STORMWATER DRAINAGE REPORT
LABOSIERRE SHORT PLAT

3035 NE 195th Street
Lake Forest Park, WA 98155
Parcel #: 6152900033

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Prepared:
March 2016
Revised:
June, 2016

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1.0 Project Overview

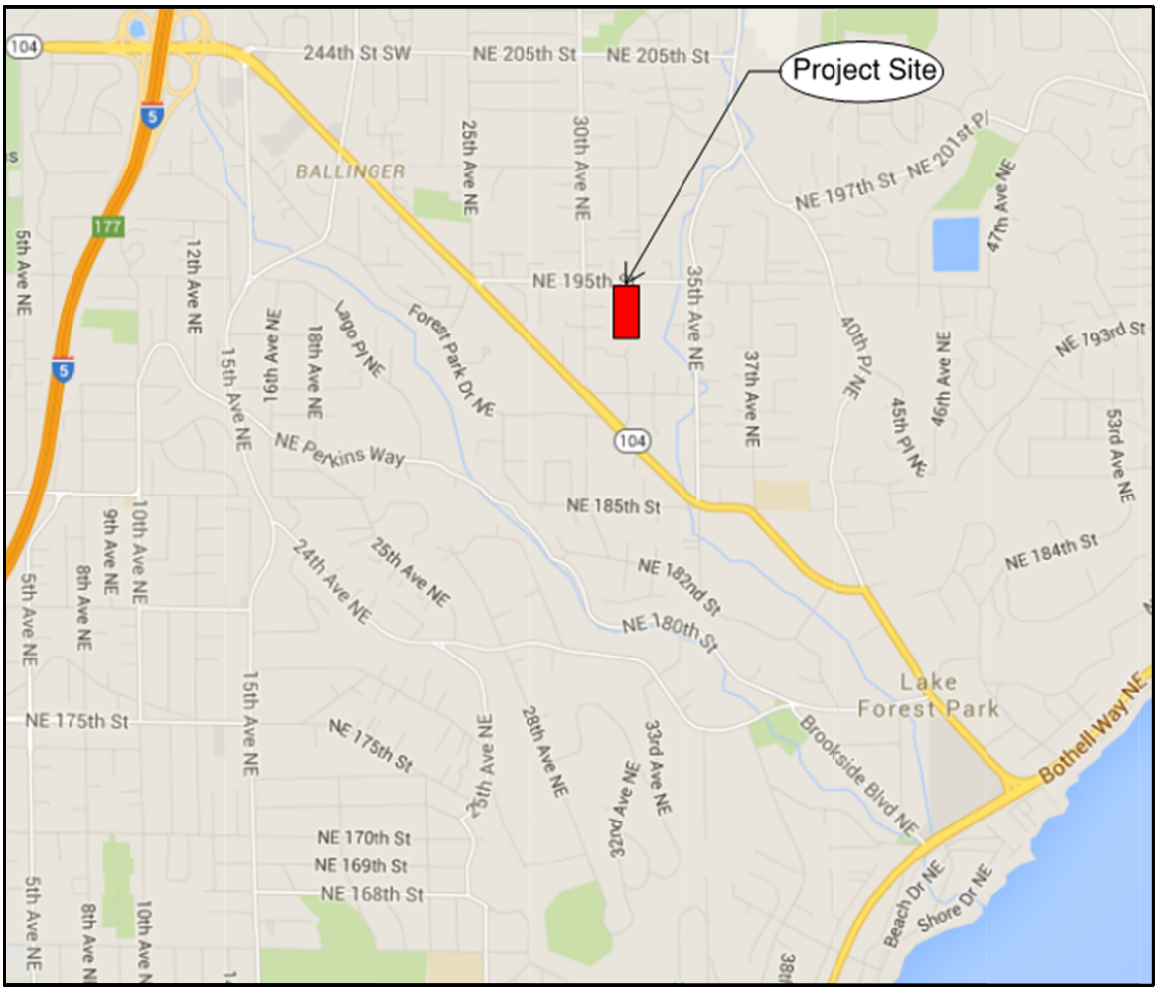
Financial Plats Group is proposing a 4-lot short plat to be constructed on approximately a 4.05 acre parcel (post-boundary line adjustment) within the RS-7.2 (Single-Family Residential, High) zone. The project site is located at 3035 NE 195th St, Lake Forest Park, Washington 98155. Existing single-family residences border the site on all sides of the property with the exception of the north side where it is bounded by NE 195th Street.

There is an existing category III wetland on the east side of the property with invasive, non-native species within the buffer. The majority of the site has a high percentage of tree canopy coverage. There are numerous large trees including Alder, Cottonwood, Maple and Douglas Fir. There is also heavy undergrowth consisting of but not limited to Himalayan Blackberry, English Ivy, Bracken and Sword Ferns and Stinging Nettle.

The site slopes down toward the south-east corner of the property resulting in an elevation drop of approximately 25 feet. The steepest slope is approximately 20% and is near the middle portion of the property. Current stormwater runoff sheet flows to the on-site wetland before exiting the property via the south-east corner. The site lies within the Lyon Creek Drainage Basin in which stormwater drainage is eventually discharged into Lake Washington (Lake Washington/Cedar River Watershed). Refer to section 3.0 for details on subbasins and site characteristics.

A 16 foot wide access street ending in a 80 foot diameter cul-de-sac is proposed to provide access to the development from NE 195th St. On-site stormwater will be collected and infiltrated into the existing soils by utilizing a bioretention cell (also known as a rain garden) and basic dispersion. These low impact development techniques will provide water quality and will benefit the wetland on site by helping to maintain natural conditions in the system post-development. The bioretention cell shall be designed in accordance with the 2009 King County Surface Water Design Manual (2009 KCSWM), as adopted by the City of Lake Forest Park.

Figure 1: Vicinity Map (Not To Scale)



2.0 Minimum Requirements

This report provides stormwater requirements for the proposed development. The project will add more than 5,000 square feet of new impervious surfacing and therefore a Full Drainage Review is necessary. The Core Requirements and Special Requirements, as outlined in the King County Surface Water Design Manual (2009), will be met when applicable and are summarized below:

Minimum Requirement #1: Discharge at the Natural Location

Discharging to the natural drainage location helps to prevent adverse impacts to downstream properties caused by diversion of flow from one flow path to another, and to discharge in a manner that does not significantly impact downhill properties or drainage systems.

The proposed discharge from the site will mimic the existing drainage conditions. The runoff will be collected and conveyed to a single bioretention cell which will be utilized to infiltrate the stormwater into the soils. Overflow from the bioretention cell will be routed to the existing wetland in order to maintain its natural hydrology.

Minimum Requirement #2: Offsite Analysis

The intent of the offsite analysis is to identify and evaluate offsite flooding, erosion, and water quality problems that may be created or aggravated by the proposed project, and to ensure appropriate measures are provided for preventing creation or aggravation of those problems. In addition, this requirement is intended to ensure appropriate provisions are made, as needed, to mitigate other identified impacts associated with the quantity and quality of surface and storm water runoff from the project site.

No erosion, flooding, or degradation of the drainage system was identified within ¼ of a mile downstream of the project site. See Section 3.0 for a detailed offsite analysis.

Minimum Requirement #3: Flow Control

Flow control will be provided in order to protect downstream properties and resources from increases in peak, duration and volume of runoff generated by new development.

The bioretention cell will provide flow control for the project site.

Minimum Requirement #4: Conveyance System

All conveyance system elements for the proposed project will be analyzed, designed, and constructed to provide a minimum level of protection against overtopping, flooding, erosion, and structural failure.

The proposed conveyance system consists of a pipe system which will convey stormwater from the impervious areas to the on-site bioretention cell.

Minimum Requirement #5: Erosion & Sediment Control

In order to help minimize the erosion and transport of sediment, several erosion control measures as detailed in the King County Erosion and Sediment Control (ESC) Standards adopted as Appendix D of the 2009 KCSWM will be utilized. See Section 7.0 of this report and the engineering plans for additional information.

Minimum Requirement #6: Maintenance and Operations

All privately maintained drainage facilities shall be maintained as specified in Appendix A of the 2009 KCSWM. A copy of the Operation and Maintenance Manual shall be retained on site and will be transferred with the property to the new owner. A copy of operation and maintenance standards are included in Appendix H of this report.

Minimum Requirement #7: Financial Guarantees and Liability

Drainage facilities will be privately maintained; therefore the financial guarantees and liability are not required for this project.

Minimum Requirement #8: Water Quality

As delineated by the Water Quality Applications Map in the 2009 KCSWM, the project site lies within an incorporated area. Water quality shall be provided by bioretention.

Special Requirement #1: Other Adopted Area-Specific Requirements

No other area-specific requirements apply to this site.

Special Requirement #2: Flood Hazard Area Delineation

The project site is not located in a flood hazard area; therefore no additional special requirements apply to this site.

Special Requirement #3: Flood Protection Facilities

The project site does not rely on any existing or proposed flood protection facilities.

Special Requirement #4: Source Controls

No commercial points of source control are proposed on site.

Special Requirement #5: Oil Control

The site is not classified as a high-use site, therefore no oil control is proposed.

3.0 Offsite Analysis

This section evaluates the upstream and downstream drainage system. The intent of this section is to identify any existing or potential drainage impacts created or exacerbated by the proposed project and drainage facilities.

Aerial imagery, topographic maps of the area, Lake Forest Park Stream and Drainage Maps, as well as a site visit conducted on November 3rd, 2015 form the basis of this level 1 analysis.

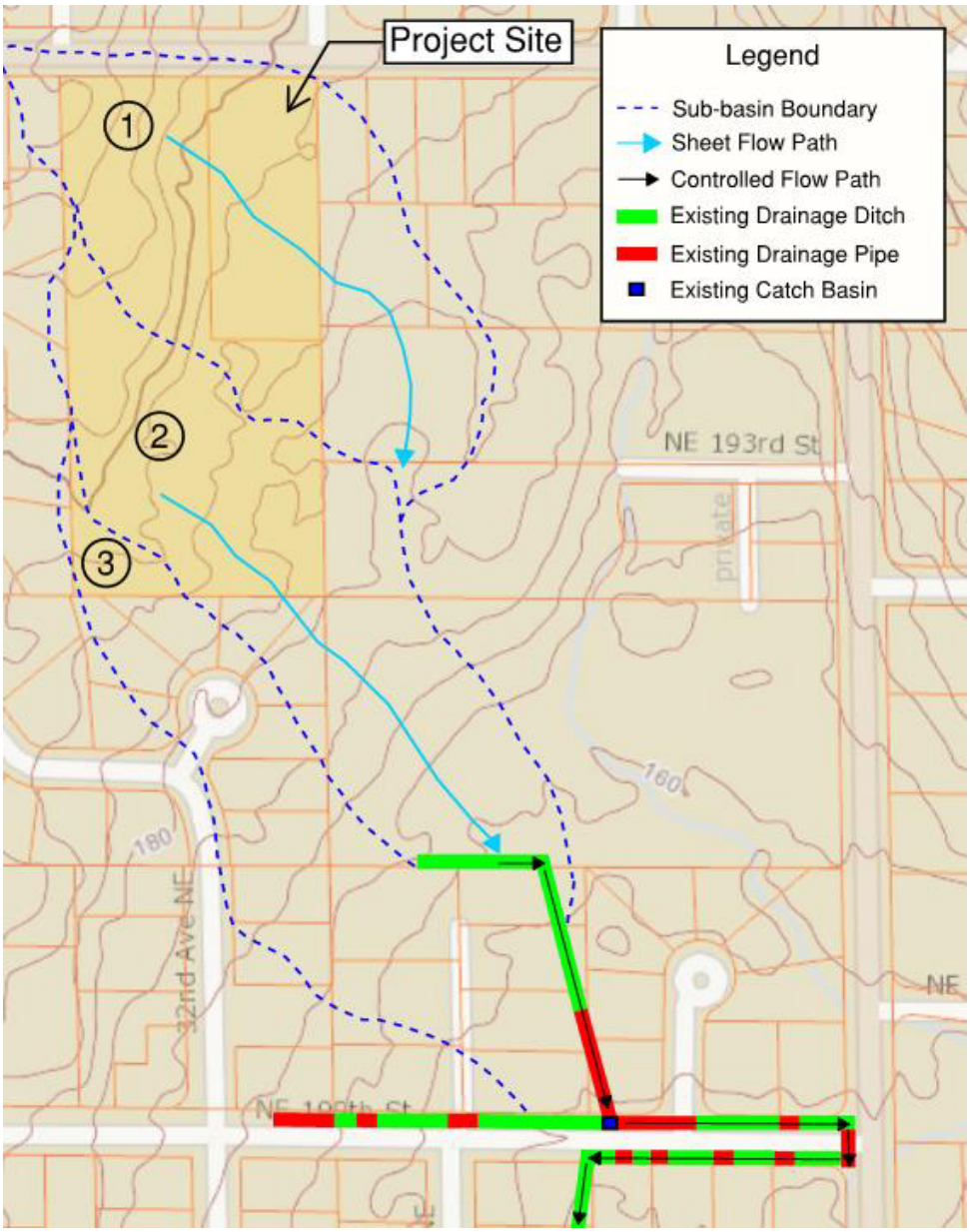
3.1 Upstream Analysis

The project site is sloping down toward the east along NE 195th Street. Upstream runoff is captured in an existing drainage ditch which is transferred under the site's existing driveway via concrete culvert. Once past the driveway, the drainage sheet flows into the existing wetland on site. There is no evidence of flooding, erosion, or degradation of the upstream drainage system.

3.2 Downstream Analysis

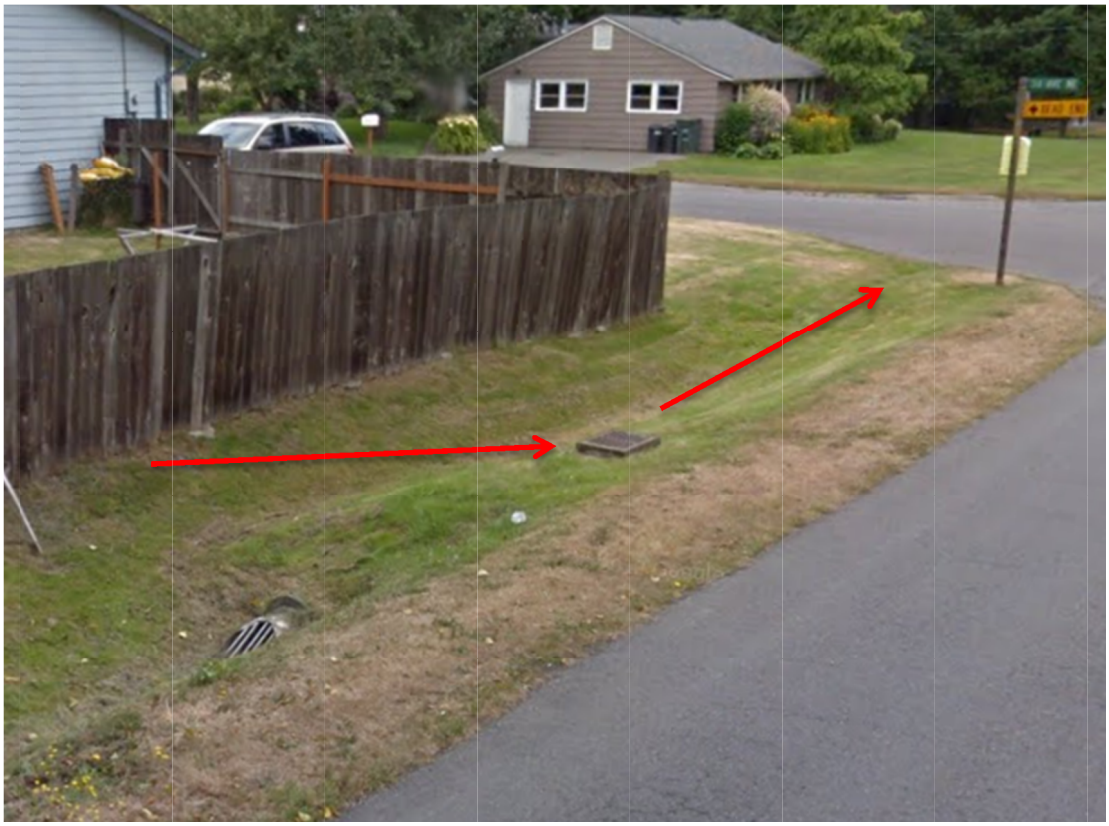
The project site currently consists of three sub-basins, as shown in Figure 2. Based on the topography, sub-basins 1 and 2 will converge in an adjacent property and tributary runoff will flow southerly into an existing drainage ditch. Sub-basin 3 runoff flows through an existing neighborhood and into a drainage ditch which runs along NE 190th Street. Therefore, all stormwater drainage is currently routed through the existing catch basin on NE 190th Street.

Figure 2: Downstream Analysis Map – Subbasins and Site Characteristics



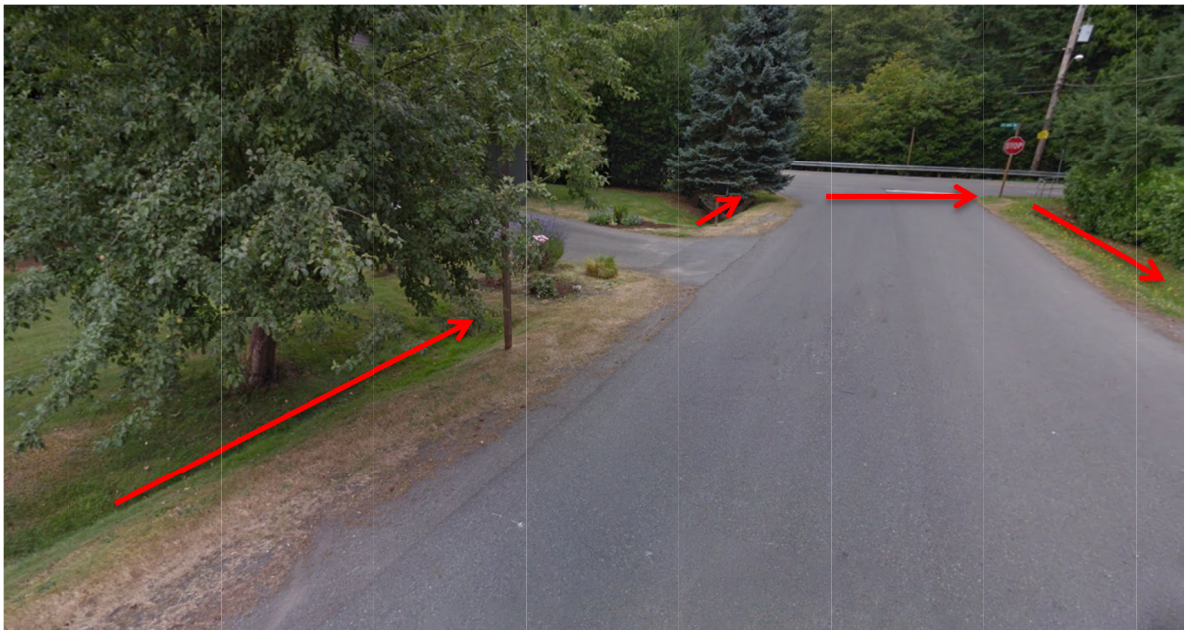
Excess runoff from the project site currently sheet flows in the southeast direction until it reaches an open drainage ditch on private property.

Figure 3: Catch Basin on NE 190th Street near 34th Ave NE



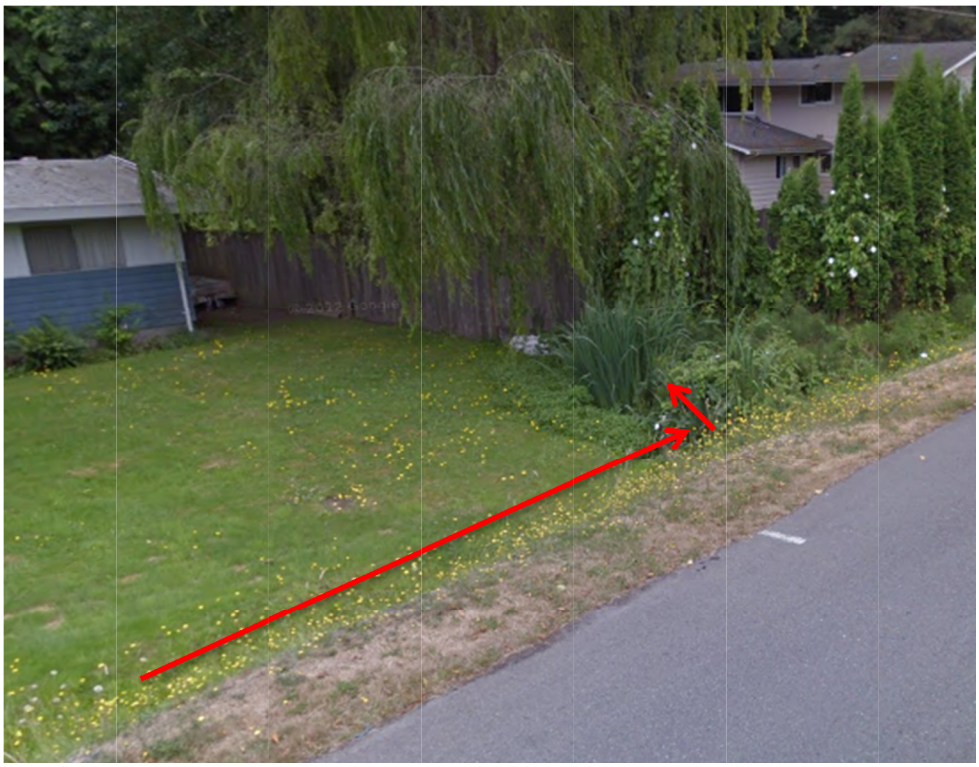
Runoff collected in the open drainage ditch is routed through a pipe and to the catch basin. The catch basin discharges to a pipe which conveys drainage east under 34th Ave NE.

Figure 4: Drainage on NE 190th Street near 35th Ave NE



The drainage passes through a series of existing ditches and concrete culverts before it is routed under NE 190th Street. It then begins to flow west on the south side of NE 190th Street.

Figure 5: Drainage ditch converging with Lyon Creek east of 33rd Ave NE



The drainage runs to the west through a series of ditches and culverts until it reaches a ditch which flows to the south. This ditch, as shown on the Lake Forest Park Drainage Map (Appendix B), runs directly into Lyon Creek approximately 300 feet downstream. No evidence of flooding, erosion, or degradation was observed within ¼ mile downstream from the project site.

4.0 Flow Control and Water Quality Design

Existing Hydrology

The site is currently forested with no existing structures on the property. On site drainage sheet flows to the existing wetland located near the east side of the site where stormwater is naturally infiltrated into the soil. Any excess drainage flows southerly until it is routed into a series of existing drainage ditches. The drainage system is tributary to the Lyon Creek Basin which drains into the north-west end of Lake Washington.

Developed Hydrology

Drainage from the developed site (1.67 acres) will be infiltrated into the soil via the on-site bioretention cell with overflow dispersing into the wetland. The 2:1 graded areas adjacent to the access road will be vegetated with wetland plantings and runoff generated shall sheet flow into the wetland. This low impact drainage design will assist in maintaining the natural state of the wetland. Any excess drainage unable to be contained within the wetland will continue to drain into the series of ditches near NE 190th Street.

