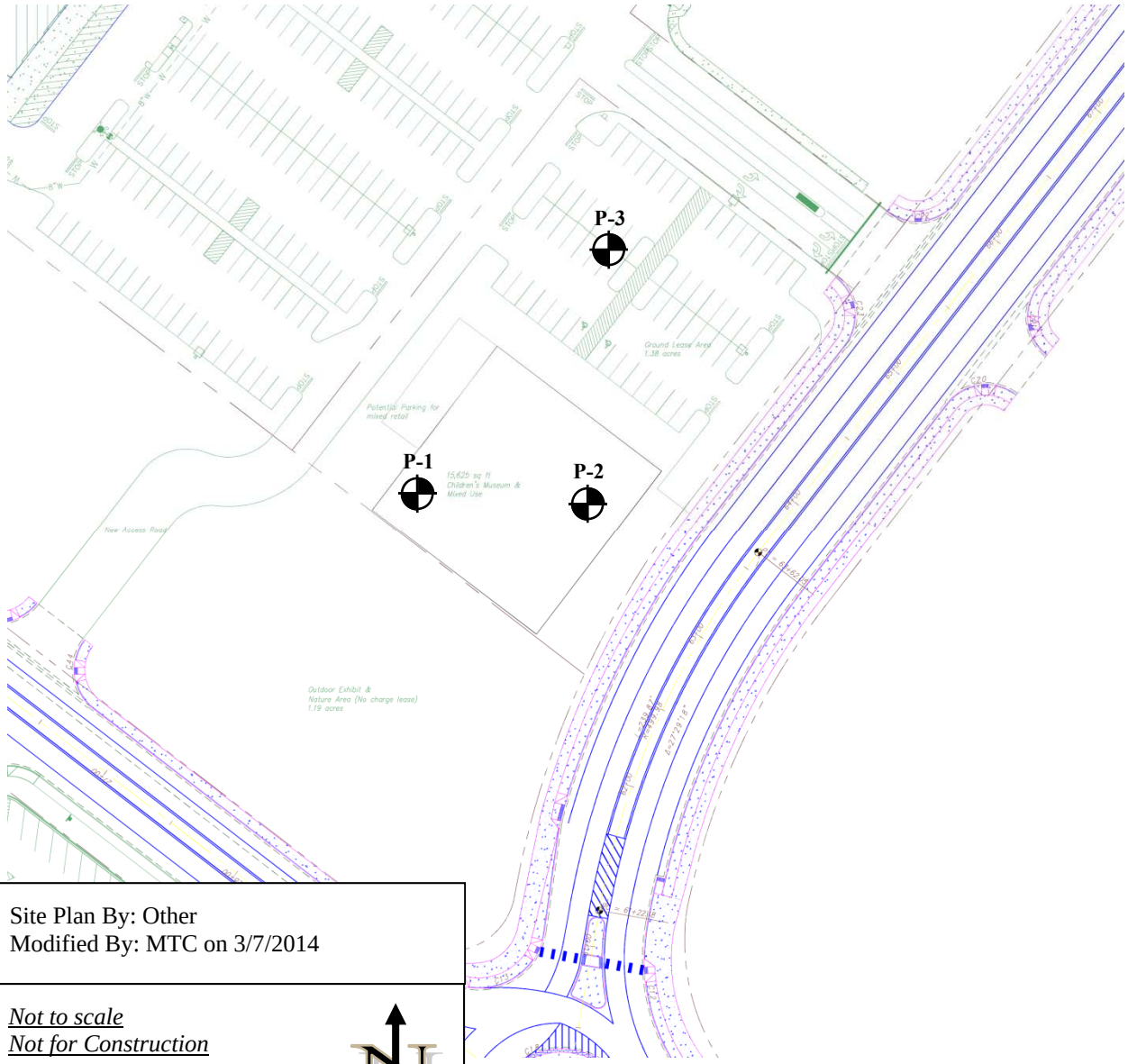
Land or facility use, on- and off-site conditions, regulations, or other factors may change over time and additional work may be required with the passage of time. Based on the intended use of the report, MTC may recommend that an additional inspection be performed and that an updated report be issued. Non-compliance with any of these requirements by Discover! Children's Museum or anyone else will release MTC from any liability resulting from the use of this report by any unauthorized party and Discover! Children's Museum agrees to defend, indemnify, and hold harmless MTC from any claim or liability associated with such unauthorized use or non-compliance. We recommend that MTC be given the opportunity to review the final project plans and specifications to evaluate if our recommendations have been properly interpreted. We assume no responsibility for misinterpretation of our recommendations.

The scope of work for this subsurface exploration and geotechnical report did not include environmental assessments or evaluations regarding the presence or absence of wetlands or hazardous substances in the soil, surface water, or groundwater at this site.

APPENDIX A. SITE PLANS



Materials Testing & Consulting, Inc. **2118 Black Lake Boulevard SW** **Olympia, WA 98512**	**Regional and Local Site Vicinity** **Discover! Children's Museum** **Chehalis, WA**	**FIGURE** **1**



Site Plan By: Other
Modified By: MTC on 3/7/2014

Not to scale
Not for Construction

N

Approx. Penetration and
Exploration (P) Location

Materials Testing & Consulting, Inc. **2118 Black Lake Boulevard SW** **Olympia, WA 98512**	**Exploration Location Map** **Discover! Children's Museum** **Chehalis, WA**	**FIGURE** **2**

APPENDIX B. EXPLORATION LOGS

Representative soil samples were collected from below the existing ground surface. During the field exploration, the soils were classified in accordance with ASTM D2487. Samples were placed in plastic bags to limit moisture loss, labeled, and returned to our laboratory for further examination and testing.

The planned excavation could not be completed due to poor site conditions. We have developed the following inferred exploration logs based on the results of our DCP testing, field observations (including adjacent undeveloped property), previous experience in the area, and our understanding of local geology. Our professional engineer examined and classified the materials encountered, obtained representative soil samples, and recorded pertinent information including soil sample depths, stratigraphy, soil engineering characteristics, and groundwater occurrence.

The stratification lines shown on the individual logs represent the approximate boundaries between soil types; actual transitions may be either more gradual or more severe. The conditions depicted are for the date and location indicated only, and it should not necessarily be expected that they are representative of conditions at other locations and times.

Unified Soil Classification System Chart

Major Divisions			Graph	USCS	Typical Description
Coarse Grained Soils More Than 50% Retained On No. 200 Sieve	**Gravel** More Than 50% of Coarse Fraction Retained On No. 4 Sieve	Clean Gravels		GW	Well-graded Gravels, Gravel-Sand Mixtures
				GP	Poorly-Graded Gravels, Gravel-Sand Mixtures
		Gravels With Fines		GM	Silty Gravels, Gravel-Sand-Silt Mixtures
				GC	Clayey Gravels, Gravel-Sand-Clay Mixtures
	Sand More Than 50% of Coarse Fraction Passing No. 4 Sieve	Clean Sands		SW	Well-graded Sands, Gravelly Sands
				SP	Poorly-Graded Sands, Gravelly Sands
		Sands With Fines		SM	Silty Sands, Sand-Silt Mixtures
				SC	Clayey Sands, Clay Mixtures
Fine Grained Soils More Than 50% Passing The No. 200 Sieve	**Silts & Clays**	Liquid Limit Less Than 50		ML	Inorganic Silts, rock Flour, Clayey Silts With Low Plasticity
				CL	Inorganic Clays of Low To Medium Plasticity
				OL	Organic Silts and Organic Silty Clays of Low Plasticity
	Silts & Clays	Liquid Limit Greater Than 50		MH	Inorganic Silts of Moderate Plasticity
				CH	Inorganic Clays of High Plasticity
				OH	Organic Clays And Silts of Medium to High Plasticity
Highly Organic Soils				PT	Peat, Humus, Soils with Predominantly Organic Content

Sampler Symbol Description

- Standard Penetration Test (SPT)
- Shelby Tube
- Grab or Bulk
- California (3.0" O.D.)
- Modified California (2.5" O.D.)

Stratigraphic Contact

- Distinct Stratigraphic Contact Between Soil Strata
- Gradual Change Between Soil Strata
- Approximate location of stratagraphic change

- Groundwater observed at time of exploration
- Measured groundwater level in exploration, well, or piezometer
- Perched water observed at time of exploration

Modifiers

Description	%
Trace	>5
Some	5-12
With	>12

Soil Consistency

Granular Soils		Fine-grained Soils	
Density	***SPT Blowcount***	***Consistency***	***SPT Blowcount***
Very Loose	0-4	Very Soft	0-2
Loose	4-10	Soft	2-4
Medium Dense	10-30	Firm	4-8
Dense	30-50	Stiff	8-15
Very Dense	> 50	Very Stiff	15-30
		Hard	> 30

Grain Size

DESCRIPTION		SIEVE SIZE	GRAIN SIZE	APPROXIMATE SIZE
Boulders		> 12"	> 12"	Larger than a basketball
Cobbles		3 - 12"	3 - 12"	Fist to basketball
Gravel	Coarse	3/4 - 3"	3/4 - 3"	Thumb to fist
	Fine	#4 - 3/4"	0.19 - 0.75"	Pea to thumb
Sand	Coarse	#10 - #4	0.079 - 0.19"	Rock salt to pea
	Medium	#40 - #10	0.017 - 0.079"	Sugar to rock salt
	Fine	#200 - #40	0.0029 - 0.017"	Flour to Sugar
Fines		Passing #200	< 0.0029"	Flour and smaller

