

June 17, 2009
Project No. 09016

Mr. Larry McNeely
McNeely Design & Drafting
1745 Kibler Avenue
Enumclaw, WA 98022

Subject: Infiltration Assessment
 KCFD #44, Station 95
 32316 148th Ave SE, Auburn, Washington

This report presents the results of our evaluation of the proposed new infiltration pond to be constructed at the above noted location near Auburn, King County, Washington. Based on the site plan provided by McNeely Design & Drafting, the new infiltration pond will be located on an open, flat parcel adjacent to the north side of the main fire station facilities and just east of 148th Ave SE.

The purpose of our site evaluation was to document existing shallow soil and ground water conditions on the property and to provide information regarding the infiltration potential for the soils at the bottom of the planned pond location.

EXISTING SITE CONDITIONS

The planned infiltration pond location is a flat lying parcel located immediately to the north of the main station facilities. A small soil berm is located along the west side of the site and separates the parcel from 148th Ave SE. Other training facilities for the station are located to the north and east of the subject site. Vegetation on the parcel consists of low lying field grass. Topographically the subject parcel is nearly flat and there is a slight downward gradient to the south over the entire site.

Surficial Soil Conditions

Soil conditions at the project site are inferred from the United States Department of Agriculture, Natural Resources Conservation Service literature. Surface soils in the area are reported to consist of Everett gravelly, sandy loam, 0 to 5 percent slopes. The Everett Series consists of very deep, well drained soils on outwash plains. These soils form over glacial outwash deposits. A typical soil profile is as follows: 0-17" - gravelly sandy loam, 17-32" – very gravelly sandy loam, 32-60" – very gravelly coarse sand.

Subsurface Soil and Ground Water Conditions

In order to more thoroughly characterize the shallow subsurface soil and ground water conditions on the property a total of three subsurface exploration pits, EP-1 through EP-3, were excavated on the site on June 4, 2009. Although the planned infiltration pond has not been exactly located at this time, the exploration pits were excavated within the approximate area selected for the pond location. See Figure 1, Site Plan, which shows the pit locations. Two pits were located along the western portion of the planned pond and one along the eastern portion of the planned pond. The logs of the pits are attached to this report. A general description of our findings and interpretations follows below.

Each of the exploration pits had a layer of sod and organic topsoil that was approximately 8 inches thick. Beneath the organic topsoil medium dense, damp to moist, brown, silty sandy gravel was observed to a depth of about 9 feet. Below a depth of 9 feet the soils changed to sandy gravel with trace silt. Occasional large gravels and cobbles were encountered. Multiple zones of pea gravel were observed within each exploration pit from about 10 to 19 feet.

The native soil is interpreted to be the Vashon age recessional outwash deposits. These sediments are typically described as stratified sand and gravel, moderately sorted to well sorted, and less common silty sand and silt that was deposited in outwash channels that carried south-draining glacial meltwater during ice retreat away from the ice margin.

Hydrology

No indication of standing or flowing water was present on the property at the time of our field work. There was no evidence of erosion anywhere on the parcel. Ground water was not encountered in any of the exploration pits to a maximum depth of 19.0 feet below existing ground surface. Below a depth of about 10 feet the soils were very moist to wet. No mottling of the soils was observed in any of the exploration pits.

Mappings

The following geologic maps were reviewed in our study;

- 1) Geologic Map of King County, by Derek B. Booth, Kathy A. Troost, and Aaron P. Wisler, March 2007, University of Washington, Department of Earth and Space Sciences, GeoMap NW.

This recently published geologic map indicate that the subject site is located in an area of Vashon age recessional outwash (Qvr) sediments. Our findings are in agreement with this published map. These sediments have not been consolidated by overriding glacial ice and thus are normally consolidated.

CONCLUSIONS AND RECOMMENDATIONS

Site Drainage

It is our understanding that storm water from the impervious surfaces of the site will be infiltrated on-site in an engineered infiltration facility located on the flat lying area north of the main station facilities and in the area of our exploration pits as shown on the attached Site Plan. The pond will reportedly be 14 feet deep. Based on the site plan provided to us, the existing ground surface elevation is approximately 379 feet. Therefore the pond bottom will be at an approximate elevation of 365 feet. As per Department of Ecology regulations a ground water table cannot be located within 5 feet of the bottom of pond elevation. Based on our field study, no ground water was observed on the site to a maximum depth of 19.0 feet below existing ground surface or within 5 feet of the planned bottom of pond elevation. In addition, no mottling of the soils was observed in any of the explorations completed for this study.