Stormwater Low Impact Development (LID)

As this project site resides within the Lyon Creek Drainage Basin, Low Impact Development is of high importance in order to reduce flooding in the area. As a geotechnical study conducted by Earth Solutions NW confirmed that the soils on site are acceptable for infiltration, the use of a bioretention cell is proposed for this project in order to maintain the hydrology of the existing wetland. This low impact design also allows water quality to be be provided by the hydrophytic plants within the bioretention cell.

Performance Standards

The low impact development drainage design meets the King County flow control BMP requirements as outlined in 5.2.1.1(3) of the 2009 Surface Water Design Manual.
The 8" pipe system which is to convey runoff to the bioretention cell is designed to convey the 25-year peak flow in accordance with section 1.2.4.1(1) of the SWDM.

Flow Control System

Existing site conditions were modeled as forested with type C soil in WWHM 2012. Developed site conditions consist of areas modeled as impervious, flat lawn, and steep lawn. WWHM basin exhibits are included in Appendix D. All runoff generated from the lots and access road will be conveyed to the bioretention cell which has been sized appropriately. Overflow will be conveyed to the wetland on site via basic dispersion. For bioretention sizing please see WWHM report 2 included in Appendix F.

Water Quality System

The Water Quality Applications Map in the 2009 KCSWM shows the project site within an incorporated area. Therefore, it is acceptable for the water quality to be provided by the bioretention facility. The bioretention cell utilizes biological processes of plant uptake and bacterial degradation as well as physical and chemical processes to remove pollutants. This is similar to Basic Water Quality Option 5 in section 6.1.1 of the King County SWDM (2009).

Infiltration System

The on-site bioretention cell will provide stormwater low impact design and flow control for the site. An infiltration rate of 4 inches per hour was provided by Earth Solutions NW for use in preliminary design of the bioretention cell. As the native soils on-site are types with high infiltration, the infiltration rate of the amended soil used within the bioretention cell will be the limiting factor. Therefore, an infiltration rate of 4 inches per hour was used in preliminary design of the bioretention cell. Please see the bioretention evaluation performed by Earth Solutions NW within the Appendix G.

Bioretention Cell Design

The bioretention cell for this project was designed according to the minimum design requirements for a rain garden as specified in section C.2.5.1 of the 2009 King County Surface Water Design Manual. Please note that rather than excavating, a containment berm shall be constructed in order to form the bioretention cell as to maintain a minimum 3-foot separation between the groundwater elevation and the bottom of cell. The following are guidelines used in the design process:

- 3:1 side slopes
- 18” amended soil depth
- 12” maximum water depth
- 12” freeboard
- 2’ wide containment berm

Sizing Results per WWHM 2012:

- 2500 SF bottom area for bioretention cell south of cul-de-sac (8,100 CF storage volume)
    - See Appendix F, Project Report 2 for details

Flow to Existing Wetland

In order to preserve the existing wetland hydrology on site, some runoff generated from the developed areas will still be allowed to flow into the category III wetland. Overflow from the bioretention cell will be dispersed into the wetland. Additionally, 0.29 acres of 2:1 graded side slopes will be allowed to sheet flow directly into the wetland. Project Report 3 in Appendix F displays the amount of flow which the side slope will contribute to the wetland compared to the pre-developed conditions.

5.0 Conveyance System Analysis and Design

General Design

Conveyance system elements have been analyzed and designed to ensure a minimum level of protection against overtopping, flooding, erosion and or structural failure. The rational method has been used in order to size the proposed conveyance systems. Flows for conveyance were analyzed using the undetained developed conditions shown in Appendix F, Project Report 1.Conveyance and backwater calculations can be found in Appendix E.

Pipe Systems

All pipe material, joints, protective treatment, and construction workmanship shall be in accordance with King County standards. This project proposes the use of 8" gravity pipe with a minimum slope of 3% for storm drainage conveyance. A minimum of 2 feet of cover shall be maintained over the entire project. Type 1 catch basins shall be used throughout project site except where there is more than 5 feet of drop between rim and invert of pipe. When the vertical drop exceeds 5 feet, Type 2 -48" diameter catch basins shall be used.

Conveyance Capacity

Two methods of hydraulic analysis using Manning's equation are used sequentially for the design and analysis of pipe systems (Uniform Flow Analysis method and Backwater Analysis method) in order to verify adequate capacity in proposed pipes. The nomograph shown in Figure 4.2.1.F of the King County Surface Water Design Manual was used in order to show that the proposed 8" storm drain pipe has sufficient capacity to carry the 10-year or 25-year peak flow rate from the site. Refer to Appendix E for calculations showing pipe capacity and backwater calculations.

6.0 Special Reports and Studies

Critical Areas Analysis and Delineation

A Sensitive Areas Study performed in 2014 confirmed the presence of hydric soil characteristics, hydrophytic vegetation, and wetland hydrology thus confirming the existence of a wetland on site. This wetland was identified within a topographic depression in the northeastern portion of the project site and was classified as a category III wetland.

In order to protect and maintain the existing hydrology of the wetland, LID techniques have been proposed for this project. Infiltration and dispersion techniques are proposed to be utilized so that the developed site hydrology will mimic the current site hydrology.

A Sensitive Areas Study Report has been prepared by Habitat Technologies as a separate document. Please refer to this report for more information on the existing wetland conditions.

Geotechnical Analysis

A geotechnical engineering study was performed on November 27th, 2015 by Earth Solutions NW. It was determined that the soil consists of silty sands and poorly graded sands which makes storm drainage techniques utilizing infiltration feasible for this project.

See the Geotechnical Report in Appendix G for specific details involving the onsite soils.

7.0 Construction Stormwater Pollution Prevention Plan (CSWPPP)

In order to protect the downstream conditions from sediments, several erosion control Best Management Practices (BMPs) from the DOE manual will be utilized.

Factors expected to create an erosion risk when developed:

- Exposure of soils during grading.

1. **Location relative to critical areas:**
   - Wetland located on eastern portion of site

2. **Soil type:**
   - Vashon advance outwash
   - Silty sands (SM) and poorly-graded sands (SP)

3. **Potential for slides or other ground movement:**
   - Low Risk - Refer to geotechnical report

4. **Sources of water for erosion:**
   - Rainfall

5. **Measures proposed to minimize and prevent erosion to the greatest extent possible for the development:**
   - Preparation and implementation of an erosion and sedimentation plan which is sensitive to the soils, slopes, and construction season
   - Sediment Trap
   - Silt fencing
   - Storm drain inlet protection
   - Mulching/Hydroseeding
   - Gravel construction entrance

Element #1 – Clearing Limits

To protect adjacent properties and to reduce the area of soil exposed to construction, the limits of construction will be clearly marked before land-disturbing activities begin. A large portion of the site will remain undisturbed throughout construction. Clearing limits will be delineated by silt fence and flagging.

Element #2 – Cover Measures

Temporary and permanent cover measures shall be provided to protect all disturbed areas, including the faces of cut and fill slopes. Temporary cover shall be installed if an area is to remain unworked for more than seven days during the dry season (May 1 to September 30) or for more than two consecutive working days during the wet season (October 1 to April 30). These time limits may be relaxed if an area poses a low risk of erosion due to soil type, slope gradient, anticipated weather conditions, or other factors. Any area to remain unworked for more than 30 days shall be seeded or sodded, unless the County determines that winter weather makes vegetation establishment infeasible. During the wet season, slopes and stockpiles at 3H:1V or steeper and with more than ten feet of vertical relief shall be covered if they are to remain unworked for more than 12 hours. Also during the wet season, the material necessary to cover all disturbed areas must be stockpiled on site. The intent of these cover requirements is to have as much area as possible covered during any period of precipitation.

D.3.2.2 – Mulching (DOE-BMP C121)
D.3.2.5 – Straw Wattles (DOE – BMP C235)
D.3.2.6 – Temporary and Permanent Seeding (DOE – BMP C120)

Element #3 – Perimeter Protection

Perimeter protection to filter sediment from sheet wash shall be located downslope of all disturbed areas and shall be installed prior to upslope grading. Perimeter protection includes the use of vegetated strips as well as, constructed measures, such as silt fences, fiber rolls, sand/gravel barriers, brush or rock filters, triangular silt dikes and other methods. During the wet season, 50 linear feet of silt fence (and the necessary stakes) per acre of disturbed area must be stockpiled on site.

D.3.3.1 – Silt Fence (DOE – BMP C233)

Element #4 – Traffic Area Stabilization

Unsurfaced entrances, roads, and parking areas used by construction traffic shall be stabilized to minimize erosion and tracking of sediment off site. Stabilized construction entrances shall be installed as the first step in clearing and grading. Roads and parking areas shall be stabilized immediately after initial grading.

D.3.4.1 – Stabilized Construction Entrance (DOE – BMP C105)

Element #5 – Sediment Retention

Surface water collected from disturbed areas of the site shall be routed through a sediment pond or trap prior to release from the site. Protection of catch basins is required for inlets that are likely to be impacted by sediment generated by the project and that do not drain to an onsite sediment pond or trap. Sediment retention facilities shall be

installed prior to grading of any contributing area and shall be located so as to avoid interference with the movement of juvenile salmonids attempting to enter off-channel areas or drainages.

D.3.5.1 – Sediment Trap (DOE – BMP C240)
D.3.5.3 – Storm Drain Inlet Protection (DOE – BMP C220)

Element #6 – Surface Water Collection

All surface water from disturbed areas shall be intercepted, conveyed to a sediment pond or trap, and discharged downslope of any disturbed areas. Significant sources of upslope surface water that drain onto disturbed areas shall be intercepted and conveyed to a stabilized discharge point downslope of the disturbed areas. Surface water controls shall be installed concurrently with rough grading.

D.3.6.1 – Interceptor Dike and Swale

Element #7 – Dewatering Control

Any runoff generated by dewatering shall be treated through construction of a sediment trap (Section D.3.5.1) when there is sufficient space or by releasing the water to a well vegetated, gently sloping area. Since pumps are used for dewatering, it may be possible to pump the sediment-laden water well away from the surface water so that vegetation can be more effectively utilized for treatment. Discharge of sediment-laden water from dewatering activities to surface and storm waters is prohibited. If dewatering occurs from areas where the water has come in contact with new concrete, such as tanks, vaults, or foundations, the pH of the water must be monitored and must be neutralized prior to discharge. Clean non-turbid dewatering water, such as well point ground water can be discharged to systems tributary to, or directly to surface waters provided the flows are controlled so no erosion or flooding occurs. Clean water must not be routed through a stormwater sediment pond. Highly turbid or contaminated dewatering water must be handled separately from stormwater.

Element #8 – Dust Control

Preventative measures to minimize the wind transport of soil shall be taken when a traffic hazard may be created or when sediment transported by wind is likely to be deposited in water resources or adjacent properties. (DOE – BMP C140)

Element #9 – Flow Control

Surface water from disturbed areas must be routed through the project's onsite flow control facility or other provisions must be made to prevent increases in the existing site conditions 2-year and 10-year runoff peaks discharging from the project site during construction.

8.0 Operations & Maintenance Manual

An Operations & Maintenance (O&M) Manual is required for all privately maintained stormwater detention and water quality, including low impact development facilities. A copy of the O&M Manual shall be retained on site and shall be transferred with the property owner to the new owner. A log maintenance activity indicating when cleaning occurred and where waste was disposed of shall be kept by the owner and available for inspection by the City of Lake Forest Park. See Appendix H for a compiled O&M Manual.

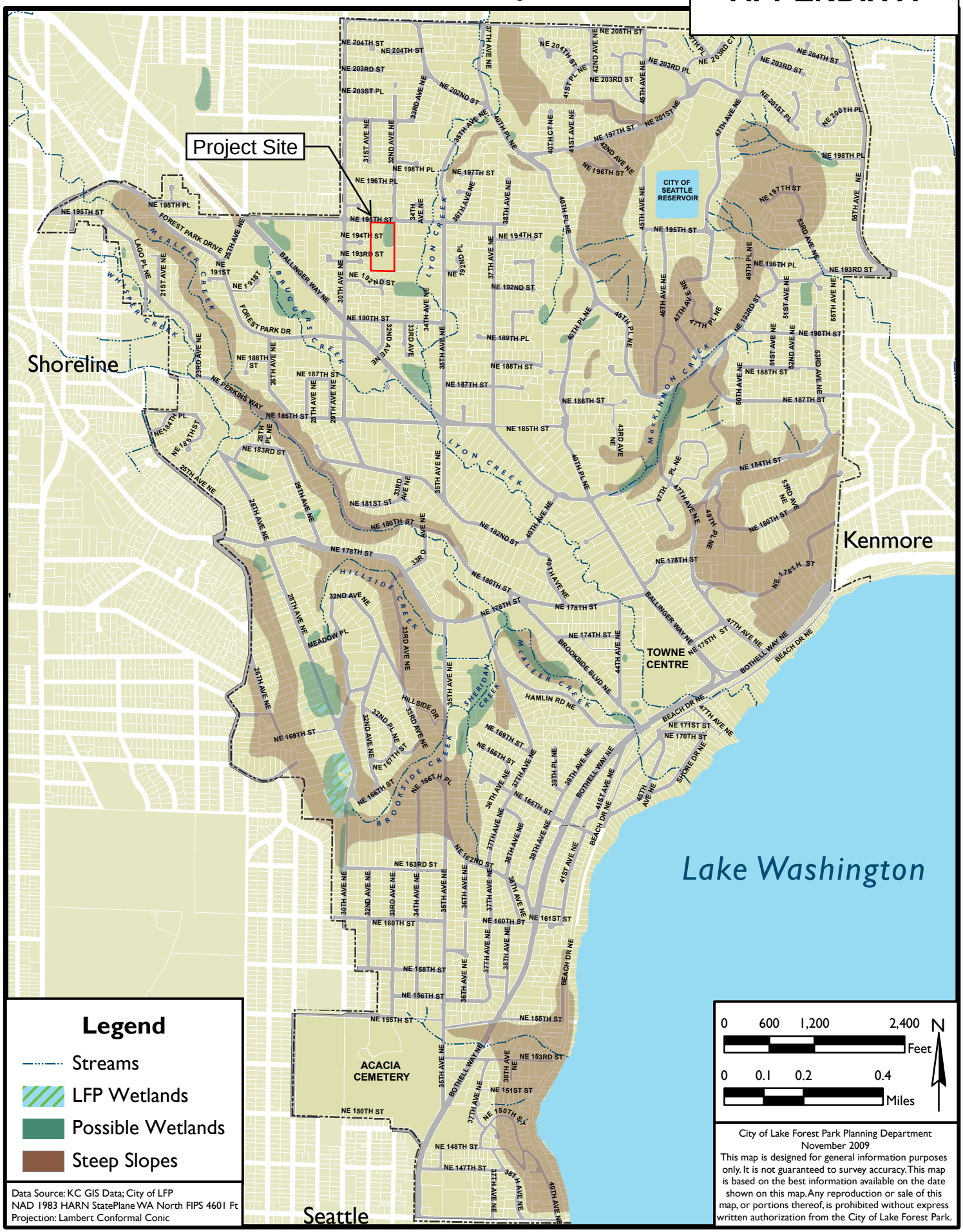
9.0 Appendix

Included in the Appendix:

A. Lake Forest Park Sensitive Areas Map
B. Lake Forest Park Drainage System Map
C. Proposed Site Plan
D. Basin Map Exhibits
E. Conveyance & Backwater Calculations
F. WWHM2012 Modeling Results
G. Geotechnical Report & Bioretention Evaluation
H. O & M Manual

Lake Forest Park Sensitive Areas Map

APPENDIX A



Data Source: KC GIS Data; City of LFP
NAD 1983 HARN StatePlane WA North FIPS 4601 Ft
Projection: Lambert Conformal Conic

City of Lake Forest Park Planning Department
November 2009

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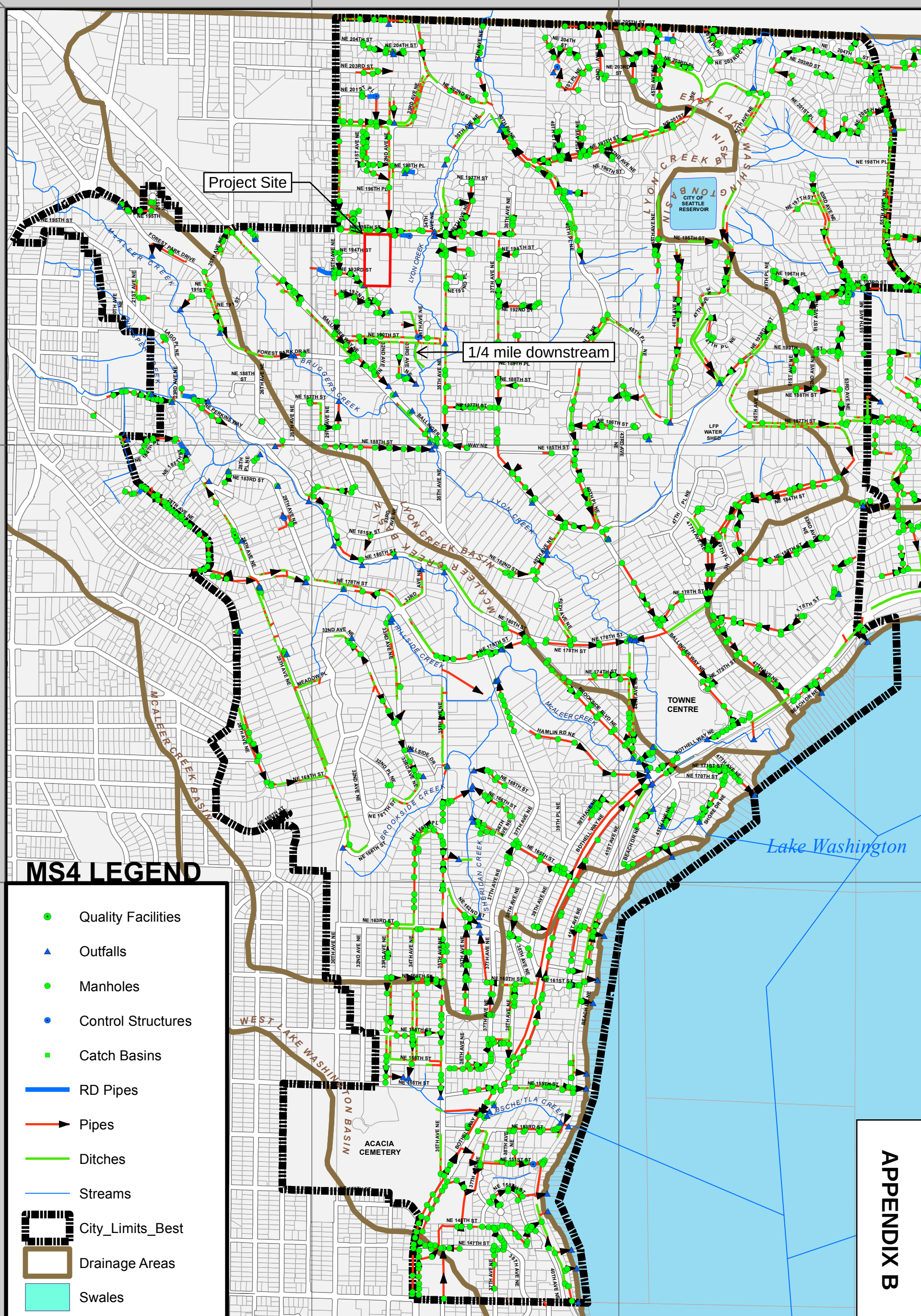

APPENDIX B

City of Lake Forest Park Engineering Department - September 2009
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CITY OF LAKE FOREST PARK
INCORPORATED 1961

LAKE FOREST PARK DRAINAGE SYSTEM MAP

N

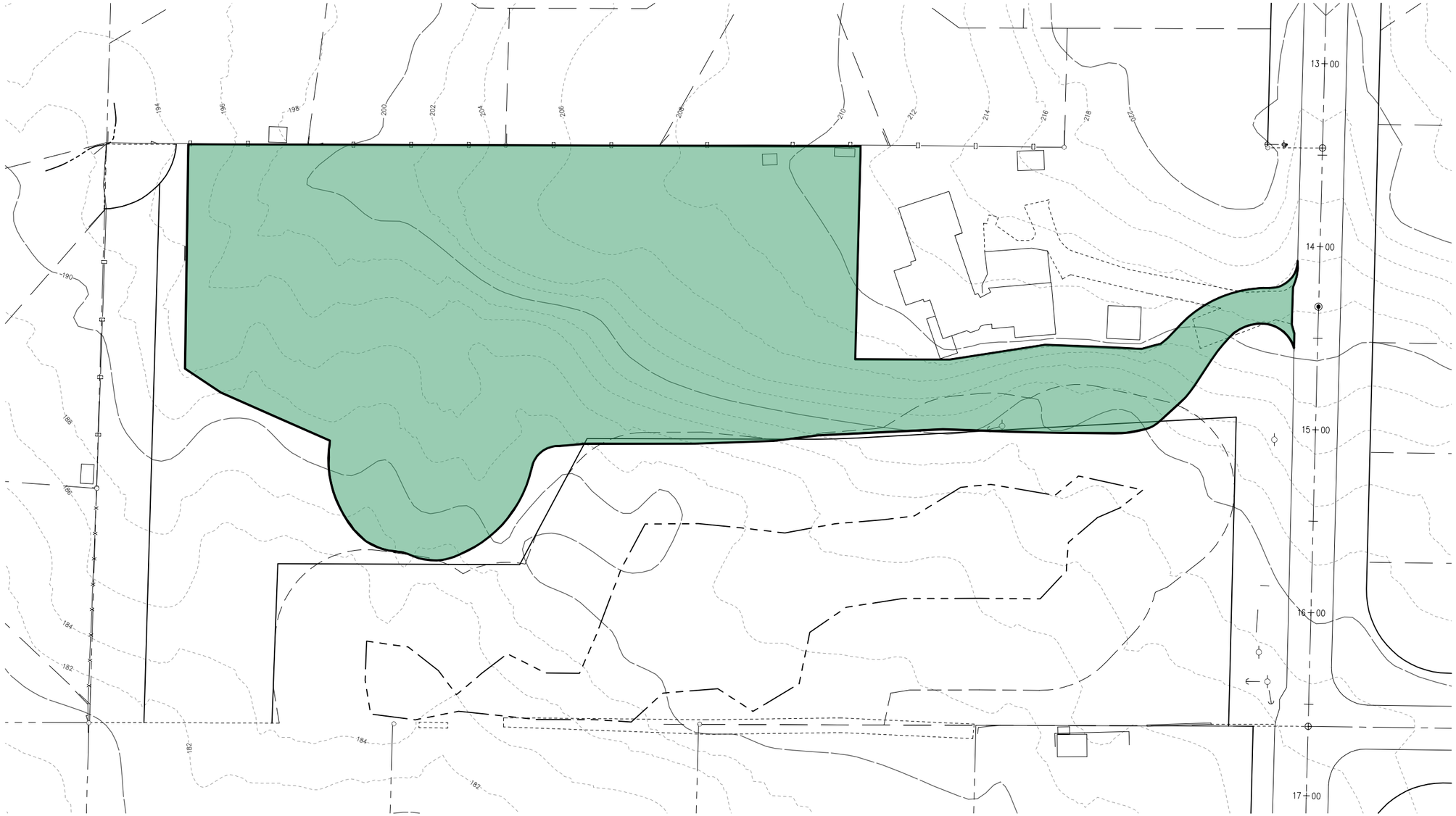
0 0.2 0.4 Mi

0 1,000 2,000 Feet

A PORTION OF THE NE 1/4 OF THE SE 1/4 OF SECTION 4, T 26 N, R 4 E, WM

NORTH

APPENDIX D



Undeveloped Area
1.67 Acres Forest, Moderate

EXISTING BASIN EXHIBIT
LABOSSIERE SHORT PLAT
PRELIMINARY PLAT
PLATS FINANCIAL GROUP LLC
LAKE FOREST PARK, WASHINGTON

JACK NAVARR STATE OF WASHINGTON 40272 REGISTERED PROFESSIONAL ENGINEER

DAVID EVANS AND ASSOCIATES INC.
1620 W. Marine View Drive, Suite 200
Everett Washington 98201
Phone: 425.259.4099

REVISIONS: APPD.