Materials Testing & Consulting, Inc. **2118 Black Lake Boulevard SW** **Olympia, WA 98512**	**Key** **Discover! Children's Museum** **Chehalis, WA**	**FIGURE** **3**

Materials Testing & Consulting, Inc.
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Olympia, Washington

Exploration 1 (P-1)

(Page 1 of 1)

Discover! Children's Museum
Geotechnical Investigation
Chehalis, WA

MTC Project #14S032

Date Started	: March 5, 2014
Date Completed	: March 5, 2014
Sampling Method	: Grab Sample (surface)
Location	: Reference Site Plan
Logged By	: L. Levine

Depth in Feet	Surf. Elev. 178	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	Water Level
0	178	SM-ML		Undocumented Fill; Light Brown to Orange-Brown Sandy SILT to Silty fine SAND with occasional Gravel, very loose/very soft to loose/soft, wet.	1		
1	177						
2	176						
3	175						
4	174						
5	173						
6	172						
7	171						
8	170						
9	169	ML		Light Brown to Orange-Brown Sandy SILT to Silty fine SAND, loose/medium stiff, wet.			
10	168						
11	167						
12	166						
13	165						
14	164						
15	163						
16	162						
17	161			Total depth = 16.5 feet This log is inferred from DCP results and visual observations, test pits not conducted due to un-traversable site conditions (backhoe got stuck in saturated surface soils and had to be winched off site). Groundwater not encountered.			
18	160						
19	159						
20							

Materials Testing & Consulting, Inc. **2118 Black Lake Boulevard SW** **Olympia, WA 98512**	**Exploration Log** **Discover! Children's Museum** **Chehalis, WA**	**FIGURE** **4**

Materials Testing & Consulting, Inc.
Geotechnical Engineering and Consulting
Olympia, Washington

Exploration 2 (P-2)

(Page 1 of 1)

Discover! Children's Museum
Geotechnical Investigation
Chehalis, WA

MTC Project #14S032

Date Started	: March 5, 2014
Date Completed	: March 5, 2014
Sampling Method	: Grab Sample (surface)
Location	: Reference Site Plan
Logged By	: L. Levine

Depth in Feet	Surf. Elev. 178	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	Water Level
0	178	SM-ML		Undocumented Fill; Light Brown to Orange-Brown Sandy SILT to Silty fine SAND with occasional Gravel, very loose/very soft to loose/soft, wet.			
1	177						
2	176						
3	175						
4	174						
5	173						
6	172						
7	171						
8	170			Subsurface soil gets siginificantly more dense at approximately 8 feet below the surface. The sharp increase is not indicative of native soils in the area and likely represents a gravel layer (ballast) used for site stabalization prior to import of undocumented fill.			
9	169			Total depth = 9.0 feet This log is inferred from DCP results and visual observations, test pits not conducted due to un-traversable site conditions (backhoe got stuck in saturated surface soils and had to be winched off site). Groundwater not encountered.			
10	168						
11	167						
12	166						
13	165						
14	164						
15	163						
16	162						
17	161						
18	160						
19	159						
20							

Materials Testing & Consulting, Inc. **2118 Black Lake Boulevard SW** **Olympia, WA 98512**	**Exploration Log** **Discover! Children's Museum** **Chehalis, WA**	**FIGURE** **5**

Materials Testing & Consulting, Inc.
Geotechnical Engineering and Consulting
Olympia, Washington

Exploration 3 (P-3)

(Page 1 of 1)

Discover! Children's Museum
Geotechnical Investigation
Chehalis, WA

MTC Project #14S032

Date Started	: March 5, 2014
Date Completed	: March 5, 2014
Sampling Method	: Grab Sample (surface)
Location	: Reference Site Plan
Logged By	: L. Levine

Depth in Feet	Surf. Elev. 178	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	Water Level
0	178	SM-ML		Undocumented Fill; Light Brown to Orange-Brown Sandy SILT to Silty fine SAND with occasional Gravel, very loose/very soft to loose/soft, wet.	1		▼
1	177						
2	176						
3	175						
4	174						
5	173						
6	172						
7	171			Subsurface soil gets siginificantly more dense at approximately 8 feet below the surface. The sharp increase is not indicative of native soils in the area and likely represents a gravel layer (ballast) used for site stabalization prior to import of undocumented fill.			
8	170			Total depth = 8.0 feet			
9	169			This log is inferred from DCP results and visual observations, test pits not conducted due to un-traversable site conditions (backhoe got stuck in saturated surface soils and had to be winched off site).			
10	168			Perched groundwater encountered at 2.0 feet below the surface..			
11	167						
12	166						
13	165						
14	164						
15	163						
16	162						
17	161						
18	160						
19	159						
20							

Materials Testing & Consulting, Inc. **2118 Black Lake Boulevard SW** **Olympia, WA 98512**	**Exploration Log** **Discover! Children's Museum** **Chehalis, WA**	**FIGURE** **6**

APPENDIX C. PENETRATION LOGS

The following penetration log details the soil resistance encountered during our exploration. The Wildcat Dynamic Cone Penetrometer (DCP) was utilized to determine the current bearing capacity of the soils. Blow counts were recorded for 10 centimeter increments as a 35-pound weight was dropped a distance of 15 inches. The DCP testing continued until groundwater was encountered and blow counts leveled off. Using a Triggs proprietary spreadsheet, the blow counts were then converted to resistance in kilograms per square centimeter (kg/cm^2), standard penetration blow counts (N'), and consistency descriptions. .

WILDCAT DYNAMIC CONE LOG

Materials Testing and Consulting
2118 Black Lake Blvd SW
Olympia, WA 98512

PROJECT NUMBER: 14S032
DATE STARTED: 03-05-2014
DATE COMPLETED: 03-05-2014

HOLE #: P-1
CREW: LL/CL/BH
PROJECT: Discover! Children's Museum
ADDRESS: Louisiana Avenue
LOCATION: Reference Site Plan for Location

SURFACE ELEVATION: 178
WATER ON COMPLETION: No
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY SAND & SILT	CLAY
-	1	4.4	•	1	VERY LOOSE	VERY SOFT
-	1	4.4	•	1	VERY LOOSE	VERY SOFT
- 1 ft	1	4.4	•	1	VERY LOOSE	VERY SOFT
-	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
-	8	35.5	••••••••••	10	LOOSE	STIFF
- 2 ft	10	44.4	••••••••••••	12	MEDIUM DENSE	STIFF
-	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
-	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
- 3 ft	2	8.9	••	2	VERY LOOSE	SOFT
- 1 m	3	13.3	•••	3	VERY LOOSE	SOFT
-	3	11.6	•••	3	VERY LOOSE	SOFT
- 4 ft	3	11.6	•••	3	VERY LOOSE	SOFT
-	4	15.4	••••	4	VERY LOOSE	SOFT
-	4	15.4	••••	4	VERY LOOSE	SOFT
- 5 ft	4	15.4	••••	4	VERY LOOSE	SOFT
-	8	30.9	••••••••	8	LOOSE	MEDIUM STIFF
-	5	19.3	•••••	5	LOOSE	MEDIUM STIFF
- 6 ft	4	15.4	••••	4	VERY LOOSE	SOFT
-	5	19.3	•••••	5	LOOSE	MEDIUM STIFF
- 2 m	4	15.4	••••	4	VERY LOOSE	SOFT
- 7 ft	4	13.7	•••	3	VERY LOOSE	SOFT
-	4	13.7	•••	3	VERY LOOSE	SOFT
-	4	13.7	•••	3	VERY LOOSE	SOFT
- 8 ft	4	13.7	•••	3	VERY LOOSE	SOFT
-	4	13.7	•••	3	VERY LOOSE	SOFT
-	6	20.5	•••••	5	LOOSE	MEDIUM STIFF
- 9 ft	7	23.9	••••••	6	LOOSE	MEDIUM STIFF
-	7	23.9	••••••	6	LOOSE	MEDIUM STIFF
-	6	20.5	•••••	5	LOOSE	MEDIUM STIFF
- 3 m 10 ft	8	27.4	•••••••	7	LOOSE	MEDIUM STIFF
-	8	24.5	•••••••	6	LOOSE	MEDIUM STIFF
-	8	24.5	•••••••	6	LOOSE	MEDIUM STIFF
-	8	24.5	•••••••	6	LOOSE	MEDIUM STIFF
- 11 ft	8	24.5	•••••••	6	LOOSE	MEDIUM STIFF
-	10	30.6	••••••••	8	LOOSE	MEDIUM STIFF
-	9	27.5	•••••••	7	LOOSE	MEDIUM STIFF
- 12 ft	8	24.5	•••••••	6	LOOSE	MEDIUM STIFF
-	8	24.5	•••••••	6	LOOSE	MEDIUM STIFF
-	10	30.6	••••••••	8	LOOSE	MEDIUM STIFF
- 4 m 13 ft	11	33.7	•••••••••	9	LOOSE	STIFF

WILDCAT.XLS

Materials Testing & Consulting, Inc. **2118 Black Lake Boulevard SW** **Olympia, WA 98512**	**Penetration Log** **Discover! Children's Museum** **Chehalis, WA**	**FIGURE** **7**