In order to determine an approximate infiltration rate for the receptor soils we utilized ASTM Gradation testing as approved by Washington State Department of Ecology (Ecology) in their Storm Water Management Design Manual. Copies of the sieve analyses are attached.

ASTM Gradation Method

Based on the ASTM gradation testing method, the D_{10} size for the three samples tested ranged from 0.6 mm to 0.8 mm. As per Table 3.8 – Alternative Recommended Infiltration Rates based on ASTM Gradation Testing, the D_{10} size for the site soils is well in excess of the maximum published size of 0.4 mm. The long term infiltration rate for 0.4 mm and greater is 9 inches per hour.

While on site a fire truck was utilized to perform an informal PIT test in exploration pit EP-2. The test was performed at the bottom of the pit at a depth of 19 feet below existing ground surface. Due to the extremely granular material a 4 hour soak was not performed and could not be performed as the pit bottom would not hold water. No attempt was made to excavate a measured depression in the bottom of the pit. Approximately 500 gallons of water was discharged into the pit bottom over a period of 3 minutes. When the water discharge was stopped the remaining water in the bottom of the pit infiltrated fully within 20 seconds. Although this test was not performed in accordance with regulatory guidelines it does provide additional information as to the infiltration potential at the site.

General Infiltration Notes

It is important to understand that the infiltration rate may be compromised if the contractor is not careful to avoid siltation of the receptor soils. This typically occurs when an infiltration area is used for temporary detention of storm water during construction. Should this occur, it may be

necessary to overexcavate the receptor soils to remove unwanted silt that has washed into the area. Two to three feet of overexcavation may be required to correct the situation. The infiltration rate can also be compromised if adequate pretreatment of the influent is not provided or if the facility is not properly maintained to remove any siltation or biomass buildup.

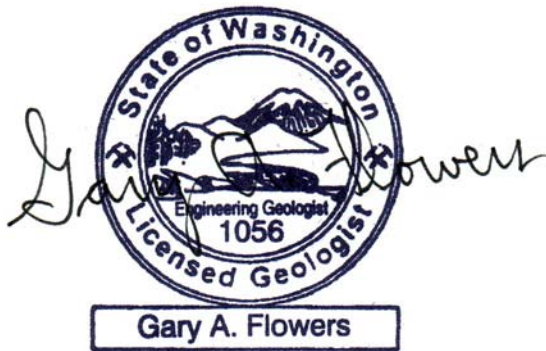
SUMMARY

Based on our site reconnaissance and subsurface explorations, infiltration of storm water is appropriate for this project. An infiltration rate of 9.0 inches per hour appears to be suitable for the observed soil conditions below a depth of 9 feet below ground surface. Ground water table was not encountered on the site to the maximum depth explored of 19 feet below existing grade.

We recommend that we be retained at time of construction to verify that subsurface conditions are as expected. Should conditions be revealed during construction that differs from the anticipated subsurface profile, we will evaluate those conditions and provide alternative recommendations where appropriate.

Our findings and recommendations provided in this report were prepared in accordance with generally accepted principles of engineering geology as practiced in the Puget Sound area at the time this report was submitted. We make no other warranty, either express or implied.