DATE: JANUARY, 2016
DESIGN: JNM
DRAWN: CLK
CHECKED: JNS
REVISION NUMBER:

SCALE: 1"=60'

PROJECT NUMBER:
PLFG00000002

DRAWING FILE:
Ec-EM-002-PLFG0002-existing Basin

SHEET NO.
1
OF 1

Plot Date: 1/11/2016 2:30 PM By: Agdt Coleman
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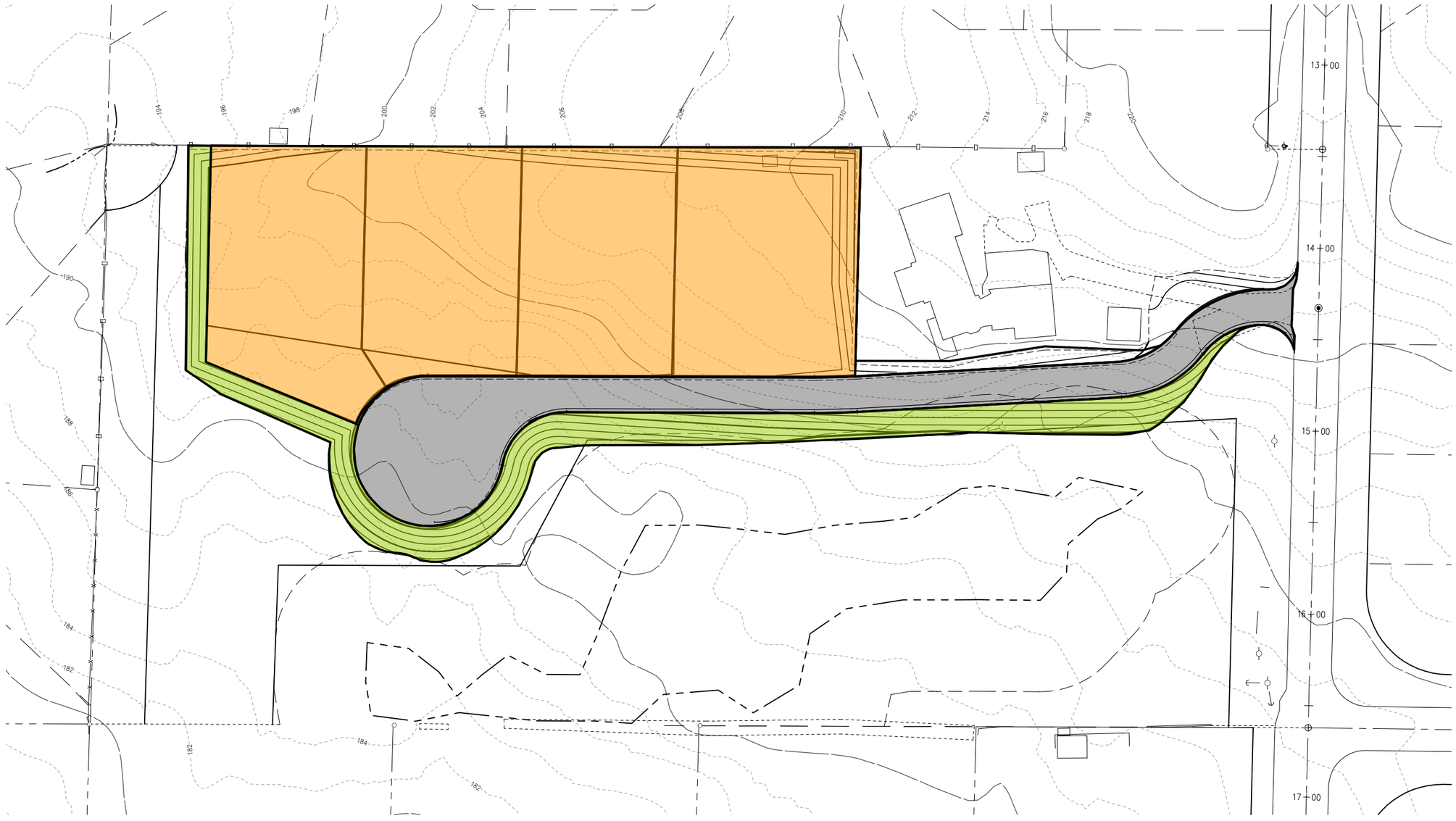
A PORTION OF THE NE 1/4 OF THE SE 1/4 OF SECTION 4, T 26 N, R 4 E, WM

NORTH



Lot Area
0.47 Acres Impervious (45%)
0.57 Acres Lawn, Flat

Access Road
0.34 Acres Impervious

Graded Area (sheet flow)
0.29 Acres Lawn, Steep

PROPOSED BASIN EXHIBIT

LABOSSIERE SHORT PLAT
PRELIMINARY PLAT

PLATS FINANCIAL GROUP LLC
LAKE FOREST PARK, WASHINGTON

DAVID EVANS AND ASSOCIATES INC.
1620 W. Marine View Drive, Suite 200
Everett Washington 98201
Phone: 425.259.4099

REVISIONS: APPD.

DATE: JANUARY, 2016
DESIGN: JNM
DRAWN: CLK
CHECKED: JNS
REVISION NUMBER:

SCALE: 1"=60'

PROJECT NUMBER:
PLFG00000002

DRAWING FILE:
Ec-EM-003-PLFG0002-proposed Basin

SHEET NO.
1
OF 1

Plot Date: 1/11/2016 2:29 PM By: April Coleman
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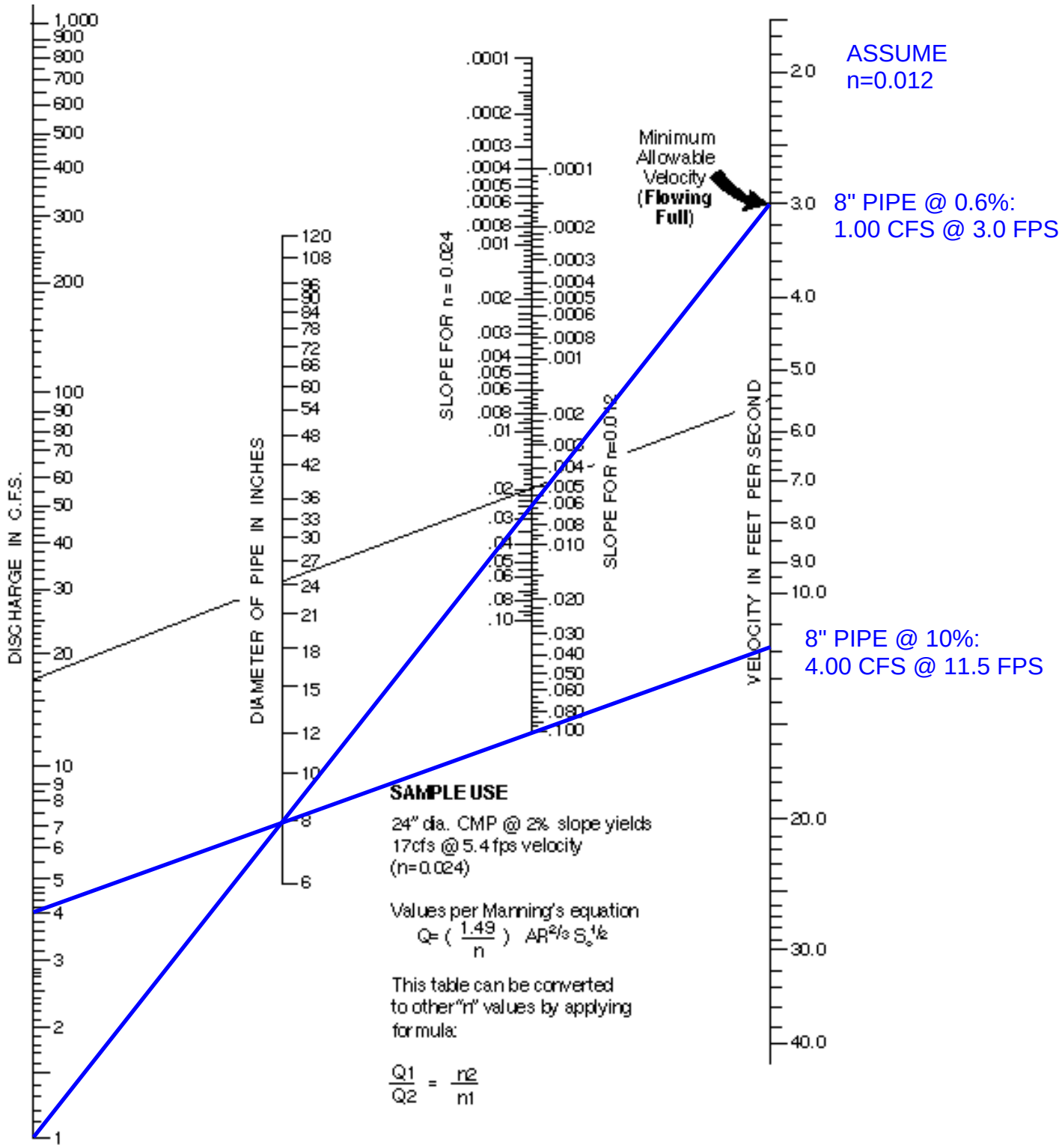
FIGURE 4.2.1.F NOMOGRAPH FOR SIZING CIRCULAR DRAINS FLOWING FULL



DAVID EVANS AND ASSOCIATES INC.

JOB DESCRIPTION La Bossiere Short Plat.
CALCULATION FOR CONVEYANCE & BACKWATER

JN. PLFG0000-0002.
BY ADC DATE 6-14-2016
SHEET ____ OF ____ SHEETS
CHECKED BY ____ DATE ____

PER NOMOGRAPH FROM FIGURE 4.2.1.F (2009 KCSWDM)

8"ϕ PVC PIPE @ 10% ⟹ 4.00 CFS @ 11.5 FPS (assuming n=0.012)

UNDETAINED DEVELOPED 25-YR PEAK FLOW = 0.48 CFS (SEE WWHM OUTPUT)

0.48 CFS < 4.00 CFS ⟹ OKAY

8"ϕ PVC PIPE @ 0.6% ⟹ 1.00 CFS @ 3.0 FPS

0.48 CFS < 1.00 CFS ⟹ OKAY

∴ 8" PVC PIPES HAVE SUFFICIENT CAPACITY

BACKWATER CALCULATIONS

FLOWS FROM MITIGATED SITE ARE NEARLY ZERO DUE TO HIGHER INFILTRATION RATE. UNDETAINED FLOWS ARE MINIMAL (~0.48 CFS)

AN 8" SD PIPE HAS CAPACITY TO SUPPORT TWICE AS MUCH FLOW AS THE UNDETAINED 25-YEAR PEAK FLOW.

∴ BACKWATER OF THE SITE IS NEGLIGIBLE

APPENDIX F

WWHM2012

PROJECT REPORT #1 OF 3

Project Name: UNDETAINED DEVELOPED CONDITIONS
Site Name: PLFG0002
Site Address: 2016-1-11 ADC
City : Lake Forest Park
Report Date: 1/11/2016
Gage : Seatac
Data Start : 1948/10/01
Data End : 2009/09/30
Precip Scale: 0.83
Version : 2015/09/09

Low Flow Threshold for POC 1 : 50 Percent of the 2 Year

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Mod	1.38
Pervious Total	1.38
Impervious Land Use	**acre**
Impervious Total	0
Basin Total	1.38

NOTE:
As these Undetained Developed Conditions are used for conveyance calculations, only those areas which generate runoff to be conveyed via PVC pipe are considered in this analysis.

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre

C, Lawn, Flat	.58
Pervious Total	0.58
Impervious Land Use	**acre**
ROADS FLAT	0.8
Impervious Total	0.8
Basin Total	1.38

Element Flows To:

Surface	Interflow	Groundwater

ANALYSIS RESULTS

Stream Protection Duration

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

Mitigated Landuse Totals for POC #1
Total Pervious Area:0.58
Total Impervious Area:0.8

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.026479
5 year	0.044397
10 year	0.054632
25 year	0.065344
50 year	0.071837
100 year	0.07724

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.265345
5 year	0.344416
10 year	0.400412
25 year	0.475469
50 year	0.534608
100 year	0.596591

WWHM2012

PROJECT REPORT #2 OF 3

Project Name: BIORETENTION CELL
Site Name: PLFG0002
Site Address: 3035 NE 195TH ST
City : LAKE FOREST PARK
Report Date: 6/21/2016 APDC
Gage : Seatac
Data Start : 1948/10/01
Data End : 2009/09/30
Precip Scale: 0.83
Version Date: 2016/02/25
Version : 4.2.12

Low Flow Threshold for POC 1 : 50 Percent of the 2 Year

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Mod	1.38
Pervious Total	1.38
Impervious Land Use	**acre**
Impervious Total	0
Basin Total	1.38

NOTE:
The 2:1 graded areas shown in Appendix D shall not be conveyed to the bioretention cell. Therefore, only 1.38 acres of the 1.67 acres are modeled within this report. Please see Project Report #3 for hydrologic analysis of the remaining 0.29 acres.

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Lawn, Flat	.58
Pervious Total	0.58

Impervious Land Use	acre
ROADS FLAT	0.8
Impervious Total	0.8
Basin Total	1.38

Element Flows To:

Surface	Interflow	Groundwater
Surface retention 1	Surface retention 1	

Name : Bioretention 1
Bottom Length: 50.00 ft.
Bottom Width: 50.00 ft.
Material thickness of first layer: 1.5
Material type for first layer: SMMWW 12 in/hr
Material thickness of second layer: 0
Material type for second layer: GRAVEL
Material thickness of third layer: 0
Material type for third layer: GRAVEL
Infiltration On
Infiltration rate: 4
Infiltration safety factor: 1
Total Volume Infiltrated (ac-ft.): 136.486
Total Volume Through Riser (ac-ft.): 0.012
Total Volume Through Facility (ac-ft.): 136.498
Percent Infiltrated: 99.99
Total Precip Applied to Facility: 9.494
Total Evap From Facility: 5.396
Underdrain not used
Discharge Structure
Riser Height: 1 ft.
Riser Diameter: 12 in.

Element Flows To:

Outlet 1	Outlet 2

Bioretention 1 Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.0799	0.0000	0.0000	0.0000
0.0330	0.0796	0.0009	0.0000	0.0000
0.0659	0.0791	0.0017	0.0000	0.0001
0.0989	0.0786	0.0026	0.0000	0.0002

0.1319	0.0780	0.0035	0.0000	0.0005
0.1648	0.0775	0.0044	0.0000	0.0008
0.1978	0.0770	0.0053	0.0000	0.0012
0.2308	0.0765	0.0062	0.0000	0.0017
0.2637	0.0759	0.0071	0.0000	0.0024
0.2967	0.0754	0.0081	0.0000	0.0031
0.3297	0.0749	0.0090	0.0000	0.0041
0.3626	0.0744	0.0099	0.0000	0.0051
0.3956	0.0739	0.0109	0.0000	0.0064
0.4286	0.0734	0.0118	0.0000	0.0078
0.4615	0.0728	0.0128	0.0000	0.0093
0.4945	0.0723	0.0138	0.0000	0.0110
0.5275	0.0718	0.0147	0.0000	0.0129
0.5604	0.0713	0.0157	0.0000	0.0150
0.5934	0.0708	0.0167	0.0000	0.0173
0.6264	0.0703	0.0177	0.0000	0.0198
0.6593	0.0698	0.0187	0.0000	0.0225
0.6923	0.0693	0.0197	0.0000	0.0254
0.7253	0.0688	0.0207	0.0000	0.0285
0.7582	0.0683	0.0218	0.0000	0.0318
0.7912	0.0678	0.0228	0.0000	0.0354
0.8242	0.0673	0.0238	0.0000	0.0391
0.8571	0.0668	0.0249	0.0000	0.0431
0.8901	0.0663	0.0259	0.0000	0.0474
0.9231	0.0659	0.0270	0.0000	0.0519
0.9560	0.0654	0.0281	0.0000	0.0566
0.9890	0.0649	0.0292	0.0000	0.0616
1.0220	0.0644	0.0302	0.0000	0.0668
1.0549	0.0639	0.0313	0.0000	0.0723
1.0879	0.0634	0.0324	0.0000	0.0781
1.1209	0.0630	0.0336	0.0000	0.0841
1.1538	0.0625	0.0347	0.0000	0.0904
1.1868	0.0620	0.0358	0.0000	0.0970
1.2198	0.0616	0.0369	0.0000	0.1038
1.2527	0.0611	0.0381	0.0000	0.1110
1.2857	0.0606	0.0392	0.0000	0.1184
1.3187	0.0601	0.0404	0.0000	0.1261
1.3516	0.0597	0.0415	0.0000	0.1341
1.3846	0.0592	0.0427	0.0000	0.1424
1.4176	0.0588	0.0439	0.0000	0.1510
1.4505	0.0583	0.0451	0.0000	0.1599
1.4835	0.0578	0.0463	0.0000	0.1690
1.5000	0.0574	0.0469	0.0000	0.1690

Surface retention 1 Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Wetted Surface
1.5000	0.0799	0.0469	0.0000	0.1690	0.0000
1.5330	0.0804	0.0495	0.0000	0.1690	0.0000
1.5659	0.0810	0.0522	0.0000	0.1690	0.0000
1.5989	0.0815	0.0549	0.0000	0.1690	0.0000
1.6319	0.0821	0.0576	0.0000	0.1690	0.0000
1.6648	0.0826	0.0603	0.0000	0.1690	0.0000
1.6978	0.0832	0.0630	0.0000	0.1690	0.0000
1.7308	0.0837	0.0658	0.0000	0.1690	0.0000
1.7637	0.0843	0.0685	0.0000	0.1690	0.0000
1.7967	0.0848	0.0713	0.0000	0.1690	0.0000
1.8297	0.0854	0.0741	0.0000	0.1690	0.0000

1.8626	0.0859	0.0769	0.0000	0.1690	0.0000
1.8956	0.0865	0.0798	0.0000	0.1690	0.0000
1.9286	0.0870	0.0826	0.0000	0.1690	0.0000
1.9615	0.0876	0.0855	0.0000	0.1690	0.0000
1.9945	0.0882	0.0884	0.0000	0.1690	0.0000
2.0275	0.0887	0.0913	0.0000	0.1690	0.0000
2.0604	0.0893	0.0943	0.0000	0.1690	0.0000
2.0934	0.0898	0.0972	0.0000	0.1690	0.0000
2.1264	0.0904	0.1002	0.0000	0.1690	0.0000
2.1593	0.0910	0.1032	0.0000	0.1690	0.0000
2.1923	0.0916	0.1062	0.0000	0.1690	0.0000
2.2253	0.0921	0.1092	0.0000	0.1690	0.0000
2.2582	0.0927	0.1123	0.0000	0.1690	0.0000
2.2912	0.0933	0.1153	0.0000	0.1690	0.0000
2.3242	0.0939	0.1184	0.0000	0.1690	0.0000
2.3571	0.0945	0.1215	0.0000	0.1690	0.0000
2.3901	0.0950	0.1246	0.0000	0.1690	0.0000
2.4231	0.0956	0.1278	0.0000	0.1690	0.0000
2.4560	0.0962	0.1309	0.0000	0.1690	0.0000
2.4890	0.0968	0.1341	0.0000	0.1690	0.0000
2.5220	0.0974	0.1373	0.0346	0.1690	0.0000
2.5549	0.0980	0.1406	0.1365	0.1690	0.0000
2.5879	0.0986	0.1438	0.2754	0.1690	0.0000
2.6209	0.0992	0.1471	0.4414	0.1690	0.0000
2.6538	0.0998	0.1503	0.6273	0.1690	0.0000
2.6868	0.1004	0.1536	0.8261	0.1690	0.0000
2.7198	0.1010	0.1569	1.0308	0.1690	0.0000
2.7527	0.1016	0.1603	1.2343	0.1690	0.0000
2.7857	0.1022	0.1636	1.4294	0.1690	0.0000
2.8187	0.1028	0.1670	1.6096	0.1690	0.0000
2.8516	0.1034	0.1704	1.7695	0.1690	0.0000
2.8846	0.1040	0.1738	1.9054	0.1690	0.0000
2.9176	0.1046	0.1773	2.0158	0.1690	0.0000
2.9505	0.1052	0.1807	2.1028	0.1690	0.0000
2.9835	0.1058	0.1842	2.1721	0.1690	0.0000
3.0000	0.1062	0.1860	2.2635	0.1690	0.0000

Name : Surface retention 1

Element Flows To:
Outlet 1 **Outlet 2**
Bioretention 1

ANALYSIS RESULTS

Stream Protection Duration

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

Mitigated Landuse Totals for POC #1
Total Pervious Area:0.58
Total Impervious Area:0.8

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.026479
5 year	0.044397
10 year	0.054632
25 year	0.065344
50 year	0.071837
100 year	0.07724

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0
5 year	0
10 year	0
25 year	0
50 year	0
100 year	0

Stream Protection Duration
Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.029	0.000
1950	0.036	0.000
1951	0.068	0.000
1952	0.019	0.000
1953	0.015	0.000
1954	0.024	0.000
1955	0.041	0.000
1956	0.033	0.000
1957	0.021	0.000
1958	0.027	0.000
1959	0.025	0.000
1960	0.036	0.000
1961	0.025	0.000
1962	0.013	0.000
1963	0.016	0.000
1964	0.027	0.000
1965	0.016	0.000
1966	0.018	0.000
1967	0.039	0.000
1968	0.025	0.000
1969	0.023	0.000
1970	0.017	0.000
1971	0.016	0.000
1972	0.050	0.000
1973	0.021	0.000
1974	0.022	0.000
1975	0.027	0.000
1976	0.021	0.000

1977	0.001	0.000
1978	0.018	0.000
1979	0.010	0.000
1980	0.032	0.000
1981	0.015	0.000
1982	0.020	0.000
1983	0.030	0.000
1984	0.017	0.000
1985	0.009	0.000
1986	0.051	0.000
1987	0.039	0.000
1988	0.014	0.000
1989	0.011	0.000
1990	0.079	0.000
1991	0.058	0.000
1992	0.019	0.000
1993	0.020	0.000
1994	0.005	0.000
1995	0.033	0.000
1996	0.068	0.000
1997	0.056	0.000
1998	0.011	0.000
1999	0.039	0.000
2000	0.022	0.000
2001	0.003	0.000
2002	0.024	0.000
2003	0.027	0.000
2004	0.030	0.091
2005	0.024	0.000
2006	0.036	0.000
2007	0.065	0.000
2008	0.082	0.022
2009	0.044	0.000