HOLE #: P-1

WILDCAT DYNAMIC CONE LOG

PROJECT: Discover! Children's Museum

PROJECT NUMBER: 14S032

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY SAND & SILT	TESTED CONSISTENCY CLAY
-	13	36.0	••••••••••	10	LOOSE	STIFF
-	12	33.2	•••••••••	9	LOOSE	STIFF
- 14 ft	12	33.2	•••••••••	9	LOOSE	STIFF
-	11	30.5	••••••••	8	LOOSE	MEDIUM STIFF
-	11	30.5	••••••••	8	LOOSE	MEDIUM STIFF
- 15 ft	10	27.7	••••••••	7	LOOSE	MEDIUM STIFF
-	10	27.7	••••••••	7	LOOSE	MEDIUM STIFF
-	8	22.2	••••••	6	LOOSE	MEDIUM STIFF
- 16 ft	9	24.9	•••••••	7	LOOSE	MEDIUM STIFF
- 5 m	9	24.9	•••••••	7	LOOSE	MEDIUM STIFF
-						
- 17 ft						
-						
-						
- 18 ft						
-						
-						
- 19 ft						
-						
- 6 m						
- 20 ft						
-						
-						
- 21 ft						
-						
-						
- 22 ft						
-						
-						
- 7 m 23 ft						
-						
-						
- 24 ft						
-						
-						
- 25 ft						
-						
-						
- 26 ft						
- 8 m						
-						
- 27 ft						
-						
-						
- 28 ft						
-						
-						
- 29 ft						
-						
- 9 m						

WILDCAT.XLS

Materials Testing & Consulting, Inc. **2118 Black Lake Boulevard SW** **Olympia, WA 98512**	**Penetration Log** **Discover! Children's Museum** **Chehalis, WA**	**FIGURE** **8**

WILDCAT DYNAMIC CONE LOG

Materials Testing and Consulting
2118 Black Lake Blvd SW
Olympia, WA 98512

PROJECT NUMBER: 14S032
DATE STARTED: 03-05-2014
DATE COMPLETED: 03-05-2014

HOLE #: P-2
CREW: LL/CL/BH
PROJECT: Discover! Children's Museum
ADDRESS: Louisiana Avenue
LOCATION: Reference Site Plan for Location

SURFACE ELEVATION: 178
WATER ON COMPLETION: No
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY SAND & SILT	CLAY
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	1	4.4	•	1	VERY LOOSE	VERY SOFT
- 1 ft	1	2.2		0	VERY LOOSE	VERY SOFT
-	1	2.2		0	VERY LOOSE	VERY SOFT
-	1	2.2		0	VERY LOOSE	VERY SOFT
- 2 ft	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
-	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
-	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
- 3 ft	3	13.3	•••	3	VERY LOOSE	SOFT
- 1 m	3	13.3	•••	3	VERY LOOSE	SOFT
-	3	11.6	•••	3	VERY LOOSE	SOFT
- 4 ft	3	11.6	•••	3	VERY LOOSE	SOFT
-	5	19.3	•••••	5	LOOSE	MEDIUM STIFF
-	5	19.3	•••••	5	LOOSE	MEDIUM STIFF
- 5 ft	7	27.0	•••••••	7	LOOSE	MEDIUM STIFF
-	8	30.9	••••••••	8	LOOSE	MEDIUM STIFF
-	6	23.2	••••••	6	LOOSE	MEDIUM STIFF
- 6 ft	9	34.7	•••••••••	9	LOOSE	STIFF
-	7	27.0	•••••••	7	LOOSE	MEDIUM STIFF
- 2 m	6	23.2	••••••	6	LOOSE	MEDIUM STIFF
- 7 ft	4	13.7	•••	3	VERY LOOSE	SOFT
-	7	23.9	••••••	6	LOOSE	MEDIUM STIFF
-	8	27.4	•••••••	7	LOOSE	MEDIUM STIFF
- 8 ft	10	34.2	••••••••	9	LOOSE	STIFF
-	18	61.6	••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
-	22	75.2	••••••••••••••••••••	21	MEDIUM DENSE	VERY STIFF
- 9 ft	26	88.9	••••••••••••••••••••••••	25	MEDIUM DENSE	VERY STIFF
-						
-						
- 3 m 10 ft						
-						
-						
-						
- 11 ft						
-						
-						
- 12 ft						
-						
-						
- 4 m 13 ft						

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Materials Testing & Consulting, Inc. **2118 Black Lake Boulevard SW** **Olympia, WA 98512**	**Penetration Log** **Discover! Children's Museum** **Chehalis, WA**	**FIGURE** **9**

WILDCAT DYNAMIC CONE LOG

Materials Testing and Consulting
2118 Black Lake Blvd SW
Olympia, WA 98512

PROJECT NUMBER: 14S032
DATE STARTED: 03-05-2014
DATE COMPLETED: 03-05-2014

HOLE #: P-3
CREW: LL/CL
PROJECT: Discover! Children's Museum
ADDRESS: Louisiana Avenue
LOCATION: Reference Site Plan for Location

SURFACE ELEVATION: 178
WATER ON COMPLETION: Yes, Perched
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY SAND & SILT	CLAY
-	2	8.9	••	2	VERY LOOSE	SOFT
-	2	8.9	••	2	VERY LOOSE	SOFT
- 1 ft	1	4.4	•	1	VERY LOOSE	VERY SOFT
-	1	4.4	•	1	VERY LOOSE	VERY SOFT
-	3	13.3	•••	3	VERY LOOSE	SOFT
- 2 ft	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
-	3	13.3	•••	3	VERY LOOSE	SOFT
-	13	57.7	••••••••••••••••	16	MEDIUM DENSE	VERY STIFF
- 3 ft	9	40.0	••••••••••	11	MEDIUM DENSE	STIFF
- 1 m	9	40.0	••••••••••	11	MEDIUM DENSE	STIFF
-	3	11.6	•••	3	VERY LOOSE	SOFT
- 4 ft	4	15.4	••••	4	VERY LOOSE	SOFT
-	6	23.2	••••••	6	LOOSE	MEDIUM STIFF
-	6	23.2	••••••	6	LOOSE	MEDIUM STIFF
- 5 ft	5	19.3	•••••	5	LOOSE	MEDIUM STIFF
-	6	23.2	••••••	6	LOOSE	MEDIUM STIFF
-	12	46.3	••••••••••••	13	MEDIUM DENSE	STIFF
- 6 ft	11	42.5	•••••••••••	12	MEDIUM DENSE	STIFF
-	11	42.5	•••••••••••	12	MEDIUM DENSE	STIFF
- 2 m	10	38.6	••••••••••	11	MEDIUM DENSE	STIFF
- 7 ft	13	44.5	•••••••••••	12	MEDIUM DENSE	STIFF
-	14	47.9	••••••••••••	13	MEDIUM DENSE	STIFF
-	11	37.6	•••••••••	10	LOOSE	STIFF
- 8 ft	40	136.8	••••••••••••••••••••••••••••••••••••	-	DENSE	HARD
-						
-						
- 9 ft						
-						
-						
- 3 m 10 ft						
-						
-						
-						
- 11 ft						
-						
-						
- 12 ft						
-						
-						
- 4 m 13 ft						

WILDCAT.XLS

Materials Testing & Consulting, Inc. **2118 Black Lake Boulevard SW** **Olympia, WA 98512**	**Penetration Log** **Discover! Children's Museum** **Chehalis, WA**	**FIGURE** **9**

APPENDIX D. LABORATORY RESULTS

Laboratory tests were conducted on representative soil samples to better identify the soil classification of the units encountered and to evaluate the material's general physical properties and engineering characteristics. A brief description of the tests performed for this study is provided below. The results of laboratory tests performed on specific samples are provided at the appropriate sample depths on the individual test pit logs. However, it is important to note that these test results may not accurately represent in situ soil conditions. MTC cannot be responsible for the interpretation of these data by others.

All collected samples that were not tested in the laboratory will be retained for a period of three months unless directed otherwise. Most of the soil samples for this project were unable to be retained because they were used to perform laboratory testing.

SOIL CLASSIFICATION

Soil samples were visually examined in the field by our representative at the time they were obtained. They were subsequently packaged and returned to our laboratory where they were reexamined and the original description checked and verified or modified. With the help of information obtained from the other classification tests, described below, the samples were described in general accordance with ASTM Standard D2487. The resulting descriptions are provided at the appropriate locations on the individual exploration logs, located in Appendix B, and are qualitative only.

MOISTURE CONTENT

Moisture content tests were performed in general accordance with ASTM Standard D2216 on representative soil samples to approximately ascertain the in-place moisture content of soil samples at the times they were collected. The information obtained assists us by providing qualitative information regarding soil compatibility. The results are presented at the appropriate sample depths on the exploration logs.

GRAIN-SIZE DISTRIBUTION

Grain-size distribution analyses were conducted in general accordance with ASTM Standard D422 and C136 on representative soil samples to determine the grain-size distribution of the onsite soil. The information gained from these analyses allows us to provide a description and classification of the in-place materials. In turn, this information helps us to understand how the in-place materials will react to conditions such as excavation, loading, potential liquefaction, infiltration, and so forth. The results are presented in this Appendix.

ATTERBERG LIMITS (Plasticity Index)

The plasticity index (PI) was determined in general accordance with ASTM Standard D4318. A shrinkage limit was not determined for the material tested. The plasticity index is a measure of the plasticity of a soil. The plasticity index is also the size of the range of water contents where the soil exhibits plastic properties or, in other words, defines the complete range of plastic state.

Sieve Report

Project: Discover Childrens Museum	**Date Received:** 5-Mar-14	**ASTM D-2487 Unified Soils Classification System**	
Project #: 14S032	**Sampled By:** LL	MH, Elastic Silt with Sand	
Client: Discover Children Museum	**Date Tested:** 11-Mar-14	**Sample Color:**	
Source: Center of Building @ 18'	**Tested By:** FP	Brown	
Sample#: S14-069			

ACCREDITED Certificate #: 1366.01, 1366.02

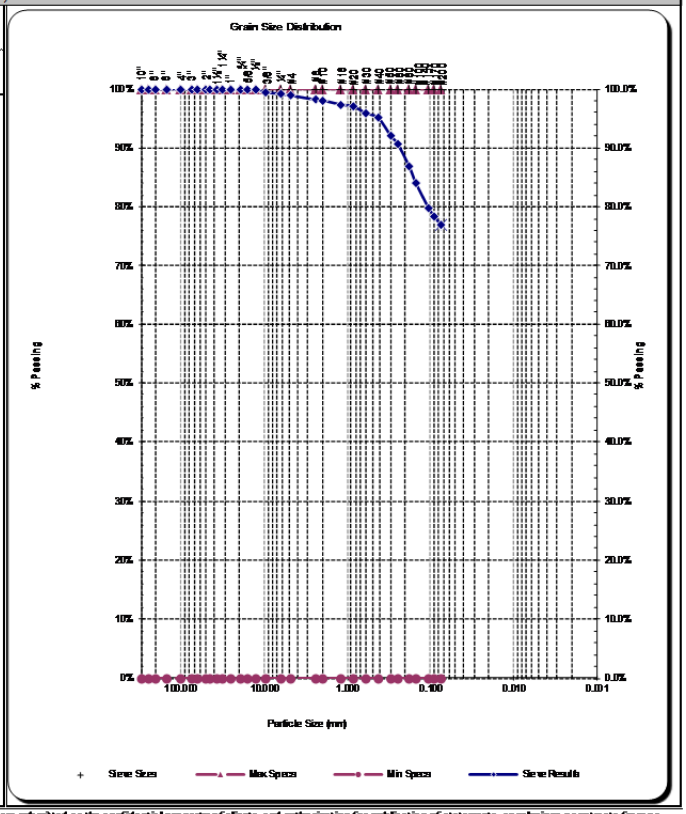
ASTM D-2216, ASTM D-2419, ASTM D-4318, ASTM D-5821

Specifications
No Specs
Sample Meets Specs ? Yes

$D_{(5)}$ = 0.005	mm	% Gravel = 1.1%		Coeff. of Curvature, C_C = 1.50	
$D_{(10)}$ = 0.010	mm	% Sand = 21.9%		Coeff. of Uniformity, C_U = 6.00	
$D_{(15)}$ = 0.015	mm	% Silt & Clay = 76.9%		Fineness Modulus = 0.34	
$D_{(30)}$ = 0.029	mm	Liquid Limit = 51.5%		Plastic Limit = 34.7%	
$D_{(50)}$ = 0.049	mm	Plasticity Index = 16.8%		Moisture %, as sampled = 34.1%	
$D_{(60)}$ = 0.058	mm	Sand Equivalent = n/a		Fracture % = n/a	
$D_{(90)}$ = 0.237	mm	Req'd Sand Equivalent =		Req'd Fracture % =	

ASTM C-136, ASTM D-6913

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
12.00"	300.00		100%	100.0%	0.0%
10.00"	250.00		100%	100.0%	0.0%
8.00"	200.00		100%	100.0%	0.0%
6.00"	150.00		100%	100.0%	0.0%
4.00"	100.00		100%	100.0%	0.0%
3.00"	75.00		100%	100.0%	0.0%
2.50"	63.00		100%	100.0%	0.0%
2.00"	50.00		100%	100.0%	0.0%
1.75"	45.00		100%	100.0%	0.0%
1.50"	37.50		100%	100.0%	0.0%
1.25"	31.50		100%	100.0%	0.0%
1.00"	25.00		100%	100.0%	0.0%
3/4"	19.00		100%	100.0%	0.0%
5/8"	16.00		100%	100.0%	0.0%
1/2"	12.50	100%	100%	100.0%	0.0%
3/8"	9.50	99%	99%	100.0%	0.0%
1/4"	6.30	99%	99%	100.0%	0.0%
#4	4.75	99%	99%	100.0%	0.0%
#8	2.36		98%	100.0%	0.0%
#10	2.00	98%	98%	100.0%	0.0%
#16	1.18		97%	100.0%	0.0%
#20	0.850	97%	97%	100.0%	0.0%
#30	0.600		96%	100.0%	0.0%
#40	0.425	95%	95%	100.0%	0.0%
#50	0.300		92%	100.0%	0.0%
#60	0.250	91%	91%	100.0%	0.0%
#80	0.180	87%	87%	100.0%	0.0%
#100	0.150	84%	84%	100.0%	0.0%
#140	0.106		80%	100.0%	0.0%
#170	0.090		78%	100.0%	0.0%
#200	0.075	76.9%	76.9%	100.0%	0.0%



Comments: _____

Reviewed by: _____

Materials Testing & Consulting, Inc. **2118 Black Lake Boulevard SW** **Olympia, WA 98512**	**Laboratory Test Results** **Discover! Children's Museum** **Chehalis, WA**	**FIGURE** **10**

ASTM D4318 - Liquid Limit, Plastic Limit and Plasticity Index of Soils

Project:	Discover Childrens Museum	**Date Received:**	5-Mar-14
Project #:	14S032	**Sampled By:**	LL
Client:	Discover Children Museum	**Date Tested:**	11-Mar-14
Source:	Center of Building @ 18"	**Tested By:**	FP
Sample #:	S14-069		

Unified Soils Classification System, ASTM D-2487
MH, Elastic Silt with Sand
Sample Color
Brown

Liquid Limit Determination

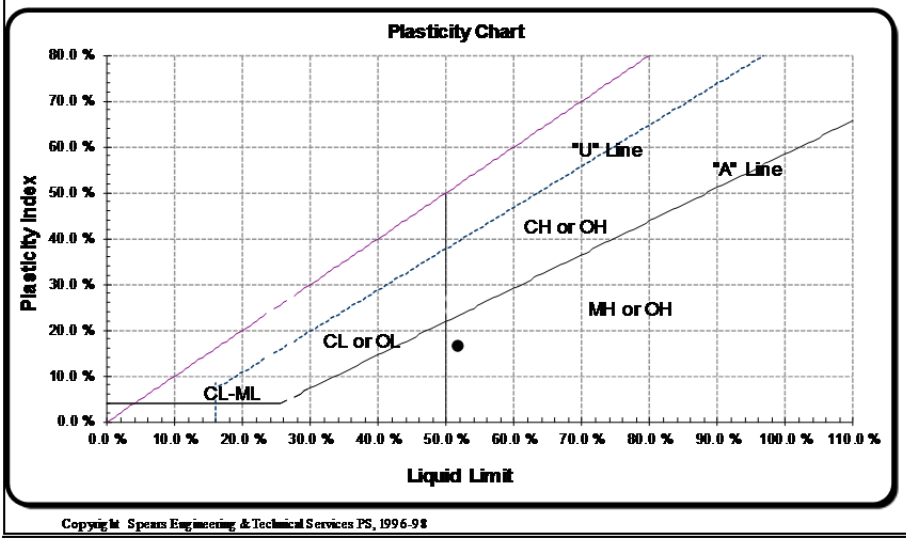
	#1	#2	#3	#4	#5	#6
Weight of Wet Soils + Pan:	23.69	27.13	25.97			
Weight of Dry Soils + Pan:	20.93	23.00	21.64			
Weight of Pan:	14.82	14.91	13.76			
Weight of Dry Soils:	6.11	8.09	7.88			
Weight of Moisture:	2.76	4.13	4.33			
% Moisture:	45.2 %	51.1 %	55.0 %			
Number of Blows:	32	27	20			

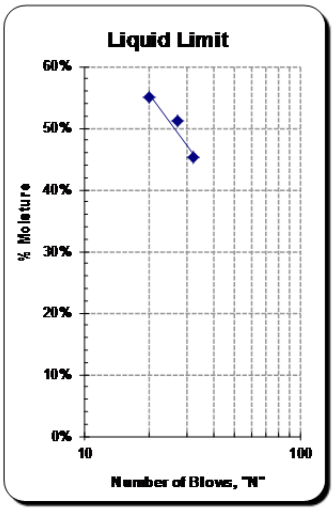
Liquid Limit @ 25 Blows: 51.5 %
Plastic Limit: 34.7 %
Plasticity Index, I_P: 16.8 %

Plastic Limit Determination

	#1	#2	#3	#4	#5	#6
Weight of Wet Soils + Pan:	30.40	32.29				
Weight of Dry Soils + Pan:	26.45	27.80				
Weight of Pan:	15.23	14.65				
Weight of Dry Soils:	11.22	13.15				
Weight of Moisture:	3.95	4.49				
% Moisture:	35.2 %	34.1 %				

ACCREDITED
Certificate #: 1366.01, 1366.02





Comments: _____

Reviewed by: _____

Materials Testing & Consulting, Inc. **2118 Black Lake Boulevard SW** **Olympia, WA 98512**	**Laboratory Test Results** **Discover! Children's Museum** **Chehalis, WA**	**FIGURE** **12**

11/12/2020

WSECU
Scott Liljedahl
330 Union Avenue SE
Olympia, WA 98501

Subject: **WSECU Chehalis – Updated Geotechnical Investigation**
Parcel # 005605082015, NW Louisiana Ave, Chehalis, WA
QG Project # QG20-063

Dear Mr. Liljedahl:

At your request, Quality Geo, PLLC (QG) has completed a geotechnical investigation of the above referenced project. The investigation was performed in accordance with our proposal for geotechnical services.