Stream Protection Duration
Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0822	0.0909
2	0.0787	0.0219
3	0.0685	0.0000
4	0.0678	0.0000
5	0.0653	0.0000
6	0.0579	0.0000
7	0.0564	0.0000
8	0.0510	0.0000
9	0.0503	0.0000
10	0.0440	0.0000
11	0.0408	0.0000
12	0.0394	0.0000
13	0.0393	0.0000
14	0.0386	0.0000
15	0.0363	0.0000
16	0.0360	0.0000
17	0.0358	0.0000
18	0.0330	0.0000
19	0.0328	0.0000

20	0.0320	0.0000
21	0.0301	0.0000
22	0.0297	0.0000
23	0.0294	0.0000
24	0.0275	0.0000
25	0.0274	0.0000
26	0.0274	0.0000
27	0.0269	0.0000
28	0.0251	0.0000
29	0.0246	0.0000
30	0.0246	0.0000
31	0.0244	0.0000
32	0.0243	0.0000
33	0.0242	0.0000
34	0.0227	0.0000
35	0.0223	0.0000
36	0.0217	0.0000
37	0.0214	0.0000
38	0.0211	0.0000
39	0.0208	0.0000
40	0.0201	0.0000
41	0.0200	0.0000
42	0.0190	0.0000
43	0.0185	0.0000
44	0.0185	0.0000
45	0.0178	0.0000
46	0.0170	0.0000
47	0.0166	0.0000
48	0.0165	0.0000
49	0.0160	0.0000
50	0.0157	0.0000
51	0.0154	0.0000
52	0.0153	0.0000
53	0.0141	0.0000
54	0.0129	0.0000
55	0.0114	0.0000
56	0.0114	0.0000
57	0.0101	0.0000
58	0.0095	0.0000
59	0.0051	0.0000
60	0.0025	0.0000
61	0.0009	0.0000

Stream Protection Duration
POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0132	17943	13	0	Pass
0.0138	16324	13	0	Pass
0.0144	14970	13	0	Pass
0.0150	13723	12	0	Pass
0.0156	12639	12	0	Pass
0.0162	11674	11	0	Pass

0.0168	10814	11	0	Pass
0.0174	10012	11	0	Pass
0.0180	9276	11	0	Pass
0.0186	8645	11	0	Pass
0.0192	8068	11	0	Pass
0.0198	7565	11	0	Pass
0.0203	7099	11	0	Pass
0.0209	6667	11	0	Pass
0.0215	6256	11	0	Pass
0.0221	5865	8	0	Pass
0.0227	5497	8	0	Pass
0.0233	5114	8	0	Pass
0.0239	4770	8	0	Pass
0.0245	4487	8	0	Pass
0.0251	4218	8	0	Pass
0.0257	3995	8	0	Pass
0.0263	3747	8	0	Pass
0.0269	3531	8	0	Pass
0.0274	3324	8	0	Pass
0.0280	3142	7	0	Pass
0.0286	2943	7	0	Pass
0.0292	2766	7	0	Pass
0.0298	2607	7	0	Pass
0.0304	2464	7	0	Pass
0.0310	2321	7	0	Pass
0.0316	2171	7	0	Pass
0.0322	2049	7	0	Pass
0.0328	1942	7	0	Pass
0.0334	1836	7	0	Pass
0.0340	1751	7	0	Pass
0.0345	1642	7	0	Pass
0.0351	1525	7	0	Pass
0.0357	1422	7	0	Pass
0.0363	1333	7	0	Pass
0.0369	1267	6	0	Pass
0.0375	1199	6	0	Pass
0.0381	1132	6	0	Pass
0.0387	1068	6	0	Pass
0.0393	1014	6	0	Pass
0.0399	964	6	0	Pass
0.0405	927	6	0	Pass
0.0411	889	6	0	Pass
0.0417	853	6	0	Pass
0.0422	809	6	0	Pass
0.0428	769	6	0	Pass
0.0434	730	6	0	Pass
0.0440	693	6	0	Pass
0.0446	655	6	0	Pass
0.0452	632	6	0	Pass
0.0458	605	6	0	Pass
0.0464	558	6	1	Pass
0.0470	530	6	1	Pass
0.0476	506	6	1	Pass
0.0482	480	6	1	Pass
0.0488	446	6	1	Pass
0.0493	413	6	1	Pass
0.0499	380	6	1	Pass

0.0505	341	6	1	Pass
0.0511	305	6	1	Pass
0.0517	285	5	1	Pass
0.0523	268	5	1	Pass
0.0529	250	5	2	Pass
0.0535	231	5	2	Pass
0.0541	216	4	1	Pass
0.0547	199	4	2	Pass
0.0553	185	4	2	Pass
0.0559	167	4	2	Pass
0.0564	151	4	2	Pass
0.0570	128	4	3	Pass
0.0576	117	4	3	Pass
0.0582	109	4	3	Pass
0.0588	100	4	4	Pass
0.0594	91	4	4	Pass
0.0600	77	4	5	Pass
0.0606	72	3	4	Pass
0.0612	65	3	4	Pass
0.0618	55	3	5	Pass
0.0624	47	3	6	Pass
0.0630	45	3	6	Pass
0.0636	40	3	7	Pass
0.0641	32	3	9	Pass
0.0647	27	3	11	Pass
0.0653	19	3	15	Pass
0.0659	12	3	25	Pass
0.0665	10	3	30	Pass
0.0671	8	3	37	Pass
0.0677	5	3	60	Pass
0.0683	4	3	75	Pass
0.0689	3	3	100	Pass
0.0695	3	2	66	Pass
0.0701	3	2	66	Pass
0.0707	3	2	66	Pass
0.0712	3	2	66	Pass
0.0718	3	2	66	Pass

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0 **acre-feet**
On-line facility target flow: 0 **cfs.**
Adjusted for 15 min: 0 **cfs.**
Off-line facility target flow: 0 **cfs.**
Adjusted for 15 min: 0 **cfs.**

LID Report

LID Technique	Used for Water Quality?	Total Volumn Needs Treatment (ac-ft)	Volumn Through Facility (ac-ft)	Infiltration Volumn (ac-ft.)	Cumulative Volumn Infiltration Credit	Percent Volumn Infiltrated	Percent Treated
retention 1 POC	N	124.21			N	99.99	

Total Volume Infiltrated 124.21 0.00 0.00
99.99 0.00 0% No Treat. Credit
Compliance with LID Standard 8
Duration Analysis Result = Passed

Perlnd and Implnd Changes

No changes have been made.

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WWHM2012

PROJECT REPORT #3 OF 3

Project Name: SHEET FLOW FOR REMAINING DEVELOPED AREA
Site Name: PLFG0002
Site Address: 2016-1-12 ADC
City : Lake Forest Park
Report Date: 1/12/2016
Gage : Seatac
Data Start : 1948/10/01
Data End : 2009/09/30
Precip Scale: 0.83
Version : 2015/09/09

Low Flow Threshold for POC 1 : 50 Percent of the 2 Year

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Mod	1.67
Pervious Total	1.67

Impervious Land Use	acre
Impervious Total	0
Basin Total	1.67

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre

C, Lawn, Steep	.29
Pervious Total	0.29
Impervious Land Use	**acre**
Impervious Total	0
Basin Total	0.29

Element Flows To:

Surface	Interflow	Groundwater

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:1.67
Total Impervious Area:0

Mitigated Landuse Totals for POC #1
Total Pervious Area:0.29
Total Impervious Area:0

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.032043
5 year	0.053727
10 year	0.066112
25 year	0.079076
50 year	0.086933
100 year	0.093472

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.019929
5 year	0.035102
10 year	0.047487
25 year	0.06586
50 year	0.081569
100 year	0.099052

Stream Protection Duration

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.036	0.041
1950	0.044	0.042
1951	0.082	0.024
1952	0.023	0.011
1953	0.019	0.008
1954	0.030	0.014
1955	0.049	0.019
1956	0.040	0.024
1957	0.025	0.023
1958	0.033	0.015
1959	0.030	0.012
1960	0.044	0.026
1961	0.030	0.015
1962	0.016	0.008
1963	0.019	0.016
1964	0.033	0.020
1965	0.019	0.023
1966	0.022	0.011
1967	0.047	0.044
1968	0.030	0.020
1969	0.028	0.021
1970	0.020	0.017
1971	0.020	0.021
1972	0.061	0.037
1973	0.026	0.010
1974	0.027	0.023
1975	0.033	0.027
1976	0.026	0.018
1977	0.001	0.009
1978	0.022	0.016
1979	0.012	0.007
1980	0.039	0.057
1981	0.019	0.015
1982	0.024	0.038
1983	0.036	0.022
1984	0.021	0.010
1985	0.011	0.012
1986	0.062	0.025
1987	0.048	0.023
1988	0.017	0.009
1989	0.014	0.006
1990	0.095	0.091
1991	0.070	0.052
1992	0.022	0.017
1993	0.024	0.011
1994	0.006	0.006
1995	0.040	0.014
1996	0.083	0.046
1997	0.068	0.028
1998	0.014	0.019
1999	0.048	0.068
2000	0.026	0.017
2001	0.003	0.004
2002	0.029	0.029
2003	0.033	0.036

2004	0.036	0.038
2005	0.029	0.021
2006	0.043	0.020
2007	0.079	0.083
2008	0.100	0.062
2009	0.053	0.030

Stream Protection Duration
Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0995	0.0907
2	0.0952	0.0834
3	0.0829	0.0676
4	0.0820	0.0620
5	0.0790	0.0575
6	0.0700	0.0520
7	0.0682	0.0458
8	0.0617	0.0437
9	0.0609	0.0422
10	0.0532	0.0406
11	0.0493	0.0378
12	0.0477	0.0376
13	0.0475	0.0373
14	0.0467	0.0359
15	0.0439	0.0297
16	0.0436	0.0287
17	0.0433	0.0277
18	0.0400	0.0270
19	0.0397	0.0263
20	0.0387	0.0245
21	0.0364	0.0244
22	0.0359	0.0241
23	0.0356	0.0233
24	0.0333	0.0232
25	0.0332	0.0227
26	0.0332	0.0225
27	0.0326	0.0216
28	0.0304	0.0214
29	0.0298	0.0210
30	0.0298	0.0206
31	0.0296	0.0203
32	0.0294	0.0203
33	0.0293	0.0202
34	0.0275	0.0188
35	0.0270	0.0186
36	0.0263	0.0184
37	0.0259	0.0170
38	0.0255	0.0169
39	0.0252	0.0168
40	0.0244	0.0159
41	0.0242	0.0158
42	0.0229	0.0150
43	0.0224	0.0147
44	0.0224	0.0146
45	0.0216	0.0144
46	0.0206	0.0139

47	0.0201	0.0117
48	0.0200	0.0115
49	0.0194	0.0114
50	0.0190	0.0111
51	0.0187	0.0109
52	0.0186	0.0104
53	0.0171	0.0103
54	0.0157	0.0095
55	0.0138	0.0085
56	0.0138	0.0078
57	0.0122	0.0076
58	0.0115	0.0069
59	0.0062	0.0063
60	0.0031	0.0056
61	0.0011	0.0044

Stream Protection Duration
POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0160	17913	1192	6	Pass
0.0167	16337	1029	6	Pass
0.0175	14970	875	5	Pass
0.0182	13710	748	5	Pass
0.0189	12639	615	4	Pass
0.0196	11665	515	4	Pass
0.0203	10825	421	3	Pass
0.0210	10016	336	3	Pass
0.0218	9272	285	3	Pass
0.0225	8645	232	2	Pass
0.0232	8064	199	2	Pass
0.0239	7565	170	2	Pass
0.0246	7105	150	2	Pass
0.0253	6667	136	2	Pass
0.0260	6256	122	1	Pass
0.0268	5863	110	1	Pass
0.0275	5491	94	1	Pass
0.0282	5118	75	1	Pass
0.0289	4770	60	1	Pass
0.0296	4485	52	1	Pass
0.0303	4216	47	1	Pass
0.0311	3993	45	1	Pass
0.0318	3749	42	1	Pass
0.0325	3531	41	1	Pass
0.0332	3322	41	1	Pass
0.0339	3142	40	1	Pass
0.0346	2941	40	1	Pass
0.0354	2766	39	1	Pass
0.0361	2607	35	1	Pass
0.0368	2464	32	1	Pass
0.0375	2323	31	1	Pass
0.0382	2171	29	1	Pass
0.0389	2050	27	1	Pass

0.0397	1944	27	1	Pass
0.0404	1836	23	1	Pass
0.0411	1750	22	1	Pass
0.0418	1642	20	1	Pass
0.0425	1524	16	1	Pass
0.0432	1422	16	1	Pass
0.0440	1333	14	1	Pass
0.0447	1267	13	1	Pass
0.0454	1199	13	1	Pass
0.0461	1131	12	1	Pass
0.0468	1068	12	1	Pass
0.0475	1014	12	1	Pass
0.0483	964	12	1	Pass
0.0490	927	12	1	Pass
0.0497	889	12	1	Pass
0.0504	853	11	1	Pass
0.0511	809	11	1	Pass
0.0518	769	10	1	Pass
0.0526	730	9	1	Pass
0.0533	693	8	1	Pass
0.0540	655	7	1	Pass
0.0547	632	7	1	Pass
0.0554	606	7	1	Pass
0.0561	558	7	1	Pass
0.0568	530	7	1	Pass
0.0576	506	6	1	Pass
0.0583	480	6	1	Pass
0.0590	446	6	1	Pass
0.0597	409	6	1	Pass
0.0604	379	6	1	Pass
0.0611	341	6	1	Pass
0.0619	305	6	1	Pass
0.0626	285	5	1	Pass
0.0633	268	5	1	Pass
0.0640	250	5	2	Pass
0.0647	231	4	1	Pass
0.0654	216	4	1	Pass
0.0662	199	4	2	Pass
0.0669	185	4	2	Pass
0.0676	167	3	1	Pass
0.0683	151	3	1	Pass
0.0690	128	3	2	Pass
0.0697	117	2	1	Pass
0.0705	109	2	1	Pass
0.0712	100	2	2	Pass
0.0719	91	2	2	Pass
0.0726	77	2	2	Pass
0.0733	72	2	2	Pass
0.0740	65	2	3	Pass
0.0748	55	2	3	Pass
0.0755	47	2	4	Pass
0.0762	45	2	4	Pass
0.0769	40	2	5	Pass
0.0776	32	2	6	Pass
0.0783	27	2	7	Pass
0.0791	19	2	10	Pass
0.0798	12	2	16	Pass

0.0805	10	2	20	Pass
0.0812	8	2	25	Pass
0.0819	5	2	40	Pass
0.0826	4	2	50	Pass
0.0834	3	2	66	Pass
0.0841	3	1	33	Pass
0.0848	3	1	33	Pass
0.0855	3	1	33	Pass
0.0862	3	1	33	Pass
0.0869	3	1	33	Pass

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0 **acre-feet**
On-line facility target flow: 0 **cfs.**
Adjusted for 15 min: 0 **cfs.**
Off-line facility target flow: 0 **cfs.**
Adjusted for 15 min: 0 **cfs.**

LID Report

LID Technique	Used for Water Quality Treatment?	Percent Treated	Total Volumn Needs Treatment (ac-ft)	Volumn Through Facility (ac-ft)	Infiltration Volumn (ac-ft.)	Cumulative Volumn Infiltrated	Percent Volumn Infiltration Credit	Comment

Perlnd and Implnd Changes

No changes have been made.

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APPENDIX G

Earth Solutions NW LLC

Geotechnical Engineering
Geology
Environmental Scientists
Construction Monitoring

EARTH SOLUTIONS NW 10 YEARS OF EXCELLENCE BELLEVUE, WA. 2005 2015

GEOTECHNICAL ENGINEERING STUDY
PROPOSED SHORT PLAT
3035 - NORTHEAST 195th STREET
LAKE FOREST PARK, WASHINGTON

ES-4195

1805 - 136th Place N.E., Suite 201 Bellevue, WA 98005
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PREPARED FOR

PLATS FINANCIAL GROUP, LLC

December 18, 2015

For: **Adam Z. Shier, G.I.T.**
Staff Geologist

Raymond A. Coglas, P.E.
Principal

GEOTECHNICAL ENGINEERING STUDY
PROPOSED SHORT PLAT
3035 - NORTHEAST 195th STREET
LAKE FOREST PARK, WASHINGTON

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Toll Free: 866-336-8710

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

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

Read the Full Report

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

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

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

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

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

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

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

Subsurface Conditions Can Change

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

Most Geotechnical Findings Are Professional Opinions

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

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

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

Do Not Redraw the Engineer's Logs

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

Give Contractors a Complete Report and Guidance

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

Read Responsibility Provisions Closely

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

Geoenvironmental Concerns Are Not Covered

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

Obtain Professional Assistance To Deal with Mold

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

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

ASFE
The Best People on Earth

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IIGER06045.0M

Earth Solutions NW LLC

• Geotechnical Engineering
• Construction Monitoring
• Environmental Sciences

December 18, 2015
ES-4195

Plats Financial Group, LLC
720 – Cedar Avenue, Suite C
Marysville, Washington 98270

Dear Mr. Nickerson:

Earth Solutions NW, LLC (ESNW) is pleased to present this report titled "Geotechnical Engineering Study, Proposed Short Plat, 3035 - Northeast 195th Street, Lake Forest Park, Washington". In our opinion, construction of a residential short plat is feasible from a geotechnical standpoint. Our investigation indicates the site is underlain primarily by Vashon advance outwash. During our subsurface exploration completed on November 27, 2015, groundwater seepage was observed at seven of the nine test pit locations. The groundwater seepage can be characterized as in a perched condition observed at depths of about three to eight and a half feet below current elevations. Seepage should be expected during grading activities, particularly during winter, spring and early summer months.

In our opinion, the proposed residential structures may be supported on conventional continuous and spread footing foundations bearing on competent native soil, recompacted native soil, or new structural fill. In general, competent native soil suitable for support of new foundations should be encountered within the upper two to three feet of existing grades. Where loose or unsuitable soil conditions are exposed at foundation subgrade elevations, compaction of the soils to the specifications of structural fill, or overexcavation and replacement with a suitable structural fill material, will be necessary.

Infiltration into the native Vashon advance outwash is feasible from a geotechnical standpoint provided the proposed facility base elevations advance through the upper silty sands and into the relatively clean outwash deposits at depth.

Recommendations for foundation design, site preparation, drainage, and other pertinent development aspects are provided in this study. We appreciate the opportunity to be of service to you on this project. If you have questions regarding the content of this geotechnical engineering study, please call.

Sincerely,

EARTH SOLUTIONS NW, LLC

Samuel M. Rogers
For: Adam Z. Shier, G.I.T.
Staff Geologist

1805 - 136th Place N.E., Suite 201 • Bellevue, WA 98005 • (425) 449-4704 • FAX (425) 449-4711

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ES-4195

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Plate 1	**Vicinity Map**
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APPENDICES

Appendix A	**Subsurface Exploration Test Pit Logs**
Appendix B	**Laboratory Test Results**

GEOTECHNICAL ENGINEERING STUDY
PROPOSED SHORT PLAT
3035 - NORTHEAST 195th STREET
LAKE FOREST PARK, WASHINGTON

ES-4195

INTRODUCTION

General

This geotechnical engineering study was prepared for the proposed residential short plat to be completed at 3035 - Northeast 195th Street in Lake Forest Park, Washington. The purpose of this study was to provide geotechnical recommendations for currently proposed development plans. Our scope of services for completing this geotechnical engineering study included the following:

- Completing subsurface test pits for purposes of characterizing site soils;
- Completing laboratory testing of soil samples collected at the test pit locations;
- Preliminary infiltration evaluation;
- Conducting engineering analyses, and;
- Preparation of this report.

The following documents and maps were reviewed as part of our report preparation:

- 2009 King County Surface Water Design Manual
- Geologic Map of Edmonds East and part of the Edmonds West Quadrangles, by Minard, J.P., 1983;
- Liquefaction Susceptibility of King County (Map 11-5), prepared by the King County Flood Control District, May 2010, and;
- Preliminary Site Plan.

Project Description

We understand the subject property will be developed with a residential short plat and related infrastructure improvements. The referenced plans shows four proposed residential lots located along the west property line with finish floor elevations between 201 and 203. A shared access driveway will be constructed along the central section of the property in order to provide ingress to each proposed residential lot. Stormwater will likely be managed by utilizing in-situ infiltration facilities where feasible.

At the time of report submission, specific building plans were not available for review; however, based on our experience with similar developments, the proposed residential structures will likely be two to three stories in height and constructed utilizing relatively lightly-loaded wood framing supported on conventional foundations. We anticipate the residential structures will incorporate slab-on-grade floors or crawl space construction at grade. We anticipate perimeter footing loads on the order of 1 to 2 kips per lineal foot (klf). Slab-on-grade loading is anticipated to be on the order of 150 pounds per square foot (psf).

If the above design assumptions are incorrect or change, ESNW should be contacted to review the recommendations in this report. ESNW should review final designs to confirm that our geotechnical recommendations have been incorporated into the plans.

SITE CONDITIONS

Surface

The subject site is located directly southwest of the intersection between 32nd Avenue Northeast and Northeast 195th Street in Lake Forest Park, Washington. The approximate location of the property is illustrated on Plate 1 (Vicinity Map). The rectangular property is comprised of one tax parcel (King County Parcel No. 615290-0030) totaling approximately 4.0 acres. The site is bordered to the south, west, and east by single-family residential lots and to the north by Northeast 195th Street.

Site topographic change may be characterized as "gentle" within the western, development area of the site, with elevation change on the order of 15 feet or less. Site gradients generally increase to the west from the topographic low located near the east property boundary. We estimate total grade change across the property is on the order of 25 feet. Existing vegetation is comprised primarily of dense, native tree and brush cover.

Subsurface

An ESNW representative observed, logged, and sampled nine test pits excavated at accessible locations within the topographically higher, western portion of the site, on November 27, 2015 using a mini-trackhoe and operator retained by our firm. The test pits were completed for purposes of assessing soil conditions, classifying site soils, and investigating the presence of groundwater below the existing ground surface. The approximate locations of the test pits are depicted on Plate 2 (Test Pit Location Plan). Please refer to the test pit logs provided in Appendix A for a more detailed description of subsurface conditions. Soil samples collected at the test pit locations were analyzed in accordance with both United States Department of Agriculture (USDA) and Unified Soil Classification System (USCS) methods and procedures.

Topsoil and Fill

Where undisturbed, forested conditions were encountered, topsoil was encountered generally within the upper 8 to 18 inches of existing grades at the test pit locations. The topsoil was characterized by brown and dark brown color, the presence of fine organic material, and small root intrusions.

Fill was not encountered at the test pit locations during our fieldwork. It is possible fill may be encountered within proximity to existing improvements. Where fill is encountered during construction, ESNW should be consulted to evaluate the in-situ competency of the fill and/or the potential for the fill to be re-used as structural fill.