We would be pleased to continue our role as your geotechnical consultant of record during the project planning and construction phases, as local inspection firms have not been found to be as familiar or reliably experienced with geotechnical design. This may include soil subgrade inspections, periodic review of special inspection reports, or supplemental recommendations if changes occur during construction. We will happily meet with you at your convenience to discuss these and other additional *Time & Materials* services.

We thank you for the opportunity to be of service on this project and trust this report satisfies your project needs currently. QG wishes you the best while completing the project.

Respectfully Submitted,
Quality Geo, PLLC

Luke P.

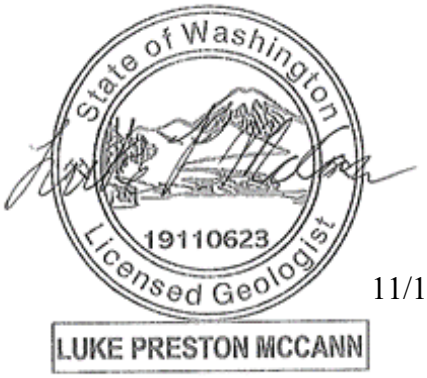
Luke Preston McCann, L.G.
Principal Licensed Geologist

UPDATED GEOTECHNICAL REPORT

WSECU CHEHALIS
PARCEL # 005605082015
NW LOUISIANA AVE, CHEHALIS, WA

WSECU
Scott Liljedahl
330 Union Avenue SE
Olympia, WA 98501

Prepared by:



11/12/2020

Luke Preston McCann, L.G.
Principal Licensed Geologist

Approved by:

11/12/2020

Nicholas Taylor, P.E.
Supervising Engineer Review

Quality Geo, PLLC
Geotechnical Investigations & Engineering Consultation
Phone: 360-764-8485 | Web: quality-geo.com
Mail: 420 Golf Club Rd SE, Ste 201, Lacey, WA 98503

11/12/2020

QG Project # QG20-063

TABLE OF CONTENTS

1.0 INTRODUCTION

This report presents the findings and recommendations of Quality Geo's (QG) geotechnical investigation and engineering conducted in support of new developments, facility design, and construction.

1.1 PROJECT DESCRIPTION

QG understands the project mainly entails the design and construction of a new bank branch office and associated surface improvements. Exterior improvements are anticipated to include infrastructure for auto access and parking, flatworks, and other necessary site amenities. QG has been contracted to perform a geotechnical investigation of the proposed site to provide foundation and site development recommendations. Exploration locations were chosen by QG as needed to avoid excessive site disturbance and existing utilities.

QG understands that the proposed structure is anticipated to employ conventional shallow foundation in support of tower construction. It is anticipated that loads will be typical for the type and materials of construction and that no unusually large, industrial, or vibratory loads are expected.

1.2 FIELD WORK

Site exploration activities were performed on 10/21/2020. Exploration locations were marked in the field by an QG Project Geologist with respect to the provided map and cleared for public conductible utilities. Our exploration locations were selected by an QG Project Geologist prior to field work to provide safest access to relevant soil conditions. The geologist directed the advancement of 2 excavated test pits (TP). The test pits were advanced within the vicinity of the anticipated development footprint areas, to depths up to 10.0 feet below present grade (BPG) in general accordance with the specified contract depth.

During explorations QG logged each soil horizon we encountered, and field classified them in accordance with the Unified Soil Classification System (USCS). Representative soil samples were collected from each unit, identified according to boring location and depth, placed in plastic bags to protect against moisture loss, and were transported to the soil laboratory for supplemental classification and other tests.

Region & vicinity maps are included in Appendix A. Exploration locations are shown in Appendix B.

2.0 EXISTING SITE CONDITIONS

2.1 LITERATURE REVIEW

QG was provided with an existing geotechnical report performed by Materials Testing & Consulting, Inc. dated 3/20/2014 (herein referred to as "the 2014 report"). The report included thorough review of subsurface soil conditions and recommended for site soil improvements. Our review of the report concludes that the evaluation was conducted to the same current standards with which modern geotechnical investigations are now done.

The report recommends site wide improvements be made to stabilize surface soils and protect foundations. The reports recommended solution mostly concerns the installation of 24 inches of structural fill beneath any solid structures.

Additionally, QG was provided existing recent inspection reports regarding the installation of a 24" thick structural fill pad across the subject site surface. Reports appear to indicate the fill was placed in conformance with project plans and the geotechnical report, with a layer of sturdy fabric separating the fill from the native soil. Soils are reported to have been compacted to a firm and unyielding condition.

The 2014 report should be attached as a supplementary piece for submission, to be reviewed in conjunction with this report.

2.2 SITE & SURFACE CONDITIONS

On our visit, it was observed that the project area is relatively flat, near the same elevation as the adjacent roadways. The site is entirely covered in a *5/8-inch minus* imported gravel. Two catch basins were observed within the eastern side of the site, and they appear to tie into the street side stormwater system.

2.3 SOIL CONDITIONS

Site soils were generally consistent across the property. The structural fill cover was noted to consistently extend to a depth of 24 inches, with geofabric separating it from the underlying soils. The fill was noted to be in a firm and unyielding condition across the site. Beneath structural fill soils, the native silt was observed in a soft and wet condition. Additional details of the native soil can be found in the 2014 report.

3.0 GEOTECHNICAL RECOMMENDATIONS

3.1 DISCUSSION

In general, the site appears in an adequate condition, with fill having successfully bridged over the soft native soils. The fill is expected to protect the site from differential settlement over time. Certain additional building foundation recommendations will still need to be observed in order to offer similar protections.

QG recommends earthwork activities take place during the summer dry season. If earthwork and concrete/asphalt placement occur during the wet season, foundation recommendations may need to be altered.

3.2 FLATWORKS

The structural fill across the site appears in a suitable condition to bear surface improvements and flatworks such as pavement, sidewalks, and concrete slabs. To maintain the required 24 inches of structural fill beneath, new surface improvements will have to be placed at an elevation near or above current grade in order to avoid decreasing the fill thickness. Existing fill may remain directly beneath these flatworks. Concrete and asphalt may be placed directly over this fill without the need for installation of any additional structural fill base beneath, unless excessive loads are anticipated. Slabs may still require the installation of vapor barriers, depending on the project designers' considerations.

3.2.1 SLAB ON GRADE

QG anticipates that slab-on-grade floors are planned for the interior of the proposed building. Based on typical construction practices, we assume finished slab grade will be similar to or marginally above present grade for the below recommendations. If floor grades are planned to be substantially raised or lowered from existing grade, QG should be contacted to provide revised or alternative recommendations.

- **Capillary Break:**

  A capillary break will be helpful to maintain a dry slab floor and reduce the potential for floor damage resulting from shallow perched water inundation. To provide a capillary moisture break, a 6-inch thick, properly compacted granular mat consisting of open-graded, free-draining angular aggregate is recommended below floor slabs.

- **Vapor Barrier:**

  During selection of flooring products for slabs on grade, consideration should be made for compatibility with a vapor retarding membrane, such as 10 mil polyethylene film placed

beneath floor slabs, to prevent transmission of moisture where floor coverings may be affected. Care should be taken during construction not to puncture or damage the membrane. To protect the membrane, a layer of sand no more than 2 inches thick may be placed over the membrane if desired. If excessive relict organic fill material is discovered at any location, additional sealant or more industrial gas barriers may be required to prevent off-gassing of decaying material from infiltrating the new structure. These measures shall be determined by the structural engineer to meet local code requirements as necessary.

- **Structural Design Considerations:**

  QG assumes design and specifications of slabs will be assessed by the project design engineer. We suggest a minimum unreinforced concrete structural section of 4.0 inches be considered to help protect against cracking and localized settlement, especially where larger equipment or localized loads are anticipated. It is generally recommended that any floor slabs and annular exterior concrete paving subject to vehicular loading be designed to incorporate reinforcing. Additionally, some level of reinforcing, such as a fiber or wire mesh may be desirable to prolong slab life due to the overwhelming presence of such poor underlying soils. It should be noted that QG does not express any guarantee or warranty for proposed slab sections.

3.2.2 RIGID PAVEMENT AND FLATWORKS

Detailed pavement recommendations are provided in the 2014 report and should be referenced therein.

Rigid pavement components are commonly utilized for portions of accesses and ancillary exterior improvements. The project civil designer may re-evaluate the below general recommendations for pavement thicknesses and base sections, if necessary, to ensure proper application to a given structure and use. QG recommends that we be contacted for further consultation if the below sections are proposed to be reduced.

Concrete driveway aprons and curb alignments, if utilized, should consist of a minimum 6-inch thickness of unreinforced concrete pavement over structural base fill. For heavy traffic zones, we recommend the incorporation of reinforcing steel in the concrete.

Concrete sidewalks, walkways and patios if present may consist of a minimum 4-inch section of plain concrete (unreinforced). Flatworks should employ frequent joint controls to limit cracking potential.

3.3 SHALLOW FOUNDATION RECOMMENDATIONS

For general foundation design considerations, QG recommends referring to guidelines and parameters of the International Building Code (IBC, 2015; or most recent edition at the time of construction).

3.3.1 FOUNDATIONS OVER EXISTING GRADE

If foundations are to bear directly over the existing 24 inches of fill without reduction of the base, no further soil amendments will be required, other than raising the exterior grade by backfilling over footings to achieve the minimum required embedment. We recommend following the other recommendations for foundations provided in the 2014 report, in order to maintain the desired 1500PSF bearing capacity.

3.3.2 FOUNDATIONS PENETRATING BENEATH EXISTING GRADE

Concrete foundations penetrating into the existing fill will have an elevated risk of settlement due to the presence of shallow soft native soils. For foundations penetrating into the existing structural fill soils, the following preparations will be required in order to maintain adequate bearing conditions:

- **Subgrade Preparation**

  QG recommends overexcavating 24 inches beneath the depth where foundations will penetrate, to, and benching the final bottom of subgrade elevation flat.

  Excavations should be performed with a smooth blade bucket to limit disturbance of subgrade soils. Vibratory compaction of the native soils should be avoided where possible to limit the degradation of soil consistency. Manual or non-vibratory compaction alternatives may be considered.

- **Structural Fill**

  A minimum 24-inch thick structural fill base composed of either gravel borrow per WSDOT Specification 9-03.14(1), or crushed surfacing per WSDOT Specification 9-03.9(3), or an approved alternative. This structural fill shall be separated from underlying and surrounding soils by a layer of rugged nonwoven permeable geofabric, with 12-inch overlaps at joints, to allow for water to escape and prevent the accumulation of fine-grained soils within the void space.

  Note: For lateral and bearing support, structural fill placement below footings shall extend at minimum a 1H:1V distance past each edge of the base of the footing equal to the depth of structural fill placed below the footing [e.g., for a 2.0-foot wide footing, fills placed to

approximately 1.5 feet below footing grade will require a minimum backfill width of 5.0 feet (1.5 feet each side plus 2.0-foot width of footing)]

- **Footing Drains:**

  Due to relatively impermeable subgrade conditions and the known seasonally saturated soils, footing drains should be incorporated to maintain dry foundation conditions. QG recommends footing drains employ 4-inch minimum perforated pipe. Footing drains shall be backfilled with free-draining material wrapped in filter fabric. Footing drains should be tightlined separately from roof drains to a catch basin system or to a permanent discharge point at least 10 feet from the structure.

3.4 INFILTRATION FEASIBILITY

QG understands design of on-site stormwater controls are pending the results of this study to confirm design parameters.

During test pit excavations for general site investigation, QG additionally collected representative samples of native soil deposits among potential infiltration strata and depths. We understand the project will be subject to infiltration design based on the Washington Department of Ecology Stormwater Management Manual for Western Washington (DoE SMMWW). For initial site infiltration characterization within the scope of this study, laboratory gradation analyses were completed including sieve and hydrometer tests for stormwater design characterization and rate determination to supplement field observations.

Based on our field observations, we conclude that infiltration on site is not feasible due to the presence of shallow fine-grained soils. QG recommends the facility designer review these results and stated assumptions per reference literature to ensure applicability with the proposed development, level of anticipated controls, and long- term maintenance plan. It may be permissible for stormwater controls to be tied into the existing municipal stormwater systems if approved by the local permitting authority.

4.0 CONSTRUCTION RECOMMENDATIONS

4.1 EARTHWORK & GENERAL CONSTRUCTION

QG recommends the design team and contractors follow the construction recommendations provided in the original geotechnical report by MTC and dated 3/20/2014. QG has reviewed the original report and confirms the recommendations are suitable for current construction.

5.0 SPECIAL INSPECTION

The recommendations made in this report assume that an adequate program of tests and observations will be made throughout construction to verify compliance with these recommendations. Testing and observations performed during construction should include, but not necessarily be limited to, the following:

- Geotechnical plan review and engineering consultation as needed prior to construction phase,
- Observations and testing during site preparation, earthwork, structural fill, and pavement section placement,
- Consultation on temporary excavation cutslopes and shoring if needed,
- Consultation as necessary during construction.

QG recommends that a local and reputable materials testing & inspection firm be retained for construction phase testing and observation in accordance with the local code requirements. We also strongly recommend that QG be retained as the project Geotechnical Engineering Firm of Record (GER) during the construction of this project to perform periodic supplementary geotechnical observations and review the special inspectors reports during construction.

Our knowledge of the project site and the design recommendations contained herein will be of great benefit in the event that difficulties arise and either modifications or additional geotechnical engineering recommendations are required or desired. We can also, in a timely fashion observe the actual soil conditions encountered during construction, evaluate the applicability of the recommendations presented in this report to the soil conditions encountered, and recommend appropriate changes in design or construction procedures if conditions differ from those described herein.

We would be pleased to meet with you at your convenience to discuss the *Time & Materials* scope and cost for these services.

6.0 LIMITATIONS

Upon acceptance and use of this report, and its interpretations and recommendations, the user shall agree to indemnify and hold harmless QG, including its owners, employees and subcontractors, from any adverse effects resulting from development and occupation of the subject site. Ultimately, it is the owner's choice to develop and live in such an area of possible geohazards (which exist in perpetuity across the earth in one form or another), and therefore the future consequences, both anticipated and unknown, are solely the responsibility of the owner. By using this report for development of the subject property, the owner must accept and understand that it is not possible to fully anticipate all inherent risks of development. The recommendations provided above are intended to reduce (but may not eliminate) such risks.

This report does not represent a construction specification or plan and shall not be used or referenced as such. The information included in this report should be considered supplemental to the requirements contained in the project plans & specifications and should be read in conjunction with the above referenced information. The selected recommendations presented in this report are intended to inform only the specific corresponding subjects. All other requirements of the above-mentioned items remain valid, unless otherwise specified.

Recommendations contained in this report are based on our understanding of the proposed development and construction activities, field observations and explorations, and laboratory test results. It is possible that soil and groundwater conditions could vary and differ between or beyond the points explored. If soil or groundwater conditions are encountered during construction that differ from those described herein, or If the scope of the proposed construction changes from that described in this report, QG should be notified immediately in order to review and provide supplemental recommendations.

The findings of this study are limited by the level of scope applied. We have prepared this report in substantial accordance with the generally accepted geotechnical engineering practice as it exists in the subject region. No warranty, expressed or implied, is made. The recommendations provided in this report assume that an adequate program of tests and observations will be conducted by a WABO approved special inspection firm during the construction phase in order to evaluate compliance with our recommendations.

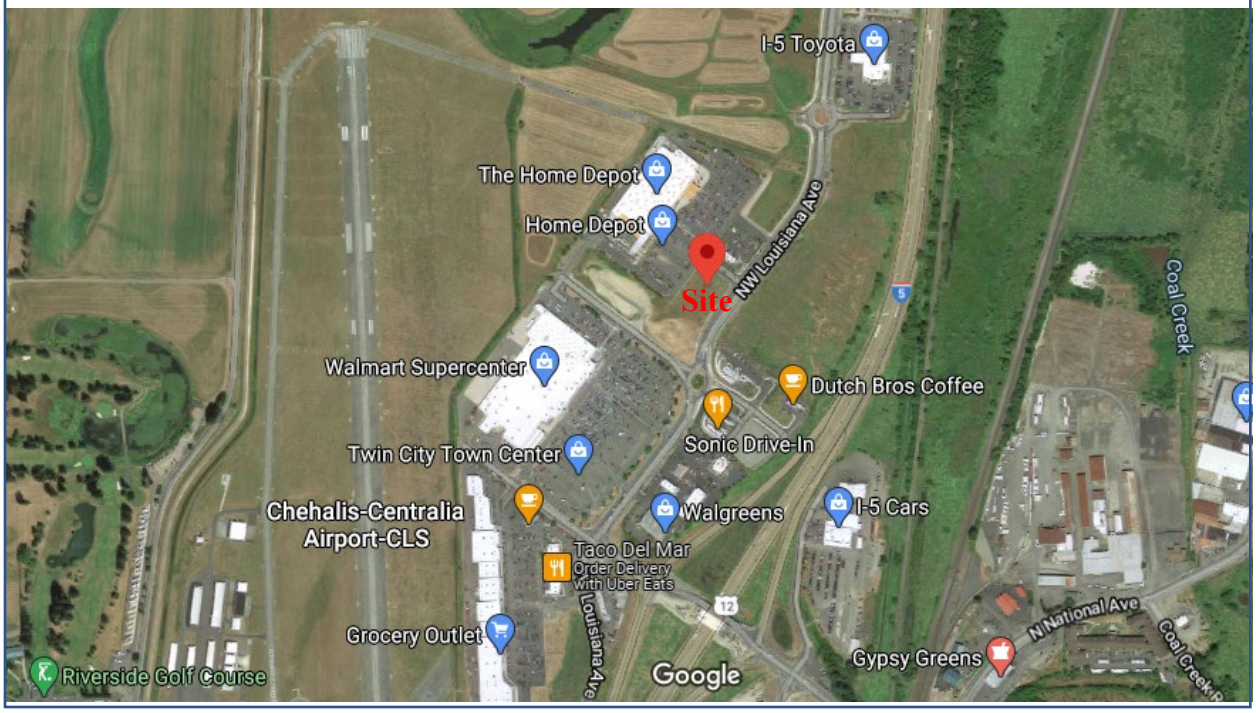
This report may be used only by the Client and their design consultants and only for the purposes stated within a reasonable time from its issuance, but in no event later than 18 months from the date of the report. It is the Client's responsibility to ensure that the Designer, Contractor, Subcontractors, etc. are made aware of this report in its entirety. Note that if another firm assumes Geotechnical Engineer of Record responsibilities, they need to review this report and either concur with the findings, conclusions, and recommendations or provide alternate findings, conclusions and recommendation.