Native Soil

Underlying the top soil at Test Pits TP-1, TP-3 and TP-9, deposits of loose to medium dense silty sand with varying amounts of gravel (USCS: SM) were encountered. The surficial soils were underlain by medium dense poorly-graded sands with varying amounts of gravel (USCS: SP) at depths of four to five feet below existing grade. Underlying the top soil at Test Pits TP-2, and TP-4 through TP-8, surficial deposits of medium dense to dense poorly graded sand with and without significant silt content (USCS: SP-SM and SP, respectively) was encountered, extending to the bottom of the explorations.

Geologic Setting

The referenced geologic map resource identifies Vashon advance outwash deposits (Qva) across the subject site. According to the geologic map resource, Vashon advance outwash is typically well-sorted sand and gravel which was deposited by streams issuing from the advancing ice sheet. Based on our observations at the test pit locations, it is our opinion site soils are consistent with the geologic mapping outlined in this section.

Groundwater

During our subsurface exploration completed on November 27, 2015, groundwater seepage was encountered at the test pit locations TP-3 through TP-9. The groundwater seepage can be characterized as a perched condition and was observed at depths of about three to eight and one-half feet below current elevations. It is our opinion, perched groundwater seepage zones may be encountered during construction, particularly within excavations at depth for utility improvements. Groundwater seepage rates and elevations fluctuate depending on many factors, including precipitation duration and intensity, the time of year, and soil conditions. In general, groundwater flow rates are higher during the wetter, winter months.

DISCUSSION AND RECOMMENDATIONS

General

In our opinion, construction of the proposed residential short plat is feasible from a geotechnical standpoint. The primary geotechnical considerations associated with the proposed development include foundation support, slab-on-grade subgrade support, and the suitability of using on-site soils as structural fill.

In our opinion, the proposed residential structures may be supported on conventional continuous and spread footing foundations bearing on competent native soil, recompacted native soil, or new structural fill. In general, competent native soil suitable for support of new foundations will be encountered within the upper two to three feet of existing grades. Where loose or unsuitable soil conditions are exposed at foundation subgrade elevations, compaction of the soils to the specifications of structural fill, or overexcavation and replacement with a suitable structural fill material, will be necessary.

Infiltration into the native Vashon advance outwash is feasible from a geotechnical standpoint provided the proposed facility base elevations advance through the upper silty sands and into the relatively clean outwash deposits at depth. Please see the infiltration feasibility section later in this report.

This study has been prepared for the exclusive use of Plats Financial Group, LLC and their representatives. No warranty, expressed or implied, is made. This study has been prepared in a manner consistent with the level of care and skill ordinarily exercised by other members of the profession currently practicing under similar conditions in this area.

Site Preparation and Earthwork

Initial site preparation activities will consist of installing temporary erosion control measures, establishing grading limits, removing existing structural improvements, and performing clearing and site stripping. Subsequent earthwork activities will involve site grading and related infrastructure improvements.

Temporary Erosion Control

The referenced site plan indicates egress will be provided from Northeast 195th Street. Prior to finish grading and paving, temporary construction entrances and drive lanes, consisting of at least 12 inches of quarry spalls, should be considered in order to minimize off-site soil tracking and to provide a stable access entrance surface. Geotextile fabric may also be placed under the quarry spalls to provide greater stability of the temporary construction entrance.

Additional erosion control measures should consist of silt fencing placed around down gradient margins of the site. Soil stockpiles should be covered or otherwise protected to reduce soil erosion. Temporary approaches for controlling surface water runoff should be established prior to beginning earthwork activities.

Stripping

In general, where undisturbed, forested conditions were encountered, topsoil was observed within the upper 8 to 18 inches of existing grades at the test pit locations. ESNW should be retained to observe site stripping activities at the time of construction. Over-stripping may result in increased project development costs and should be avoided. Topsoil and organic-rich soil is neither suitable for foundation support nor is it suitable for use as structural fill. Topsoil and organic-rich soil can be used in non-structural areas if desired.

In-situ Soils

From a geotechnical standpoint, our field observations indicate on-site soils likely to be encountered during construction will be suitable for use as structural fill, provided the soil moisture content is at (or slightly above) the optimum level at the time of placement and compaction. Site soils nearest to existing surface grades should be considered moisture sensitive, and successful use of on-site soils as structural fill will largely be dictated by the moisture content at the time of placement and compaction.

In general, soil that is near, or slightly above, the optimum moisture content at the time of placement and compaction may be used as structural fill. Conversely, soil that is found to be dry of optimum at the time of installation will likely require moisture conditioning (typically achieved through the application of water) prior to soil compaction. Soil encountered during site excavations that is excessively over the optimum moisture content will likewise require moisture conditioning (typically achieved through soil aeration) prior to placement and compaction. It should be emphasized native material should not be placed and compacted dry of the optimum moisture content, especially in site utility trench applications. If the on-site soils cannot be successfully compacted, the use of an imported soil may be necessary.

In our opinion, if grading activities take place during months of heavy rainfall activity, a contingency should be provided in the project budget for export of soil that cannot be successfully compacted as structural fill and import of granular structural fill. Silty sand and soils with fines contents greater than 5 percent typically degrade rapidly when exposed to periods of rainfall.

Imported Soils

Where necessary, imported soil intended for use as structural fill should consist of a well-graded granular soil with a moisture content that is at or slightly above the optimum level. During wet weather conditions, imported soil intended for use as structural fill should consist of a well-graded granular soil with a fines content of 5 percent or less (defined as the percent passing the Number 200 sieve, based on the minus three-quarter inch fraction).

Subgrade Preparation

Grading activities will likely be necessary in order to establish proposed subgrade and/or finish grade elevations for the proposed structures. Uniform compaction of the foundation and slab subgrade areas will establish a relatively consistent subgrade condition below the foundation and slab elements. ESNW should observe the compacted subgrade prior to placing formwork, particularly where existing structures have been removed.

Structural Fill

Structural fill is defined as compacted soil placed in foundation, slab-on-grade, and roadway areas. Fills placed to construct permanent slopes and throughout retaining wall and utility trench backfill areas are also considered structural fill. Soils placed in structural areas should be placed in loose lifts of 12 inches or less and compacted to a relative compaction of at least 90 percent, based on the laboratory maximum dry density as determined by the Modified Proctor Method (ASTM D1557). Soil placed in the upper 12 inches of slab-on-grade, utility trench, and pavement areas should be compacted to a relative compaction of at least 95 percent. More stringent compaction specifications may be required for utility trench backfill zones depending on the responsible utility district or jurisdiction.

Foundations

In our opinion, the proposed residential structures may be supported on conventional continuous and spread footing foundations bearing on competent native soil, recompacted native soil, or new structural fill. In general, competent native soil suitable for support of new foundations will be encountered within the upper two to three feet of existing grades. Where loose or unsuitable soil conditions are exposed at foundation subgrade elevations, compaction of the soils to the specifications of structural fill, or overexcavation and replacement with a suitable structural fill material, will be necessary.

Provided foundations will be supported as described above, the following parameters may be used for design:

- Allowable soil bearing capacity — 2,500 psf
- Passive earth pressure — 300 pcf (equivalent fluid)
- Coefficient of friction — 0.35

A one-third increase in the allowable soil bearing capacity may be assumed for short-term wind and seismic loading conditions. The above passive pressure and friction values include a minimum factor-of-safety of 1.5. With structural loading as expected, total settlement in the range of one inch, as well as differential settlement of approximately one-half inch, is anticipated. The majority of the settlements should occur during construction as dead loads are applied.

Seismic Design

The 2012 International Building Code recognizes the American Society of Civil Engineers (ASCE) for seismic site class definitions. In accordance with Table 20.3-1 of the ASCE Minimum Design Loads for Buildings and Other Structures manual, Site Class D should be used for design.

The referenced liquefaction susceptibility map indicates the site and surrounding areas maintain either very low, low, or low to moderate liquefaction susceptibility. Liquefaction is a phenomenon where saturated or loose soils suddenly lose internal strength and behave as a fluid. This behavior is in response to excess pore water pressures resulting from an earthquake or other intense or prolonged ground shaking. Based on our field observations, it is our opinion site susceptibility to liquefaction during a seismic event may be considered low. The Vashon advance outwash within the northern portion of the site was encountered primarily in a medium dense state and without the presence of a uniformly established, shallow groundwater table.

Slab-on-Grade Floors

Slab-on-grade floors for the proposed residential structures should be supported on a firm and unyielding subgrade. Where feasible, native soil likely to be exposed at the slab-on-grade subgrade levels can be compacted in situ to the specifications of structural fill. Unstable or yielding areas of the subgrade should be recompacted, or overexcavated and replaced with suitable structural fill, prior to construction of the slab.

A capillary break consisting of at least four inches of free-draining crushed rock or gravel should be placed below the slab. The free-draining material should have a fines content of 5 percent or less (percent passing the Number 200 sieve, based on the minus three-quarter inch fraction). In areas where slab moisture is undesirable, installation of a vapor barrier below the slab should be considered. If a vapor barrier is to be utilized, it should be a material specifically designed for use as a vapor barrier and should be installed in accordance with the specifications of the manufacturer.

Retaining Walls

Retaining walls must be designed to resist earth pressures and applicable surcharge loads. The following parameters may be used for design:

- Active earth pressure (yielding condition) — 35 pcf (equivalent fluid)
- At-rest earth pressure (restrained condition) — 50 pcf
- Traffic surcharge* (passenger vehicles) — 70 psf (rectangular distribution)
- Passive earth pressure — 300 pcf (equivalent fluid)
- Coefficient of friction — 0.35
- Lateral seismic surcharge — 6H**

* *Where applicable*
** *Where H equals the retained height (in feet)*

The above design parameters are based on a level backfill condition and level grade extending at least 10 feet from the wall toe. Revised design values will be necessary if sloping grades are to be used above or below retaining walls. Additional surcharge loading from adjacent foundations, sloped backfill, or other relevant loads should be included in the retaining wall design.

Retaining walls should be backfilled with free-draining material that extends along the height of the wall and a distance of at least 18 inches behind the wall. The upper 12 inches of the wall backfill can consist of a less permeable soil, if desired. A perforated drain pipe should be placed along the base of the wall and connected to an approved discharge location. A typical retaining wall drainage detail is provided on Plate 3. If drainage is not provided, hydrostatic pressures should be included in the wall design.

Drainage

Perched groundwater should be anticipated in site excavations depending on the time of year grading operations take place, particularly in utility excavations at depth. Temporary measures to control surface water runoff and groundwater during construction would likely involve interceptor trenches and sumps. ESNW should be consulted during preliminary grading to identify areas of seepage and to provide recommendations to reduce the potential for instability related to seepage effects.

During construction surface water must not be allowed to flow over the top and down slopes unless in a controlled manner utilizing swales and rock-lined drainage channels. Finish grades must be designed to direct surface drain water away from structures and slopes. Water must not be allowed to pond adjacent to structures or slopes. In our opinion, foundation drains should be installed along building perimeter footings. A typical foundation drain detail is provided on Plate 4.

Infiltration Feasibility

As indicated in the *Subsurface* section of this report, native soils encountered during our fieldwork were characterized primarily as Vashon advance outwash. Subsequent to USDA textural analyses, the relatively clean Vashon advance outwash was further classified as either gravelly sand or very gravelly sand. The fines contents of the relatively clean Vashon advance outwash were on the order of 0.3 to 5.9 percent.

From a geotechnical standpoint, the Vashon advance outwash is generally suitable for infiltration facility design provided the proposed facility base elevations are advanced through the upper silty sands and into the relatively clean outwash deposits at depth. The 2009 King County Surface Design Manual gives specific outlines for design. Infiltration trenches must be at least 20 feet in length per 1,000 square feet of impervious surface served. The trench must be filled with at least 18 inches of 3/4-inch to 1-1/2-inch washed drain rock. If drywells are to be used for infiltration, drywells must contain a volume of gravel equal to or greater than 60 cubic feet per 1,000 square feet of impervious surface served. The gravel used for drywells must be 1 1/2-inch to 3-inch washed drain rock. In-situ testing can be performed to refine/confirm long-term infiltration rates used for design.

Excavations and Slopes

The Federal Occupation Safety and Health Administration (OSHA) and the Washington Industrial Safety and Health Act (WISHA) provide soil classification in terms of temporary slope inclinations. Soils that exhibit a high compressive strength are allowed steeper temporary slope inclinations than are soils that exhibit a lower compressive strength.

Based on the soil conditions encountered at the test pit locations, site soils are classified as Type C by OSHA and WISHA. Temporary slopes over four feet in height in Type C soils must be sloped no steeper than one-and-one-half horizontal to one vertical (1.5H:1V). Where encountered, the presence of perched groundwater may cause caving of the temporary slopes due to hydrostatic pressure. ESNW should observe site excavations to confirm soil types and allowable slope inclinations. If the recommended temporary slope inclinations cannot be achieved, temporary shoring may be necessary to support excavations.

Permanent slopes should be planted with vegetation to enhance stability and to minimize erosion and should maintain a gradient of 2H:1V or flatter. An ESNW representative should observe temporary and permanent slopes to confirm the slope inclinations are suitable for the exposed soil conditions. Supplementary recommendations with respect to excavations and slopes may be provided as requested.

Pavement Sections

The performance of site pavements is largely related to the condition of the underlying subgrade. To ensure adequate pavement performance, the subgrade should be in a firm and unyielding condition when subjected to proofrolling with a loaded dump truck. Structural fill in pavement areas should be compacted to the specifications previously detailed in this report. It is possible that soft, wet, or otherwise unsuitable subgrade areas may still exist after base grading activities. Areas containing unsuitable or yielding subgrade conditions will require remedial measures, such as overexcavation and replacement with crushed rock or structural fill, prior to pavement.

We anticipate new on-site pavement sections will be subjected primarily to passenger vehicle traffic. For lightly loaded pavement areas subjected primarily to passenger vehicles, the following preliminary pavement sections may be considered:

- A minimum of two inches of hot mix asphalt (HMA) placed over four inches of crushed rock base (CRB), or;
- A minimum of two inches of HMA placed over three inches of asphalt treated base (ATB).

The HMA, ATB and CRB materials should conform to WSDOT specifications. All soil base material should be compacted to a relative compaction of 95 percent, based on the laboratory maximum dry density as determined by ASTM D1557. Final pavement design parameters, including recommendations for heavy traffic areas or access roads, may be provided once final traffic loading has been determined. Road standards utilized by the City of Lake Forest Park may supersede the recommendations provided in this report.

Utility Support and Trench Backfill

In our opinion, on-site soils will generally be suitable for support of utilities. Remedial measures may be necessary in some areas in order to provide support for utilities, such as overexcavation and replacement with structural fill, or placement of geotextile fabric. Groundwater seepage may be encountered within utility excavations and caving of trench walls may occur where groundwater is encountered. Depending on the time of year and conditions encountered, dewatering, as well as temporary trench shoring, may be necessary during utility excavation and installation.

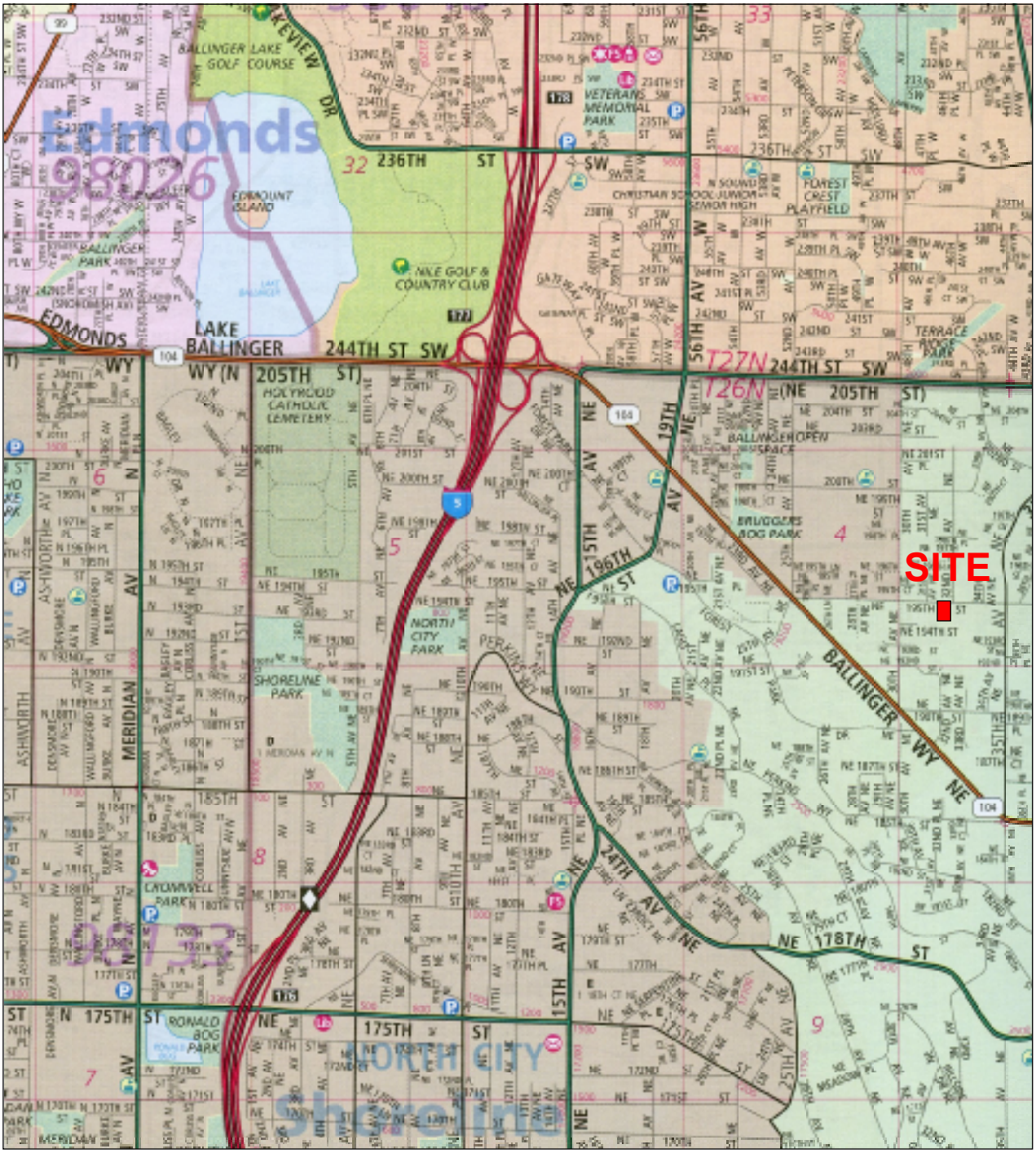
In general, on-site soils will likely be suitable for use as structural backfill throughout utility trench excavations provided the soil is at or near the optimum moisture content at the time of placement and compaction. Moisture conditioning of the soils may be necessary at some locations prior to use as structural fill. Each section of the utility lines must be adequately supported in the bedding material. Utility trench backfill should be placed and compacted to the specifications of structural fill as previously detailed in this report, or to the applicable specifications of the City of Lake Forest Park or other responsible jurisdiction or agency.

LIMITATIONS

The recommendations and conclusions provided in this geotechnical engineering study are professional opinions consistent with the level of care and skill that is typical of other members in the profession currently practicing under similar conditions in this area. A warranty is neither expressed nor implied. Variations in the soil and groundwater conditions observed at the test pit locations may exist and may not become evident until construction. ESNW should reevaluate the conclusions in this geotechnical engineering study if variations are encountered.

Additional Services

ESNW should have an opportunity to review final project plans with respect to geotechnical recommendations provided in this report. ESNW should also be retained to provide testing and consultation services during construction.



Reference:
King County, Washington
Map 475
By The Thomas Guide
Rand McNally
32nd Edition

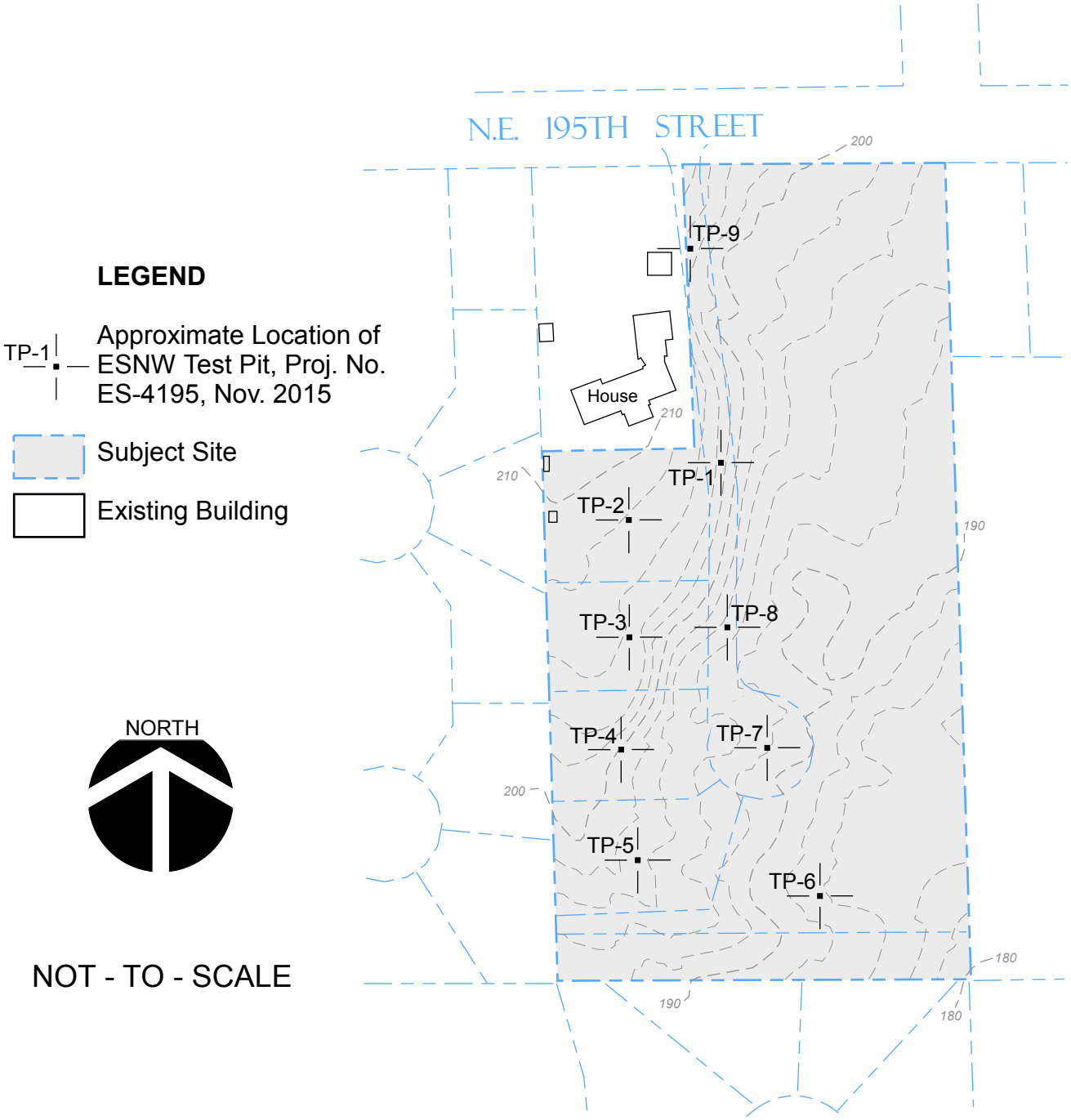
NORTH

Earth Solutions NW LLC
Geotechnical Engineering, Construction Monitoring and Environmental Sciences

Vicinity Map
3035 N.E. 195th Street
Lake Forest Park, Washington

Drwn.	MRS	Date	12/07/2015	Proj. No.	4195
Checked	AZS	Date	Dec. 2015	Plate	1

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.



NOTE: The graphics shown on this plate are not intended for design purposes or precise scale measurements, but only to illustrate the approximate test locations relative to the approximate locations of existing and / or proposed site features. The information illustrated is largely based on data provided by the client at the time of our study. ESNW cannot be responsible for subsequent design changes or interpretation of the data by others.

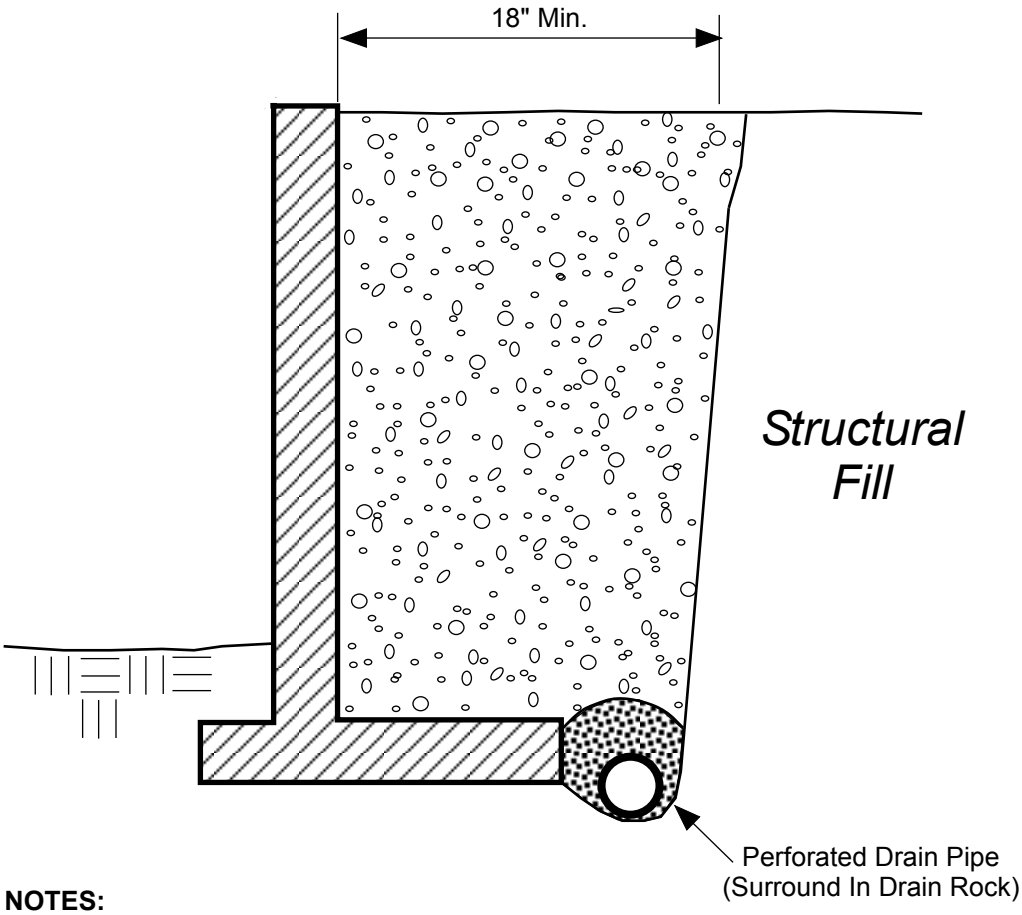
NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Earth Solutions NW LLC

Geotechnical Engineering, Construction Monitoring and Environmental Sciences

Test Pit Location Plan
3035 N.E. 195th Street
Lake Forest Park, Washington

Drwn. MRS	Date 12/07/2015	Proj. No. 4195
Checked AZS	Date Dec. 2015	Plate 2



NOTES:

- Free Draining Backfill should consist of soil having less than 5 percent fines. Percent passing #4 should be 25 to 75 percent.
- Sheet Drain may be feasible in lieu of Free Draining Backfill, per ESNW recommendations.
- Drain Pipe should consist of perforated, rigid PVC Pipe surrounded with 1" Drain Rock.

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

LEGEND:

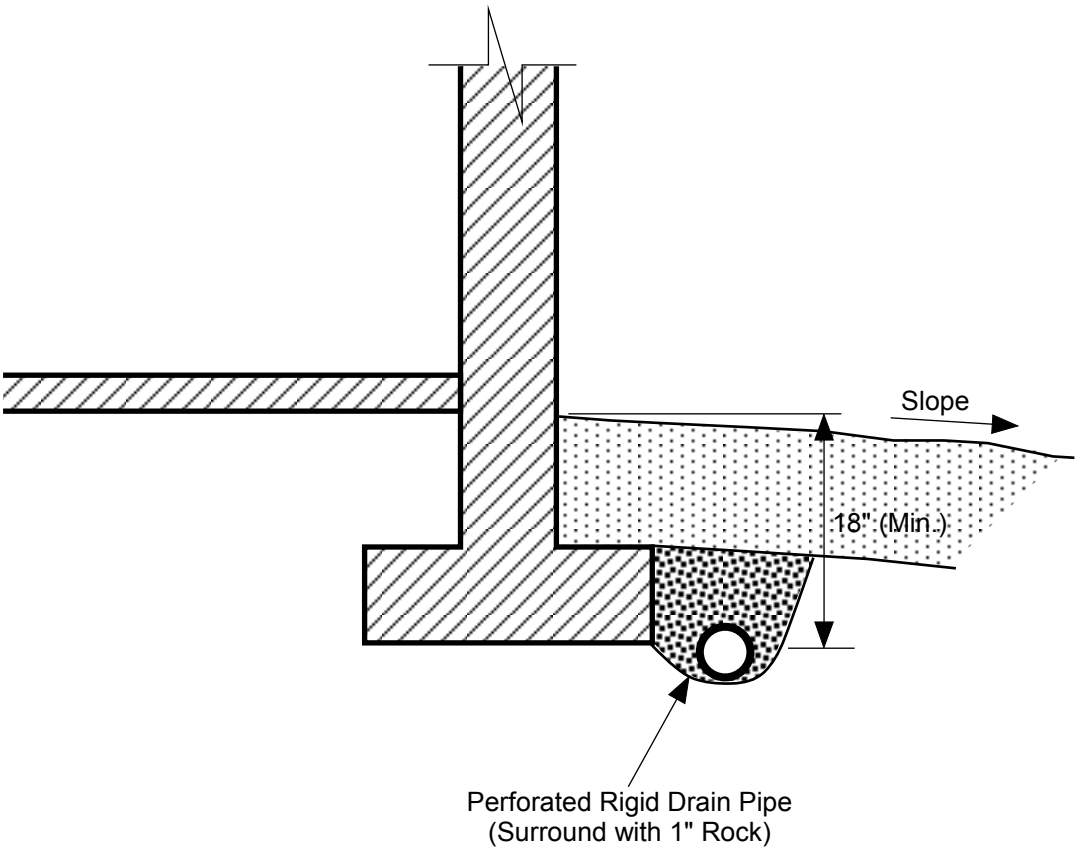
Free Draining Structural Backfill

1 inch Drain Rock

Earth Solutions NW LLC
Geotechnical Engineering, Construction Monitoring and Environmental Sciences

RETAINING WALL DRAINAGE DETAIL
3035 N.E. 195th Street
Lake Forest Park, Washington

Drwn. MRS	Date 12/07/2015	Proj. No. 4195
Checked AZS	Date Dec. 2015	Plate 3



NOTES:

- Do NOT tie roof downspouts to Footing Drain.
- Surface Seal to consist of 12" of less permeable, suitable soil. Slope away from building.

LEGEND:

Surface Seal; native soil or other low permeability material.

1" Drain Rock

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

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FOOTING DRAIN DETAIL
3035 N.E. 195th Street
Lake Forest Park, Washington

Drwn. MRS	Date 12/07/2015	Proj. No. 4195
Checked AZS	Date Dec. 2015	Plate 4

Appendix A

Subsurface Exploration
Test Pit Logs

ES-4195

The subsurface conditions at the site were explored on November 27, 2015 by excavating nine test pits using a mini-trackhoe and operator retained by our firm. The approximate locations of the subsurface exploration test pits are illustrated on Plate 2 of this study. The test pit logs are provided in this Appendix. The test pits were advanced to a maximum depth of eight and one-half feet.

The final logs represent the interpretations of the field logs and the results of laboratory analyses. The stratification lines on the logs represent the approximate boundaries between soil types. In actuality, the transitions may be more gradual.

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SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

DUAL SYMBOLS are used to indicate borderline soil classifications.

The discussion in the text of this report is necessary for a proper understanding of the nature of the material presented in the attached logs.

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-1

CLIENT Plats Financial Group, LLC
PROJECT NAME 3035 N.E. 195th Street
PROJECT NUMBER 4195
PROJECT LOCATION Lake Forest Park, Washington
DATE STARTED 11/27/15 **COMPLETED** 11/27/15
GROUND ELEVATION
TEST PIT SIZE
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION ---
LOGGED BY AZS **CHECKED BY** AZS
AT END OF EXCAVATION ---
NOTES Depth of Topsoil & Sod 18": blackberries
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0					
			TPSL		-roots
		MC = 13.60%		1.5	
			SM		Brown silty SAND, loose to medium dense, moist
		MC = 14.80%		4.0	
5			SM		Gray silty SAND, medium dense, moist -oxidation
		MC = 12.50%		7.0	
					Test pit terminated at 7.0 feet below existing grade. No groundwater encountered during excavation. Bottom of test pit at 7.0 feet.

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Bellevue, Washington 98005
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TEST PIT NUMBER TP-2

CLIENT Plats Financial Group, LLC
PROJECT NAME 3035 N.E. 195th Street
PROJECT NUMBER 4195
PROJECT LOCATION Lake Forest Park, Washington
DATE STARTED 11/27/15 **COMPLETED** 11/27/15
GROUND ELEVATION
TEST PIT SIZE
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION ---
LOGGED BY AZS **CHECKED BY** AZS
AT END OF EXCAVATION ---
NOTES Depth of Topsoil & Sod 10": field grass
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		0.9
		MC = 3.70%	SP		Brown poorly-graded SAND with gravel, medium dense, moist -caving
5		MC = 6.40% Fines = 3.60%			[USDA Classification: brown very gravelly coarse SAND]
		MC = 7.00%			8.0 Test pit terminated at 8.0 feet below existing grade. No groundwater encountered during excavation. Bottom of test pit at 8.0 feet.

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Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-3

CLIENT Plats Financial Group, LLC
PROJECT NAME 3035 N.E. 195th Street
PROJECT NUMBER 4195
PROJECT LOCATION Lake Forest Park, Washington
DATE STARTED 11/27/15 **COMPLETED** 11/27/15
GROUND ELEVATION
TEST PIT SIZE
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION ---
LOGGED BY AZS **CHECKED BY** AZS
AT END OF EXCAVATION ---
NOTES Depth of Topsoil & Sod 12": ivy
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	1.0	
		MC = 7.20%	SM	4.0	Brown silty SAND, medium dense, moist
		MC = 7.10%	SP	7.0	Gray poorly graded SAND
5					-seepage
		MC = 16.90%			Test pit terminated at 7.0 feet below existing grade. Groundwater seepage encountered at 7.0 feet during excavation.
					Bottom of test pit at 7.0 feet.

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-4

CLIENT Plats Financial Group, LLC
PROJECT NAME 3035 N.E. 195th Street
PROJECT NUMBER 4195
PROJECT LOCATION Lake Forest Park, Washington
DATE STARTED 11/27/15 **COMPLETED** 11/27/15
GROUND ELEVATION
TEST PIT SIZE
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION ---
LOGGED BY AZS **CHECKED BY** AZS
AT END OF EXCAVATION ---
NOTES Depth of Topsoil & Sod 18": forest duff
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		1.5
		MC = 7.00%	SP		Brown poorly-graded SAND, medium dense, moist
					-increasing gravel
5					
		MC = 7.80%			7.0 -seepage
					Test pit terminated at 7.0 feet below existing grade. Groundwater seepage encountered at 7.0 feet during excavation.
					Bottom of test pit at 7.0 feet.

Earth Solutions NW
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Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-5

CLIENT Plats Financial Group, LLC
PROJECT NAME 3035 N.E. 195th Street
PROJECT NUMBER 4195
PROJECT LOCATION Lake Forest Park, Washington
DATE STARTED 11/27/15 **COMPLETED** 11/27/15
GROUND ELEVATION
TEST PIT SIZE
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION ---
LOGGED BY AZS **CHECKED BY** AZS
AT END OF EXCAVATION ---
NOTES Depth of Topsoil & Sod 18": blackberries
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	1.5	
		MC = 7.30% Fines = 0.30%	SP		Tan poorly-graded SAND, medium dense, moist [USDA Classification: brown gravelly SAND]
5		MC = 14.40%			-increasing gravel -becomes wet
				7.5	-seepage
			SP-SM	8.5	Brown poorly-graded SAND with silt, dense, wet
		MC = 22.80%			Test pit terminated at 8.5 feet below existing grade. Groundwater seepage encountered at 7.0 feet during excavation. Bottom of test pit at 8.5 feet.

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-6

CLIENT Plats Financial Group, LLC
PROJECT NAME 3035 N.E. 195th Street
PROJECT NUMBER 4195
PROJECT LOCATION Lake Forest Park, Washington
DATE STARTED 11/27/15 **COMPLETED** 11/27/15
GROUND ELEVATION
TEST PIT SIZE
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION ---
LOGGED BY AZS **CHECKED BY** AZS
AT END OF EXCAVATION ---
NOTES Depth of Topsoil & Sod 12": blackberries
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	1.0	
		MC = 13.60%	SP		Tan poorly-graded SAND, medium dense, moist
					-seepage
5		MC = 20.70%			-oxidation
		MC = 23.90%		7.0	-caving
					Test pit terminated at 7.0 feet below existing grade. Groundwater seepage encountered at 3.0 feet during excavation.
					Bottom of test pit at 7.0 feet.

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Bellevue, Washington 98005
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Fax: 425-449-4711

TEST PIT NUMBER TP-7

CLIENT Plats Financial Group, LLC
PROJECT NAME 3035 N.E. 195th Street
PROJECT NUMBER 4195
PROJECT LOCATION Lake Forest Park, Washington
DATE STARTED 11/27/15 **COMPLETED** 11/27/15
GROUND ELEVATION **TEST PIT SIZE**
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION ---
LOGGED BY AZS **CHECKED BY** AZS
AT END OF EXCAVATION ---
NOTES Depth of Topsoil & Sod 10": blackberries
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	0.9	
		MC = 10.80%	SP-SM	3.5	Brown poorly graded SAND with silt, medium dense, moist -seepage
5		MC = 10.90% Fines = 18.30% MC = 18.30%	SM	7.0	Tan gray silty SAND with gravel, medium dense, wet [USDA Classification: gray gravelly loamy SAND] -oxidation -becomes dense
					Test pit terminated at 7.0 feet below existing grade. Groundwater seepage encountered at 2.5 feet during excavation. Bottom of test pit at 7.0 feet.

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Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-8

CLIENT Plats Financial Group, LLC
PROJECT NAME 3035 N.E. 195th Street
PROJECT NUMBER 4195
PROJECT LOCATION Lake Forest Park, Washington
DATE STARTED 11/27/15 **COMPLETED** 11/27/15
GROUND ELEVATION
TEST PIT SIZE
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION ---
LOGGED BY AZS **CHECKED BY** AZS
AT END OF EXCAVATION ---
NOTES Depth of Topsoil & Sod 8": ivy
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	0.7	
		MC = 3.70% Fines = 5.90%	SP-SM	3.5	Brown poorly-graded SAND with silt and gravel, medium dense, moist [USDA Classification: brown very gravelly coarse SAND]
5		MC = 10.60% MC = 14.00%	SP	6.5	Brown poorly-graded SAND with gravel, medium dense, wet -seepage
		MC = 10.70%	SM	7.0	Gray silty SAND, dense, moist

Test pit terminated at 7.0 feet below existing grade. Groundwater seepage encountered at 4.0 feet during excavation.

Bottom of test pit at 7.0 feet.

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Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-9

CLIENT Plats Financial Group, LLC
PROJECT NAME 3035 N.E. 195th Street
PROJECT NUMBER 4195
PROJECT LOCATION Lake Forest Park, Washington
DATE STARTED 11/27/15 **COMPLETED** 11/27/15
GROUND ELEVATION
TEST PIT SIZE
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION ---
LOGGED BY AZS **CHECKED BY** AZS
AT END OF EXCAVATION ---
NOTES Depth of Topsoil & Sod 16": ivy
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	1.5	
		MC = 11.10%	SM	5.5	Brown silty SAND, medium dense, moist
5		MC = 7.90%	SP	7.5	Gray poorly-graded SAND, medium dense, wet -seepage
		MC = 10.10%			Test pit terminated at 7.5 feet below existing grade. Groundwater seepage encountered at 7.0 feet during excavation. Bottom of test pit at 7.5 feet.

Appendix B

Laboratory Test Results

ES-4195

GRAIN SIZE DISTRIBUTION

Earth Solutions NW
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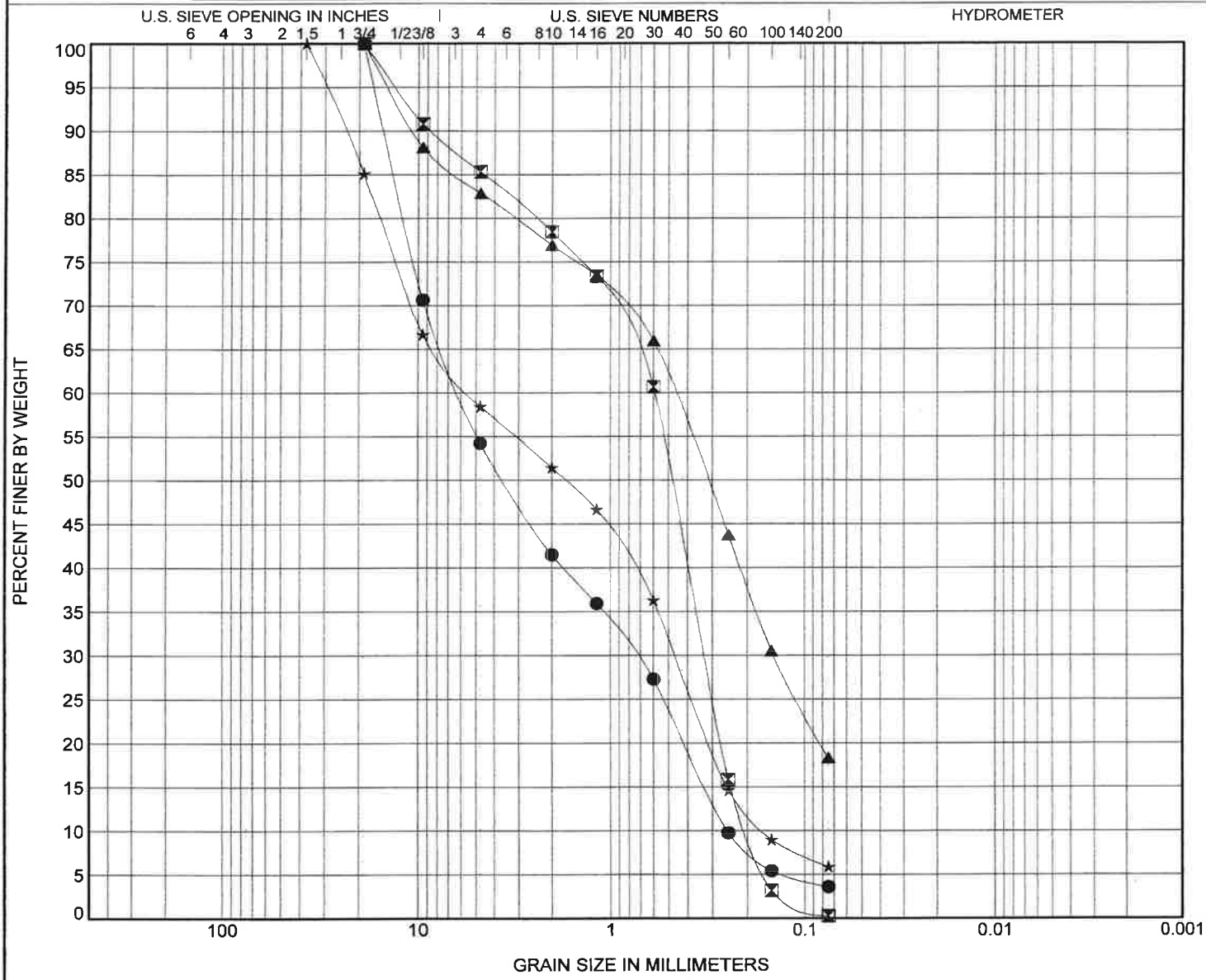
Bellevue, WA 98005
Telephone: 425-284-3300

CLIENT Plats Financial Group LLC
PROJECT NAME 3035 NE 195th St
PROJECT NUMBER ES-4195
PROJECT LOCATION Lake Forest Park



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	Cc	Cu
●	TP-2	6.0ft.	USDA: Brown Very Gravelly Coarse Sand. USCS: SP with Gravel.	0.36	23.98
⧗	TP-5	2.0ft.	USDA: Brown Gravelly Sand. USCS: SP.	0.93	3.00
▲	TP-7	4.0ft.	USDA: Gray Gravelly Loamy Sand. USCS: SM with Gravel.		
★	TP-9	2.0ft.	USDA: Brown Very Gravelly Coarse Sand. USCS: SP-SM with Gravel.	0.24	33.00

	Specimen Identification		D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
●	TP-2	6.0ft.	19	6.064	0.742	0.253				3.6	
⧗	TP-5	2.0ft.	19	0.592	0.33	0.198				0.3	
▲	TP-7	4.0ft.	19	0.474	0.146					18.3	
★	TP-9	2.0ft.	37.5	5.426	0.465	0.164				5.9	

Report Distribution

ES-4195

EMAIL ONLY

Plats Financial Group, LLC
720 – Cedar Avenue, Suite C
Marysville, Washington 98270

June 20, 2016
ES-4195.01

Earth Solutions NW LLC

- Geotechnical Engineering
- Construction Monitoring
- Environmental Sciences

Plats Financial Group, LLC
720 Cedar Avenue, Suite C
Marysville, Washington 98270

Attention: Mr. Tage Nickerson

Subject: Bioretention Evaluation
Proposed Labosierre Short Plat
3035 Northeast 195th Street
Lake Forest Park, Washington

Reference: David Evans and Associates, Inc.
Plan Sheet No. PR3, dated April 2016

Earth Solutions NW, LLC
Geotechnical Engineering Study
ES-4195, dated December 18, 2015

King County, Washington
Surface Water Design Manual, dated January 9, 2009

Dear Mr. Nickerson:

In accordance with your request, Earth Solutions NW, LLC (ESNW) has prepared this letter providing a bioretention evaluation for the subject project. We performed our work in general accordance with the contingency regarding additional services for this project as outlined in our proposal revised November 12, 2015 and authorized by you on November 17, 2015. Geotechnical recommendations for bioretention facility design and construction are provided in this letter.