Land or facility use, on- and off-site conditions, regulations, or other factors may change over time, and additional work may be required. Based on the intended use of the report, QG may recommend that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by the Client or anyone else will release QG from any liability resulting from the use of this report. The Client, the design consultants, and any unauthorized party, agree to defend, indemnify, and hold harmless QG from any claim or liability associated with such unauthorized use or non-compliance. We recommend that QG be given the opportunity to review the final project plans and specifications to evaluate if our recommendations have been properly interpreted. We assume no responsibility for misinterpretation of our recommendations.

Appendix A. Region & Vicinity Maps

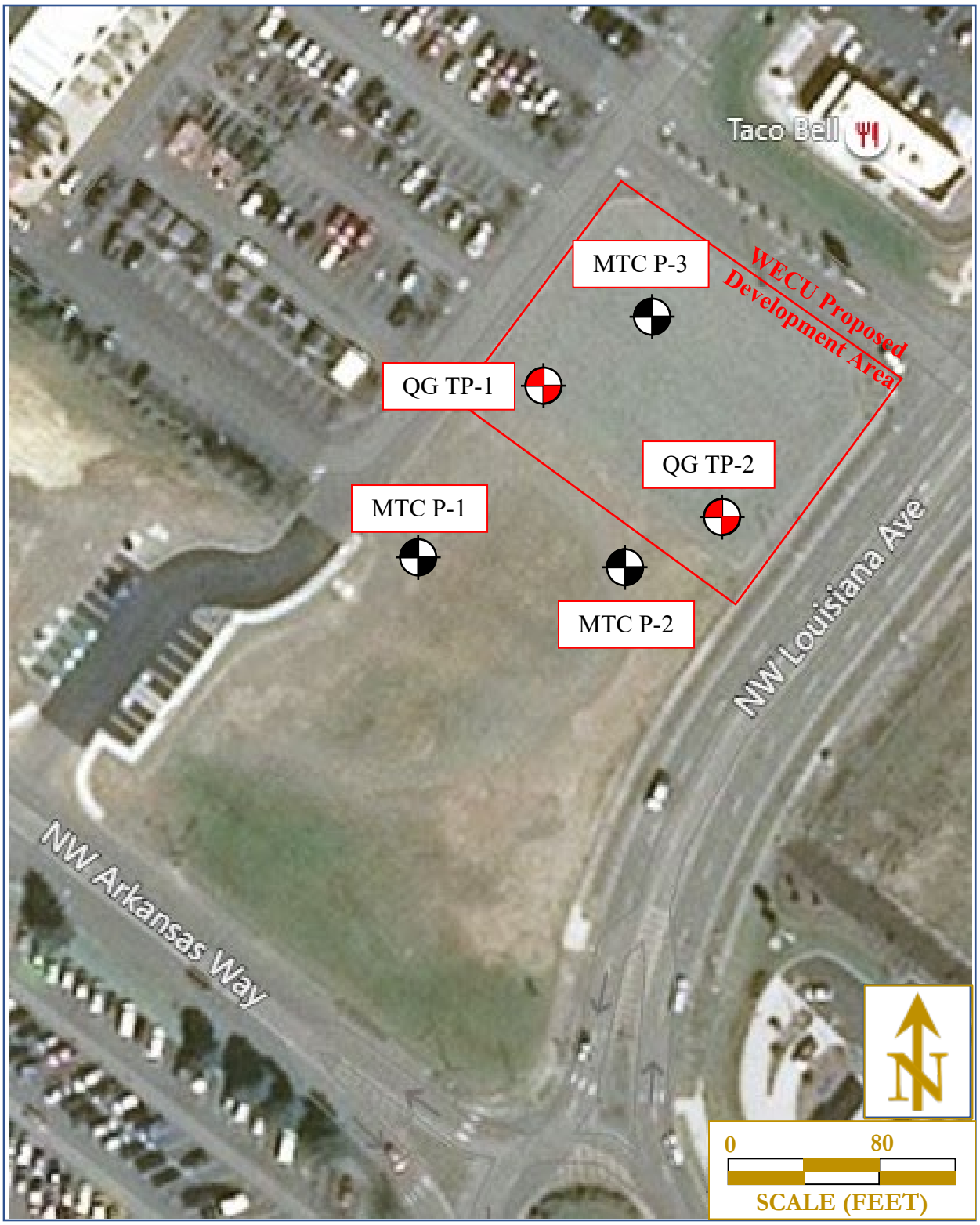
REGION

VICINITY



Quality Geo, PLLC	**Site Region** WSECU Chehalis	Source: Google Imagery, 2020 **Scale & Locations are approx.** **Not for Construction**	**Figure 1**

Appendix B. Exploration Map



Quality Geo, PLLC	**Site Map** WSECU Chehalis	Source: Microsoft Imagery, 2020 **Scale & Locations are approx.** **Not for Construction**	**Figure 2**

APPENDIX 6

OPERATIONS AND MAINTENANCE MANUAL

APPENDIX 7

CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN

APPENDIX 8
FEMA FLOOD INSURANCE MAP

National Flood Hazard Layer FIRMette

FEMA

122°58'56"W 46°41'5"N

122°58'18"W 46°40'41"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 7/2/2021 at 11:43 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

APPENDIX 9
DESIGN CALCULATIONS AND COMPUTATIONS

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	conveyance
Site Name:	
Site Address:	
City:	
Report Date:	7/2/2021
Gage:	Olympia
Data Start:	1955/10/01
Data End:	2008/09/30
Timestep:	15 Minute
Precip Scale:	0.800
Version Date:	2019/09/13
Version:	4.2.17

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year

Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
SAT, Forest, Flat	1.38
Pervious Total	1.38
Impervious Land Use	acre
Impervious Total	0
Basin Total	1.38

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C, Lawn, Flat	0.63
Pervious Total	0.63

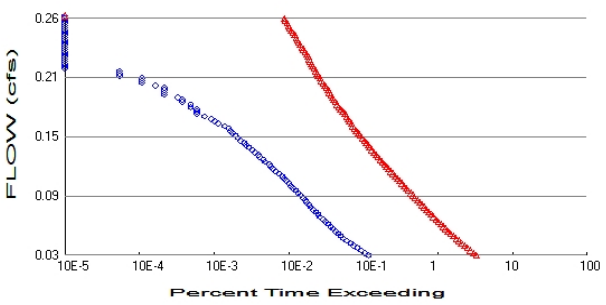
Impervious Land Use	acre
ROOF TOPS FLAT	0.11
SIDEWALKS FLAT	0.08
PARKING FLAT	0.56
Impervious Total	0.75
Basin Total	1.38

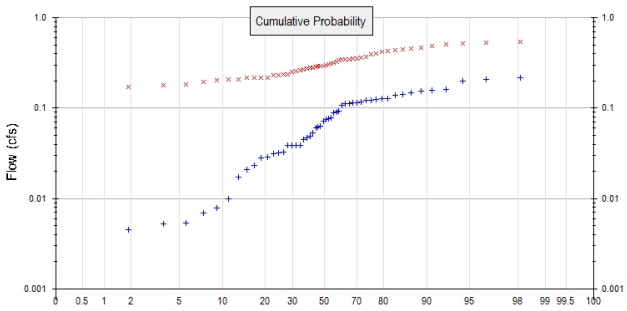
Element Flows To:

Surface	Interflow	Groundwater

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 1.38
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.63
Total Impervious Area: 0.75

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.063137
5 year	0.132668
10 year	0.178734
25 year	0.231166
50 year	0.26487
100 year	0.29396

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.300832
5 year	0.394268
10 year	0.454144
25 year	0.528047
50 year	0.582066
100 year	0.63536

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1956	0.089	0.278
1957	0.108	0.465
1958	0.054	0.234
1959	0.032	0.284
1960	0.111	0.360
1961	0.091	0.270
1962	0.004	0.210
1963	0.117	0.530
1964	0.148	0.317
1965	0.157	0.282

1966	0.032	0.206
1967	0.077	0.234
1968	0.039	0.195
1969	0.028	0.204
1970	0.045	0.218
1971	0.062	0.234
1972	0.199	0.353
1973	0.039	0.215
1974	0.075	0.346
1975	0.047	0.421
1976	0.071	0.345
1977	0.010	0.402
1978	0.039	0.366
1979	0.122	0.437
1980	0.039	0.262
1981	0.122	0.426
1982	0.112	0.357
1983	0.023	0.458
1984	0.154	0.256
1985	0.017	0.219
1986	0.093	0.299
1987	0.207	0.536
1988	0.007	0.182
1989	0.005	0.294
1990	0.049	0.488
1991	0.143	0.518
1992	0.021	0.238
1993	0.008	0.172
1994	0.003	0.178
1995	0.060	0.274
1996	0.160	0.340
1997	0.114	0.291
1998	0.140	0.397
1999	0.114	0.329
2000	0.029	0.346
2001	0.005	0.219
2002	0.127	0.294
2003	0.032	0.160
2004	0.078	0.306
2005	0.064	0.253
2006	0.126	0.315
2007	0.127	0.450
2008	0.215	0.509