Project Description

We understand that each of the four lots will be developed with a single-family residential home and related infrastructure improvements. Entry and egress for the new residences will be provided off the Northeast 195th Street frontage. One bioretention facility (rain garden) will be constructed near the southern property boundary to accommodate stormwater runoff from new impervious surfaces. The bioretention facility will collectively manage new stormwater runoff from all four proposed lots.

Surface Conditions

The subject site is located approximately 350 feet east of the intersection between Northeast 195th Street and 30th Avenue Northeast in Lake Forest Park, Washington. The approximate location of the property is illustrated on Plate 1 (Vicinity Map). The subject development area is comprised of one irregularly shaped tax parcel (King County Parcel No. 615290-0033) totaling approximately 4.05 acres. The site is surrounded to the east, south, and west by single-family residential homes and to the north by Northeast 195th Street. Topographic relief ascends relatively gently from the southwest to northeast, and total site elevation change is on the order of 20 feet.

Subsurface Conditions

In completion of the referenced geotechnical study, an ESNW representative observed, logged, and sampled nine test pits on November 27, 2015 using a mini trackhoe and operator retained by our firm. The test pits were completed for purposes of assessing soil conditions, classifying site soils, evaluating in-situ infiltration capacity, and characterizing the presence of groundwater or soil mottling. The approximate locations of the test pits are depicted on Plate 2 (Test Pit Location Plan). Please refer to the attached test pit logs for a more detailed description of subsurface conditions. Representative soil samples were collected at the test pit locations and analyzed in accordance with both Unified Soil Classification System (USCS) and United States Department of Agriculture (USDA) methods and procedures. The information provided within this section is intended as a general overview of subsurface conditions located within the proposed bioretention installation area.

Underlying about 12 inches of topsoil at Test Pit Location TP-6, native soils within the proposed bioretention cell consisted primarily of medium dense, poorly graded sand (USCS: SP). Native soils were encountered primarily in a moist condition and extended to the maximum exploration depth of seven feet below existing grades. Subsurface conditions encountered at depth during our fieldwork visit are consistent with local geologic mapping, which identifies Vashon advance outwash (Qva) as the primary geologic unit across the site and surrounding areas. Groundwater seepage was encountered at the test pit location during our fieldwork at a depth of about three feet below existing grades. While we do not expect significant groundwater intrusion during excavation activities, perched groundwater seepage may be encountered during construction.

Bioretention Evaluation

Our evaluation of site bioretention facilities was completed in accordance with applicable requirements and procedures of the referenced King County Surface Water Design Manual (2009 KCSWDM), as adopted by the City of Lake Forest Park. A bioretention facility will be used to accommodate stormwater runoff from new pollution-generating impervious surfaces.

Bioretention Soil Mixture

A bioretention soil mixture (BSM) must be installed underlying the surface grade of the bioretention facility and atop the native soil grade. The BSM is the primary detention and/or filter layer for impervious surface runoff entering the bioretention facility. The BSM also serves as a growth medium for plants. Based on the results of previous USDA textural analyses completed on representative soil samples, native site soils are comprised primarily of gravelly sand. In accordance with Appendix C of the 2009 KCSWDM, native sands may be mixed with compost to meet the required specification for a BSM. In our opinion, the native sands can be successfully amended to achieve the requirements of the BSM and should be considered feasible for use from a geotechnical standpoint. The following requirements should be incorporated into the design of the BSM:

- The soil mixture shall be comprised of at least 4 inches of compost tilled into the upper sand *or* at least 12 inches of an imported, amended soil mixture;
- Where utilized, the imported, amended soil mixture shall possess 8 to 13 percent organic material by weight;
- The initial infiltration rate must be equal to, or less than, 4 inches per hour, and;
- Debris larger than two inches, including stones, stumps, and roots, must be absent (the mixture must be uniform).

The native sands intended for use with BSM designs should be clean, as confirmed by ESNW at the time of construction. Additional BSM and/or bioretention design requirements outlined in the 2009 KCSWDM, including minimum water storage areas and volumes, setbacks, and critical area considerations, should be incorporated into final designs.

Summary

In our opinion, construction of bioretention facilities on the subject site is feasible from a geotechnical standpoint. On-site soils, as encountered during our November 2015 fieldwork, may be mixed with compost to create an acceptable BSM for use during construction; however, ESNW should verify in-situ conditions encountered during construction to confirm soil conditions and soil types are as anticipated in this letter. Bioretention facilities should be constructed in accordance with the requirements of the 2009 KCSWDM; it is noted bioretention specifications provided in this letter are based largely on those required by the aforementioned manual. ESNW should be retained to observe installation of the bioretention facilities on a periodic or full-time basis, as appropriate, to confirm construction in accordance with our geotechnical recommendations.

Limitations

The recommendations and conclusions provided in this letter are professional opinions consistent with the level of care and skill that is typical of other members in the profession currently practicing under similar conditions in this area. A warranty is not expressed or implied. Variations in the soil and groundwater conditions observed at the test pit locations may exist and may not become evident until construction. ESNW should reevaluate the conclusions provided in this letter if variations are encountered.

We trust this letter meets your current needs. Should you require additional information, or have questions, please call.

Sincerely,

EARTH SOLUTIONS NW, LLC

06/20/2016

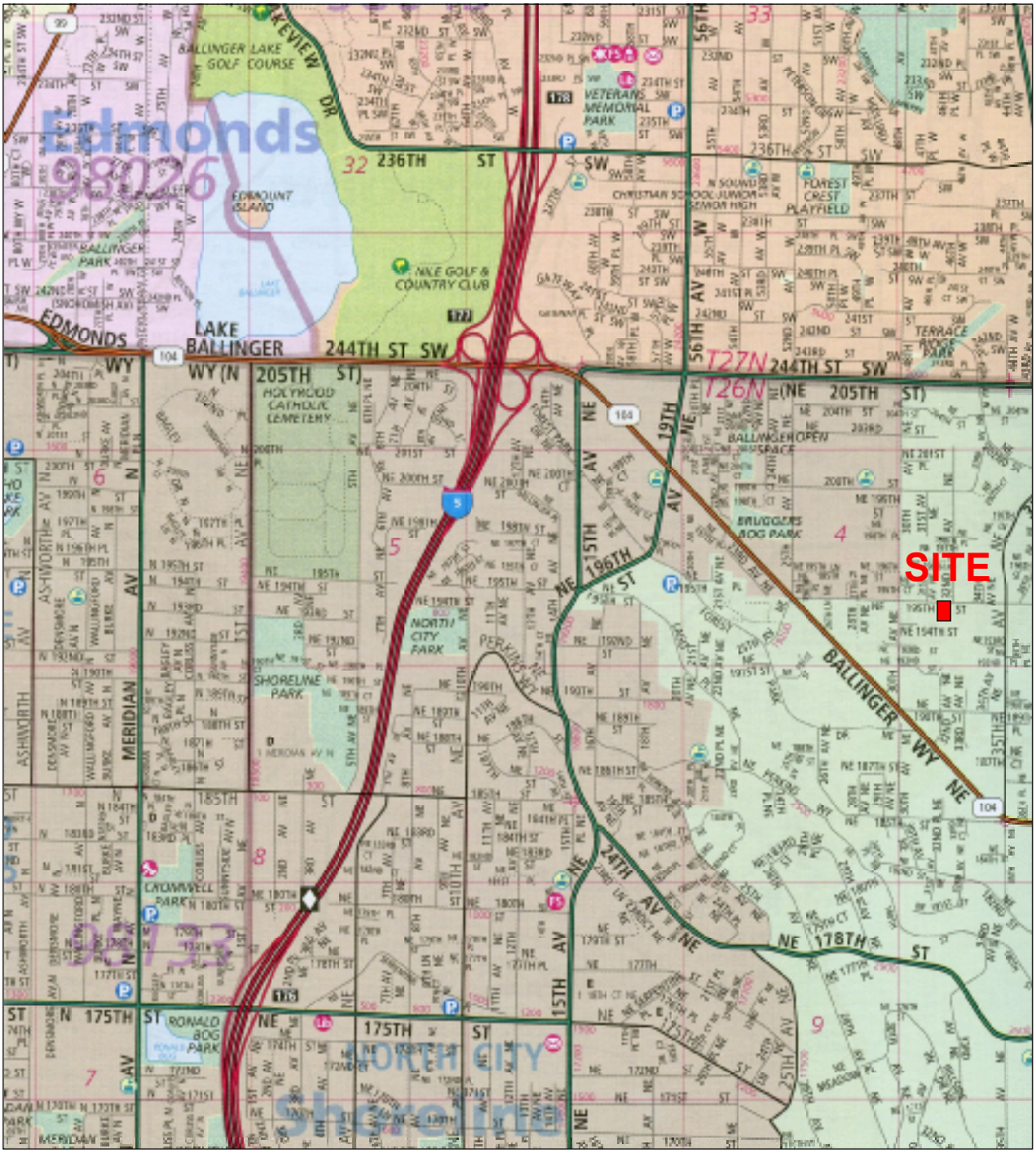
KEVEN D. HOFFMANN
STATE OF WASHINGTON
53734
REGISTERED
PROFESSIONAL ENGINEER

Adam Z. Shier, G.I.T.
Staff Geologist

Keven D. Hoffmann, P.E.
Project Engineer

Attachments: Plate 1 – Vicinity Map
Plate 2 – Test Pit Location Plan
Test Pit Logs
Grain Size Distribution

cc: David Evans and Associates, Inc.
Attention: Ms. April Coleman (Email only)



Reference:
King County, Washington
Map 475
By The Thomas Guide
Rand McNally
32nd Edition

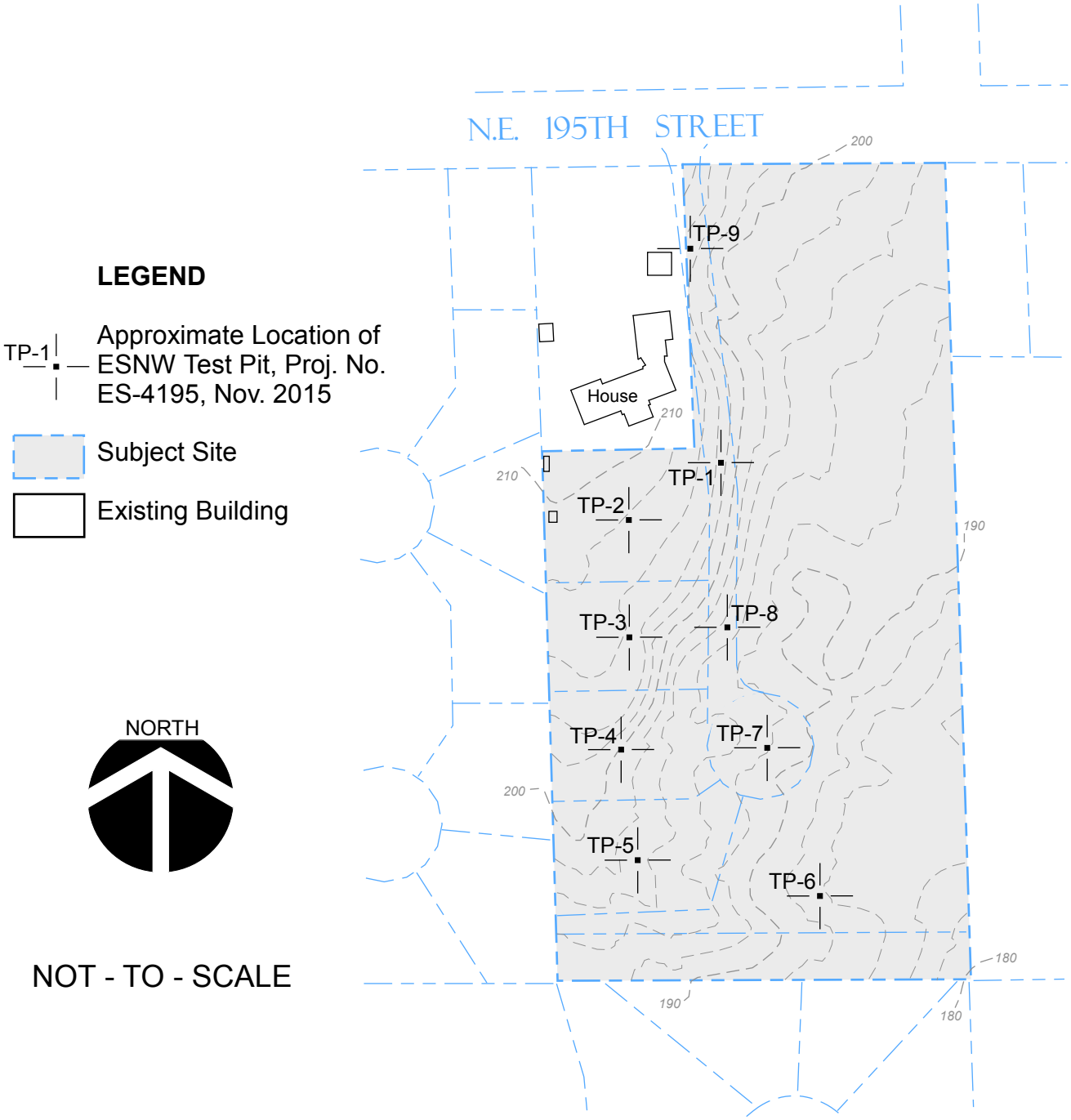
NORTH

Earth Solutions NW LLC
Geotechnical Engineering, Construction Monitoring and Environmental Sciences

Vicinity Map
3035 N.E. 195th Street
Lake Forest Park, Washington

Drwn.	MRS	Date	12/07/2015	Proj. No.	4195
Checked	AZS	Date	Dec. 2015	Plate	1

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.



NOTE: The graphics shown on this plate are not intended for design purposes or precise scale measurements, but only to illustrate the approximate test locations relative to the approximate locations of existing and / or proposed site features. The information illustrated is largely based on data provided by the client at the time of our study. ESNW cannot be responsible for subsequent design changes or interpretation of the data by others.

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Earth Solutions NW LLC

Geotechnical Engineering, Construction Monitoring and Environmental Sciences

Test Pit Location Plan
3035 N.E. 195th Street
Lake Forest Park, Washington

Drwn. MRS	Date 12/07/2015	Proj. No. 4195
Checked AZS	Date Dec. 2015	Plate 2

Earth Solutions NW LLC

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

DUAL SYMBOLS are used to indicate borderline soil classifications.

The discussion in the text of this report is necessary for a proper understanding of the nature of the material presented in the attached logs.

Earth Solutions NW
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Telephone: 425-449-4704
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TEST PIT NUMBER TP-1

CLIENT Plats Financial Group, LLC
PROJECT NAME 3035 N.E. 195th Street
PROJECT NUMBER 4195
PROJECT LOCATION Lake Forest Park, Washington
DATE STARTED 11/27/15 **COMPLETED** 11/27/15
GROUND ELEVATION **TEST PIT SIZE**
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION ---
LOGGED BY AZS **CHECKED BY** AZS
AT END OF EXCAVATION ---
NOTES Depth of Topsoil & Sod 18": blackberries
AFTER EXCAVATION —

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0					
			TPSL		-roots
		MC = 13.60%			1.5
			SM		Brown silty SAND, loose to medium dense, moist
		MC = 14.80%			4.0
5			SM		Gray silty SAND, medium dense, moist -oxidation
		MC = 12.50%			7.0
					Test pit terminated at 7.0 feet below existing grade. No groundwater encountered during excavation. Bottom of test pit at 7.0 feet.

Earth Solutions NW
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Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-2

CLIENT Plats Financial Group, LLC
PROJECT NAME 3035 N.E. 195th Street
PROJECT NUMBER 4195
PROJECT LOCATION Lake Forest Park, Washington
DATE STARTED 11/27/15 **COMPLETED** 11/27/15
GROUND ELEVATION
TEST PIT SIZE
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION —
LOGGED BY AZS **CHECKED BY** AZS
AT END OF EXCAVATION —
NOTES Depth of Topsoil & Sod 10"; field grass
AFTER EXCAVATION —

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	0.9	
		MC = 3.70%	SP		Brown poorly-graded SAND with gravel, medium dense, moist -caving
5		MC = 6.40% Fines = 3.60%			[USDA Classification: brown very gravelly coarse SAND]
		MC = 7.00%		8.0	
					Test pit terminated at 8.0 feet below existing grade. No groundwater encountered during excavation. Bottom of test pit at 8.0 feet.

Earth Solutions NW
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Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-3

CLIENT Plats Financial Group, LLC
PROJECT NAME 3035 N.E. 195th Street
PROJECT NUMBER 4195
PROJECT LOCATION Lake Forest Park, Washington
DATE STARTED 11/27/15 **COMPLETED** 11/27/15
GROUND ELEVATION
TEST PIT SIZE
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION ---
LOGGED BY AZS **CHECKED BY** AZS
AT END OF EXCAVATION —
NOTES Depth of Topsoil & Sod 12": ivy
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	1.0	
		MC = 7.20%	SM	4.0	Brown silty SAND, medium dense, moist
		MC = 7.10%	SP	7.0	Gray poorly graded SAND
5					-seepage
		MC = 16.90%			Test pit terminated at 7.0 feet below existing grade. Groundwater seepage encountered at 7.0 feet during excavation.
					Bottom of test pit at 7.0 feet.

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-4

CLIENT Plats Financial Group, LLC
PROJECT NAME 3035 N.E. 195th Street
PROJECT NUMBER 4195
PROJECT LOCATION Lake Forest Park, Washington
DATE STARTED 11/27/15 **COMPLETED** 11/27/15
GROUND ELEVATION **TEST PIT SIZE**
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION ---
LOGGED BY AZS **CHECKED BY** AZS
AT END OF EXCAVATION ---
NOTES Depth of Topsoil & Sod 18": forest duff
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		1.5
		MC = 7.00%	SP		Brown poorly-graded SAND, medium dense, moist
					-increasing gravel
5					
		MC = 7.80%			-seepage 7.0
					Test pit terminated at 7.0 feet below existing grade. Groundwater seepage encountered at 7.0 feet during excavation.
					Bottom of test pit at 7.0 feet.

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-5

CLIENT Plats Financial Group, LLC
PROJECT NAME 3035 N.E. 195th Street
PROJECT NUMBER 4195
PROJECT LOCATION Lake Forest Park, Washington
DATE STARTED 11/27/15 **COMPLETED** 11/27/15
GROUND ELEVATION **TEST PIT SIZE**
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION ---
LOGGED BY AZS **CHECKED BY** AZS
AT END OF EXCAVATION —
NOTES Depth of Topsoil & Sod 18": blackberries
AFTER EXCAVATION —

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		1.5
		MC = 7.30% Fines = 0.30%	SP		Tan poorly-graded SAND, medium dense, moist [USDA Classification: brown gravelly SAND]
5		MC = 14.40%			-increasing gravel -becomes wet
					7.5 -seepage
		MC = 22.80%	SP-SM		Brown poorly-graded SAND with silt, dense, wet 8.5
					Test pit terminated at 8.5 feet below existing grade. Groundwater seepage encountered at 7.0 feet during excavation. Bottom of test pit at 8.5 feet.

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-6

CLIENT Plats Financial Group, LLC
PROJECT NAME 3035 N.E. 195th Street
PROJECT NUMBER 4195
PROJECT LOCATION Lake Forest Park, Washington
DATE STARTED 11/27/15 **COMPLETED** 11/27/15
GROUND ELEVATION
TEST PIT SIZE
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION —
LOGGED BY AZS **CHECKED BY** AZS
AT END OF EXCAVATION —
NOTES Depth of Topsoil & Sod 12": blackberries
AFTER EXCAVATION —

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		1.0
		MC = 13.60%	SP		Tan poorly-graded SAND, medium dense, moist
					-seepage
5		MC = 20.70%			-oxidation
		MC = 23.90%			-caving 7.0
					Test pit terminated at 7.0 feet below existing grade. Groundwater seepage encountered at 3.0 feet during excavation.
					Bottom of test pit at 7.0 feet.

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-7

CLIENT Plats Financial Group, LLC
PROJECT NAME 3035 N.E. 195th Street
PROJECT NUMBER 4195
PROJECT LOCATION Lake Forest Park, Washington
DATE STARTED 11/27/15 **COMPLETED** 11/27/15
GROUND ELEVATION ____ **TEST PIT SIZE** ____
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD ____
AT TIME OF EXCAVATION ---
LOGGED BY AZS **CHECKED BY** AZS
AT END OF EXCAVATION ---
NOTES Depth of Topsoil & Sod 10": blackberries
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	0.9	
		MC = 10.80%	SP-SM	3.5	Brown poorly graded SAND with silt, medium dense, moist -seepage
5		MC = 10.90% Fines = 18.30% MC = 18.30%	SM	7.0	Tan gray silty SAND with gravel, medium dense, wet [USDA Classification: gray gravelly loamy SAND] -oxidation -becomes dense

Test pit terminated at 7.0 feet below existing grade. Groundwater seepage encountered at 2.5 feet during excavation.

Bottom of test pit at 7.0 feet.

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-8

CLIENT Plats Financial Group, LLC
PROJECT NAME 3035 N.E. 195th Street
PROJECT NUMBER 4195
PROJECT LOCATION Lake Forest Park, Washington
DATE STARTED 11/27/15 **COMPLETED** 11/27/15
GROUND ELEVATION **TEST PIT SIZE**
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION ---
LOGGED BY AZS **CHECKED BY** AZS
AT END OF EXCAVATION —
NOTES Depth of Topsoil & Sod 8": ivy
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	0.7	
		MC = 3.70% Fines = 5.90%	SP-SM	3.5	Brown poorly-graded SAND with silt and gravel, medium dense, moist [USDA Classification: brown very gravelly coarse SAND]
		MC = 10.60%	SP	6.5	Brown poorly-graded SAND with gravel, medium dense, wet -seepage
5		MC = 14.00%			
		MC = 10.70%	SM	7.0	Gray silty SAND, dense, moist
					Test pit terminated at 7.0 feet below existing grade. Groundwater seepage encountered at 4.0 feet during excavation. Bottom of test pit at 7.0 feet.