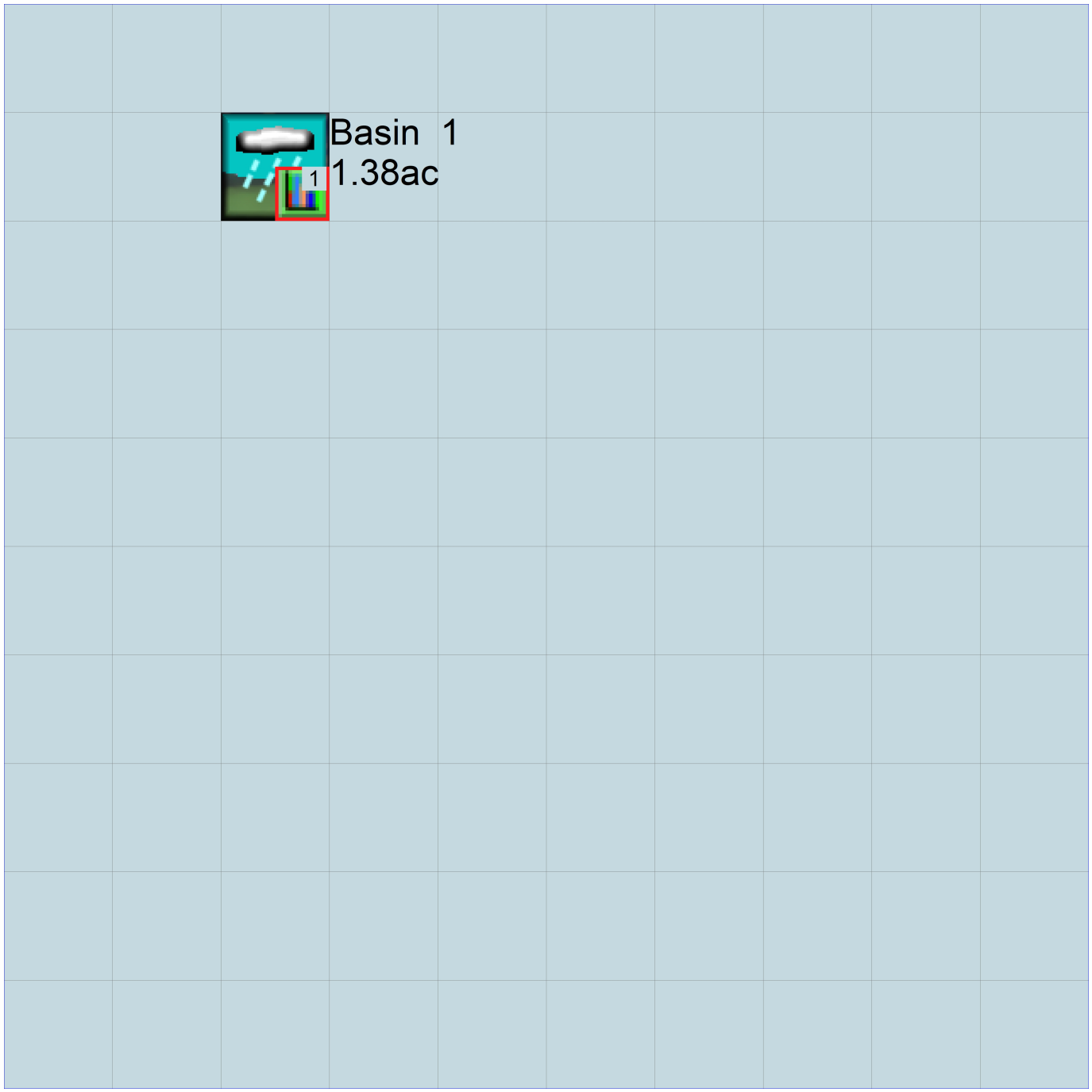
Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

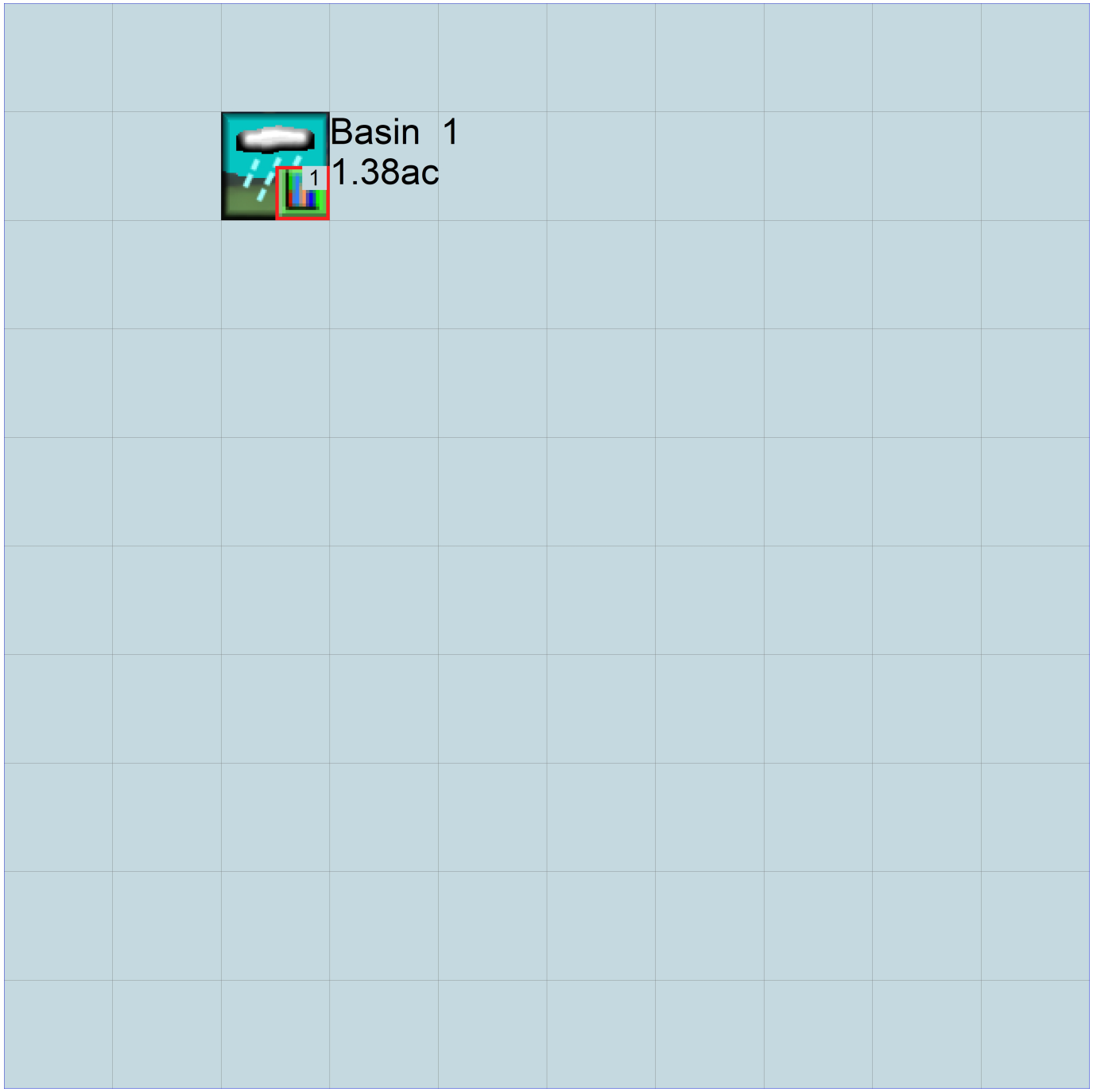
Rank	Predeveloped	Mitigated
1	0.2151	0.5365
2	0.2065	0.5305
3	0.1993	0.5177
4	0.1599	0.5090
5	0.1572	0.4883
6	0.1537	0.4654
7	0.1478	0.4576
8	0.1426	0.4505
9	0.1404	0.4373
10	0.1275	0.4257
11	0.1270	0.4213

12	0.1261	0.4020
13	0.1222	0.3969
14	0.1216	0.3658
15	0.1171	0.3602
16	0.1144	0.3574
17	0.1138	0.3527
18	0.1122	0.3462
19	0.1114	0.3457
20	0.1079	0.3447
21	0.0932	0.3399
22	0.0913	0.3286
23	0.0888	0.3168
24	0.0781	0.3147
25	0.0769	0.3062
26	0.0745	0.2994
27	0.0713	0.2940
28	0.0638	0.2937
29	0.0625	0.2907
30	0.0603	0.2840
31	0.0537	0.2821
32	0.0489	0.2777
33	0.0471	0.2740
34	0.0453	0.2698
35	0.0388	0.2616
36	0.0387	0.2562
37	0.0386	0.2529
38	0.0386	0.2379
39	0.0324	0.2345
40	0.0319	0.2337
41	0.0317	0.2336
42	0.0286	0.2193
43	0.0284	0.2188
44	0.0233	0.2176
45	0.0208	0.2152
46	0.0174	0.2098
47	0.0098	0.2062
48	0.0078	0.2036
49	0.0069	0.1953
50	0.0053	0.1816
51	0.0052	0.1776
52	0.0045	0.1719
53	0.0032	0.1598

Appendix
Predeveloped Schematic



Mitigated Schematic



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