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-9

CLIENT Plats Financial Group, LLC
PROJECT NAME 3035 N.E. 195th Street
PROJECT NUMBER 4195
PROJECT LOCATION Lake Forest Park, Washington
DATE STARTED 11/27/15 **COMPLETED** 11/27/15
GROUND ELEVATION **TEST PIT SIZE**
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION —
LOGGED BY AZS **CHECKED BY** AZS
AT END OF EXCAVATION —
NOTES Depth of Topsoil & Sod 16": ivy
AFTER EXCAVATION —

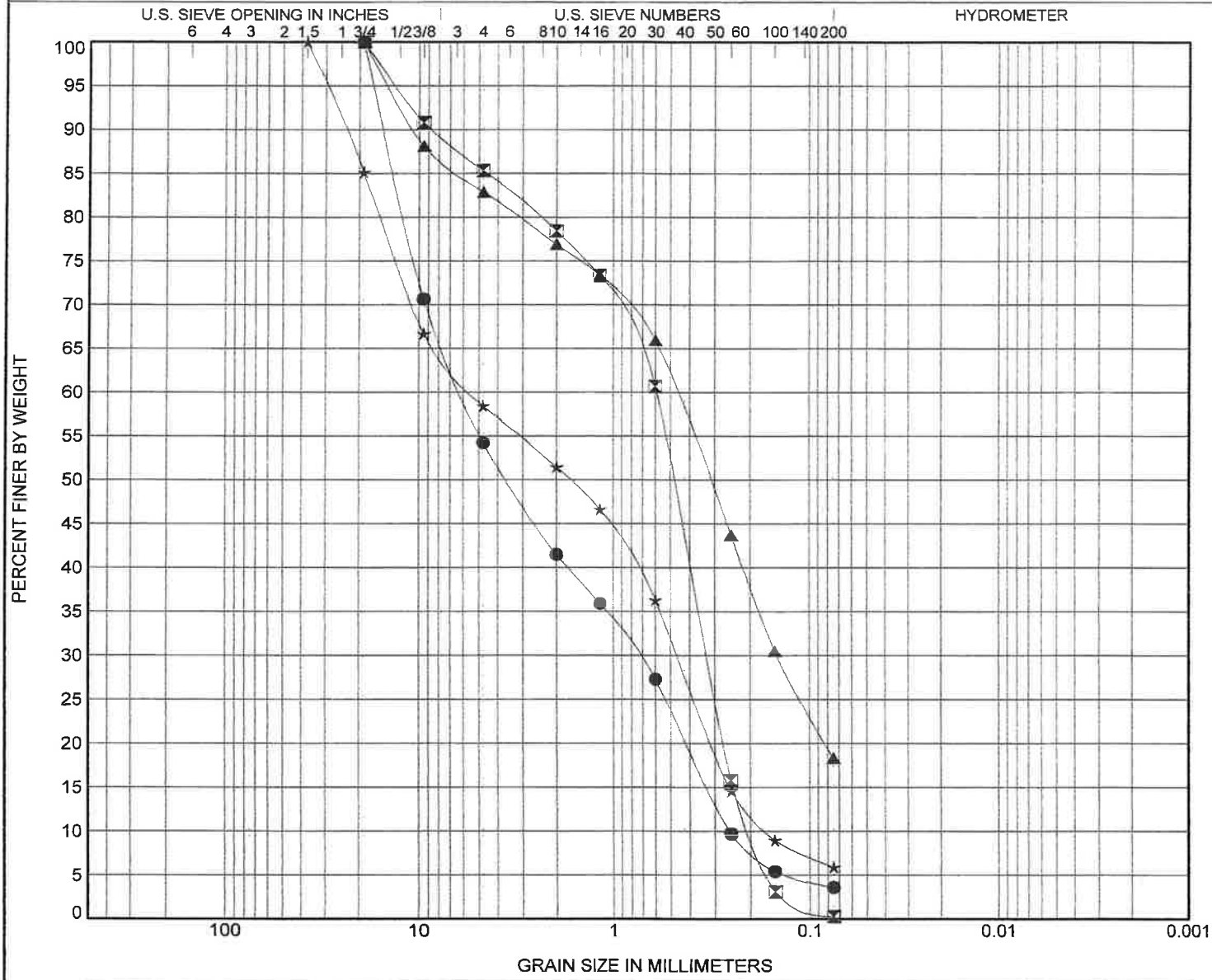
DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		1.5
		MC = 11.10%	SM		Brown silty SAND, medium dense, moist
5					5.5
		MC = 7.90%	SP		Gray poorly-graded SAND, medium dense, wet
		MC = 10.10%			7.5 -seepage
					Test pit terminated at 7.5 feet below existing grade. Groundwater seepage encountered at 7.0 feet during excavation. Bottom of test pit at 7.5 feet.

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, WA 98005
Telephone: 425-284-3300

GRAIN SIZE DISTRIBUTION

CLIENT Plats Financial Group LLC **PROJECT NAME** 3035 NE 195th St

PROJECT NUMBER ES-4195 **PROJECT LOCATION** Lake Forest Park



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	Cc	Cu
●	TP-2	6.0ft.	USDA: Brown Very Gravelly Coarse Sand. USCS: SP with Gravel.	0.36	23.98
⧗	TP-5	2.0ft.	USDA: Brown Gravelly Sand. USCS: SP.	0.93	3.00
▲	TP-7	4.0ft.	USDA: Gray Gravelly Loamy Sand. USCS: SM with Gravel.		
★	TP-9	2.0ft.	USDA: Brown Very Gravelly Coarse Sand. USCS: SP-SM with Gravel.	0.24	33.00

	Specimen Identification		D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
●	TP-2	6.0ft.	19	6.064	0.742	0.253				3.6	
⧗	TP-5	2.0ft.	19	0.592	0.33	0.198				0.3	
▲	TP-7	4.0ft.	19	0.474	0.146					18.3	
★	TP-9	2.0ft.	37.5	5.426	0.465	0.164				5.9	

C.2.4.5 USE OF SHEET FLOW FOR BASIC DISPERSION

Sheet flow, as a dispersion device, is the grading of a developed surface (either a strip of impervious surface or a width of non-native pervious surface) as needed to avoid the concentration of runoff before and after discharge from the surface. Two types of sheet flow, one for impervious surface and one for pervious surface, are detailed in this section.

Uses: Flat or moderately sloping surfaces (<15% slope) such as driveways, sport courts, patios, roofs without gutters, lawns, pastures, etc.; or any situation where concentration of flows can be avoided.

Design Specifications for Impervious Surface Sheet Flow (Basic Dispersion)

Figure C.2.4.D (p. C-55) illustrates a typical use of sheet flow dispersion for impervious surface in accordance with the following specifications:

1. The strip of impervious surface may be either roof (with no gutter) or pavement. The edge of the target impervious strip and the ground adjacent to or immediately below the edge must be either level or sloped such that the direction of sheet flow is perpendicular to the edge or no more than 45 degrees from perpendicular.
2. A 2-foot-wide, 4-to-6 inch-deep, strip of crushed rock or the extended base course of a road or driveway must be provided at or below the edge of the impervious strip to facilitate dispersal of runoff. This requirement may be waived for use of *reverse slope sidewalks*[17] and other impervious strips that are 10-feet wide or less.
3. A "vegetated flowpath segment" of at least 10 feet in length must be available along the flowpath that runoff would follow upon discharge from the strip of crushed rock.
4. No more than a 20-foot-wide strip of impervious surface may be sheet flowed in this manner unless the length of vegetated flowpath segment is increased 10 feet for each additional 20 feet of impervious surface width or fraction thereof.
5. For purposes of maintaining adequate separation of flows discharged from adjacent dispersion devices, the outer edge of the vegetated flowpath segment for the strip of impervious surface must not overlap with other flowpath segments, except those associated with sheet flow from a non-native pervious surface.

Design Specifications for Pervious Surface Sheet Flow (Basic Dispersion)

The runoff from any ***new pervious surface*** is considered dispersed by sheet flow if the runoff is not concentrated by a manmade or natural conveyance system (e.g., pipe, yard drain, drain tile, ditch, swale, etc.) within 25 feet of leaving the ***new pervious surface*** area or prior to leaving the ***site*** or entering a critical area buffer on the ***site***.

C.2.4.6 MAINTENANCE INSTRUCTIONS FOR BASIC DISPERSION

If the basic dispersion flow control BMP is proposed for a project, the following maintenance and operation instructions must be recorded as an attachment to the required **declaration of covenant and grant of easement** per Requirement 3 of Section C.1.3.3 (p. C-18). The intent of these instructions is to explain to future property owners, the purpose of the BMP and how it must be maintained and operated. These instructions are intended to be a minimum; DDES may require additional instructions based on site-specific conditions. Also, as the County gains more experience with the maintenance and operation of these BMPs, future updates to the instructions will be posted on King County's *Surface Water Design Manual* website.

[17] *Reverse slope sidewalk* is one that slopes away from rather than onto the roadway it abuts as required by County road standards. If this technique is proposed within County right-of-way, a Road Variance will be required for its use.

❑ TEXT OF INSTRUCTIONS FOR BASIC DISPERSION

Your property contains a stormwater management flow control BMP (best management practice) called "basic dispersion," which was installed to mitigate the stormwater quantity and quality impacts of some or all of the impervious surfaces or non-native pervious surfaces on your property. Basic dispersion is a strategy for utilizing any available capacity of onsite vegetated areas to retain, absorb, and filter the runoff from developed surfaces. This flow control BMP has two primary components that must be maintained: (1) the devices that disperse runoff from the developed surfaces and (2) the vegetated area over which runoff is dispersed.

Dispersion Devices

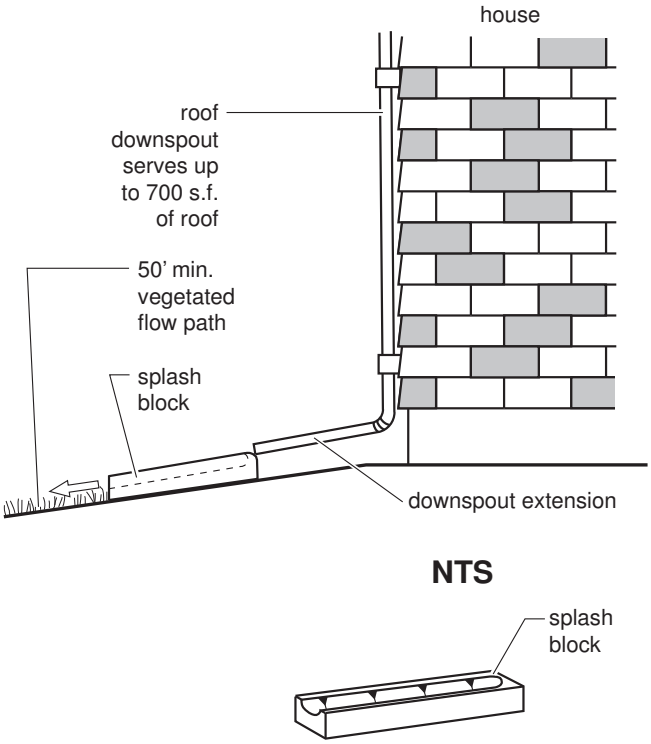
The dispersion devices used on your property include the following as indicated on the flow control BMP site plan: ❑ splash blocks, ❑ rock pads, ❑ gravel filled trenches, ❑ sheet flow. The size, placement, composition, and downstream flowpaths of these devices as depicted by the flow control BMP site plan and design details must be maintained and may not be changed without written approval either from the King County Water and Land Resources Division or through a future development permit from King County.

Dispersion devices must be inspected annually and after major storm events to identify and repair any physical defects. When native soil is exposed or erosion channels are present, the sources of the erosion or concentrated flow need to be identified and mitigated. Concentrated flow can be mitigated by leveling the edge of the pervious area and/or realigning or replenishing the rocks in the dispersion device, such as in rock pads and gravel filled trenches.

Vegetated Flowpaths

The vegetated area over which runoff is dispersed must be maintained in good condition free of bare spots and obstructions that would concentrate flows.

FIGURE C.2.4.A TYPICAL SPLASHBLOCK FOR BASIC DISPERSION



C.2.5.3 MAINTENANCE INSTRUCTIONS FOR A RAIN GARDEN

If the rain garden flow control BMP is proposed for a project, the following maintenance and operation instructions must be recorded as an attachment to the required **declaration of covenant and grant of easement** per Requirement 3 of Section C.1.3.3 (p. C-18). The intent of these instructions is to explain to future property owners, the purpose of the BMP and how it must be maintained and operated. These instructions are intended to be a minimum; DDES may require additional instructions based on site-specific conditions. Also, as the County gains more experience with the maintenance and operation of these BMPs, future updates to the instructions will be posted on King County's *Surface Water Design Manual* website.

❑ TEXT OF INSTRUCTIONS

Your property contains a stormwater management flow control BMP (best management practice) called a "rain garden," which was installed to mitigate the stormwater quantity and quality impacts of some or all of the impervious or non-native pervious surfaces on your property. Rain gardens, also known as "bioretention," are vegetated closed depressions or ponds that retain and filter stormwater from an area of impervious surface or non-native pervious surface. The soil in the rain garden has been enhanced to encourage and support vigorous plant growth that serves to filter the water and sustain infiltration capacity. Depending on soil conditions, rain gardens may have water in them throughout the wet season and may overflow during major storm events.

The size, placement, and design of the rain garden as depicted by the flow control BMP site plan and design details must be maintained and may not be changed without written approval either from the King County Water and Land Resources Division or through a future development permit from King County. Plant materials may be changed to suit tastes, but chemical fertilizers and pesticides must not be used. Mulch may be added and additional compost should be worked into the soil over time.

Rain gardens must be inspected annually for physical defects. After major storm events, the system should be checked to see that the overflow system is working properly. If erosion channels or bare spots are evident, they should be stabilized with soil, plant material, mulch, or landscape rock. A supplemental watering program may be needed the first year to ensure the long-term survival of the rain garden's vegetation. Vegetation should be maintained as follows: 1) replace all dead vegetation as soon as possible; 2) remove fallen leaves and debris as needed; 3) remove all noxious vegetation when discovered; 4) manually weed without herbicides or pesticides; 5) during drought conditions, use mulch to prevent excess solar damage and water loss.

NO. 5 – CATCH BASINS

Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
General	Trash & Debris (Includes Sediment)	Trash or debris of more than ½ cubic foot which is located immediately in front of the catch basin opening or is blocking capacity of the basin by more than 10%.	No Trash or debris located immediately in front of catch basin opening.
		Trash or debris (in the basin) that exceeds $^1/_3$ the depth from the bottom of basin to invert the lowest pipe into or out of the basin.	No trash or debris in the catch basin.
		Trash or debris in any inlet or outlet pipe blocking more than $^1/_3$ of its height.	Inlet and outlet pipes free of trash or debris.
		Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within the catch basin.
		Deposits of garbage exceeding 1 cubic foot in volume.	No condition present which would attract or support the breeding of insects or rodents.
	Structure Damage to Frame and/or Top Slab	Corner of frame extends more than ¾ inch past curb face into the street (If applicable).	Frame is even with curb.
		Top slab has holes larger than 2 square inches or cracks wider than ¼ inch (intent is to make sure all material is running into basin).	Top slab is free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than ¾ inch of the frame from the top slab.	Frame is sitting flush on top slab.
	Cracks in Basin Walls/Bottom	Cracks wider than ½ inch and longer than 3 feet, any evidence of soil particles entering catch basin through cracks, or maintenance person judges that structure is unsound.	Basin replaced or repaired to design standards.
		Cracks wider than ½ inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	No cracks more than $^1/_4$ inch wide at the joint of inlet/outlet pipe.
	Settlement/ Misalignment	Basin has settled more than 1 inch or has rotated more than 2 inches out of alignment.	Basin replaced or repaired to design standards.
	Fire Hazard	Presence of chemicals such as natural gas, oil and gasoline.	No flammable chemicals present.
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening.	No vegetation blocking opening to basin.
		Vegetation growing in inlet/outlet pipe joints that is more than 6 inches tall and less than 6 inches apart.	No vegetation or root growth present.
	Pollution	Nonflammable chemicals of more than ½ cubic foot per three feet of basin length.	No pollution present other than surface film.
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Catch basin cover is closed
	Locking Mechanism Not Working	Mechanism cannot be opened by on maintenance person with proper tools. Bolts into frame have less than ½ inch of thread.	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying 80 lbs. of lift; intent is keep cover from sealing off access to maintenance.	Cover can be removed by one maintenance person.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.

NO. 5 – CATCH BASINS

Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
Metal Grates (If Applicable)	Unsafe Grate Opening	Grate with opening wider than $^{7}/_{8}$ inch.	Grate opening meets design standards.
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface.	Grate free of trash and debris.
	Damaged or Missing.	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.

NO. 6 – DEBRIS BARRIERS (E.G., TRASH RACKS)

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed.
General	Trash and Debris	Trash or debris that is plugging more than 20% of the openings in the barrier.	Barrier clear to receive capacity flow.
Metal	Damaged/Missing Bars.	Bars are bent out of shape more than 3 inches.	Bars in place with no bends more than ¾ inch.
		Bars are missing or entire barrier missing.	Bars in place according to design.
		Bars are loose and rust is causing 50% deterioration to any part of barrier.	Repair or replace barrier to design standards.

NO. 7 – ENERGY DISSIPATERS

Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed.
External:			
Rock Pad	Missing or Moved Rock	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil.	Replace rocks to design standards.
Dispersion Trench	Pipe Plugged with Sediment	Accumulated sediment that exceeds 20% of the design depth.	Pipe cleaned/flushed so that it matches design.
	Not Discharging Water Properly	Visual evidence of water discharging at concentrated points along trench (normal condition is a "sheet flow" of water along trench). Intent is to prevent erosion damage.	Trench must be redesigned or rebuilt to standards.
	Perforations Plugged.	Over ½ of perforations in pipe are plugged with debris and sediment.	Clean or replace perforated pipe.
	Water Flows Out Top of "Distributor" Catch Basin.	Maintenance person observes water flowing out during any storm less than the design storm or its causing or appears likely to cause damage.	Facility must be rebuilt or redesigned to standards.
	Receiving Area Over-Saturated	Water in receiving area is causing or has potential of causing landslide problems.	No danger of landslides.
Internal:			
Manhole/Chamber	Worn or Damaged Post. Baffles, Side of Chamber	Structure dissipating flow deteriorates to ½ or original size or any concentrated worn spot exceeding one square foot which would make structure unsound.	Replace structure to design standards.

NO. 10 – CONVEYANCE PIPES AND DITCHES

Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Pipes	Sediment & Debris	Accumulated sediment that exceeds 20% of the diameter of the pipe.	Pipe cleaned of all sediment and debris.
	Vegetation	Vegetation that reduces free movement of water through pipes.	All vegetation removed so water flows freely through pipes.
	Damaged	Protective coating is damaged; rust is causing more than 50% deterioration to any part of pipe.	Pipe repaired or replaced.
		Any dent that decreases the cross section area of pipe by more than 20%.	Pipe repaired or replaced.
Open Ditches	Trash & Debris	Trash and debris exceeds 1 cubic foot per 1,000 square feet of ditch and slopes.	Trash and debris cleared from ditches.
	Sediment	Accumulated sediment that exceeds 20% of the design depth.	Ditch cleaned/flushed of all sediment and debris so that it matches design.
	Vegetation	Vegetation that reduces free movement of water through ditches.	Water flows freely through ditches.
	Erosion Damage to Slopes	See "Detention Ponds" Table No. 1	See "Detention Ponds" Table No. 1
	Rock Lining Out of Place or Missing (If Applicable).	Maintenance person can see native soil beneath the rock lining.	Replace rocks to design standards.

NO. 11 – GROUNDS (LANDSCAPING)

Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Weeds (Nonpoisonous, not noxious)	Weeds growing in more than 20% of the landscaped area (trees and shrubs only).	Weeds present in less than 5% of the landscaped area.
	Safety Hazard	Any presence of poison ivy or other poisonous vegetation.	No poisonous vegetation present in landscaped area.
	Trash or Litter	Paper, cans, bottles, totaling more than 1 cubic foot within a landscaped area (trees and shrubs only) of 1,000 square feet.	Area clear of litter.
Trees and Shrubs	Damaged	Limbs or parts of trees or shrubs that are split or broken which affect more than 25% of the total foliage of the tree or shrub.	Trees and shrubs with less than 5% of total foliage with split or broken limbs.
		Trees or shrubs that have been blown down or knocked over.	Tree or shrub in place free of injury.
		Trees or shrubs which are not adequately supported or are leaning over, causing exposure of the roots.	Tree or shrub in place and adequately supported; remove any dead or diseased trees.

NO. 12 – ACCESS ROADS

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris	Trash and debris exceeds 1 cubic foot per 1,000 square feet (i.e., trash and debris would fill up one standards size garbage can).	Roadway free of debris which could damage tires.
	Blocked Roadway	Debris which could damage vehicle tires (glass or metal).	Roadway free of debris which could damage tires.
		Any obstruction which reduces clearance above road surface to less than 14 feet.	Roadway overhead clear to 14 feet high.
		Any obstruction restricting the access to a 10- to 12-foot width for a distance of more than 12 feet or any point restricting access to less than a 10-foot width.	Obstruction removed to allow at least a 12-foot access.
Road Surface	Settlement, Potholes, Mush Spots, Ruts	When any surface defect exceeds 6 inches in depth and 6 square feet in area. In general, any surface defect which hinders or prevents maintenance access.	Road surface uniformly smooth with no evidence of settlement, potholes, mush spots, or ruts.
	Vegetation in Road Surface	Weeds growing in the road surface that are more than 6 inches tall and less than 6 inches tall and less than 6 inches apart within a 400-square foot area.	Road surface free of weeds taller than 2 inches.
	Modular Grid Pavement	Build-up of sediment mildly contaminated with petroleum hydrocarbons.	Removal of sediment and disposal in keeping with Health Department recommendations for mildly contaminated soils or catch basin sediments.
Shoulders and Ditches	Erosion Damage	Erosion within 1 foot of the roadway more than 8 inches wide and 6 inches deep.	Shoulder free of erosion and matching the surrounding road.
	Weeds and Brush	Weeds and brush exceed 18 inches in height or hinder maintenance access.	Weeds and brush cut to 2 inches in height or cleared in such a way as to allow maintenance access.

NO. 14 – WET BIOFILTRATION SWALE

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
Swale Section	Sediment Accumulation	Sediment depth exceeds 2 inches in 10% of the swale treatment area.	Remove sediment deposits in treatment area.
	Water Depth	Water not retained to a depth of about 4 inches during the wet season.	Build up or repair outlet berm so that water is retained in the wet swale.
	Defective Wetland Vegetation	Vegetation becomes sparse and does not provide adequate filtration, OR vegetation is crowded out by very dense clumps of cattail which do not allow water to flow through the clumps.	Determine cause of lack of vigor of vegetation and correct. Replant as needed. For excessive cattail growth, cut cattail shoots back and compost offsite. *Note: normally wetland vegetation does not need to be harvested unless die-back is causing oxygen depletion in downstream waters.*
	Trash and Debris Accumulation	Trash and debris accumulated in the wet swale.	Remove trash and debris from wet swale.
	Erosion/Scouring	Swale has eroded or scoured due to flow channelization, or higher flows.	Check design flows to assure swale is large enough to handle flows. Bypass excess flows or enlarge swale. Replant eroded areas with fibrous-rooted plants such as *Juncus effusus* (soft rush) in wet areas or snowberry (*Symphoricarpos albus*) in dryer areas.
Inlet/Outlet	Sediment and Debris	Inlet/outlet area clogged with sediment and/or debris.	Remove clogging or blockage in the inlet and outlet areas.

NO. 24 – CATCHBASIN INSERT

Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Catch Basin	Inspection	Inspection of media insert is required.	Effluent water from media insert is free of oils and has no visible sheen.
	Sediment Accumulation	When sediment forms a cap over the insert media of the insert and/or unit.	No sediment cap on the insert media and its unit.
	Trash and Debris Accumulation	Trash and debris accumulates on insert unit creating a blockage/restriction.	Trash and debris removed from insert unit. Runoff freely flows into catch basin.
Media Insert	Water Saturated	Catch basin insert is saturated with water, which no longer has the capacity to absorb.	Remove and replace media insert
	Oil Saturated	Media oil saturated due to petroleum spill that drains into catch basin.	Remove and replace media insert.
	Service Life Exceeded	Regular interval replacement due to typical average life of media insert product.	Remove and replace media at regular intervals, depending on insert product.