Respectfully submitted,

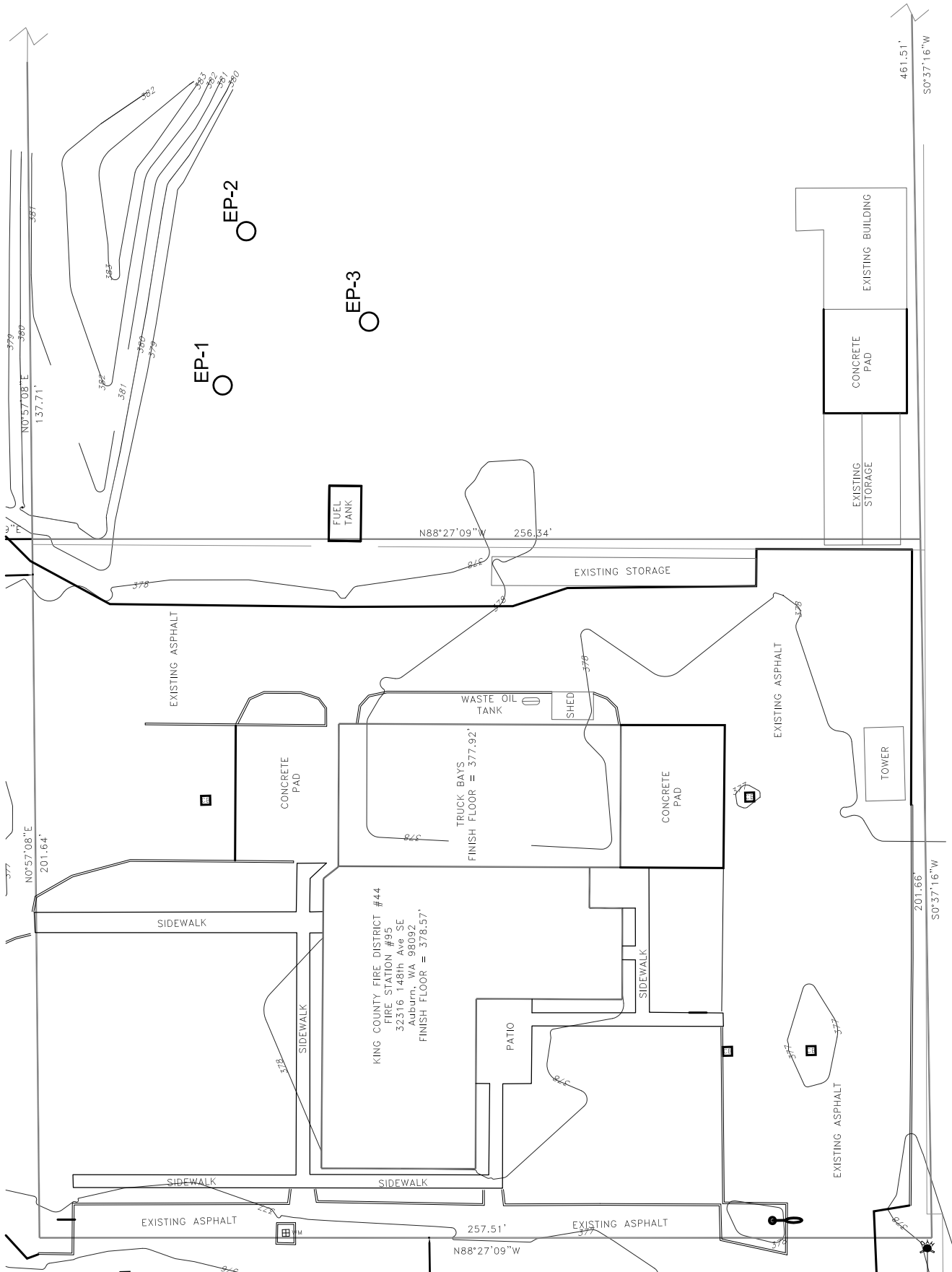


Gary A. Flowers, P.G., P.E.G.
Principal Engineering Geologist

Attachments: Soil Exploration Logs
Laboratory Sieve Analyses

Gary A. Flowers, PLLC
 Geological & Geotechnical Consulting
 19532 12th Avenue NE
 Shoreline, WA 98155-1106

FIGURE 1



SITE PLAN

SCALE: 1" = 40'

King County Fire District #44, Station 95
32316 148th Ave SE
Auburn, WA
Project No. 09016
June 2009

EP-1 Located near southwest corner of planned infiltration pond. Approx. el. 379'

RECESSIONAL OUTWASH

0.0' – 0.7' sod and sandy topsoil
0.7' – 9.0' medium dense, damp to moist, brown, silty, sandy GRAVEL
9.0' – 19.0' medium dense, very moist to wet, brown, sandy GRAVEL with trace silt – gravel primarily about 1" in size with occasional large gravels and cobbles – some zones of primarily pea gravel size

BOH @ 19.0' No ground water observed throughout excavation. Some caving observed especially within pea gravel zones.

EP-2 Located near northwest corner of planned infiltration pond. Approx. el. 379'

RECESSIONAL OUTWASH

0.0' – 0.7' sod and sandy topsoil
0.7' – 9.0' medium dense, damp to moist, brown, silty, sandy GRAVEL
9.0' – 19.0' medium dense, very moist to wet, brown, sandy GRAVEL with trace silt – gravel primarily about 1" in size with significant larger gravels and cobbles – some zones of primarily pea gravel size

BOH @ 19.0' No ground water observed throughout excavation. Some caving observed especially within pea gravel zones.

EP-3 Located near east central portion of planned infiltration pond. Approx el. 379'

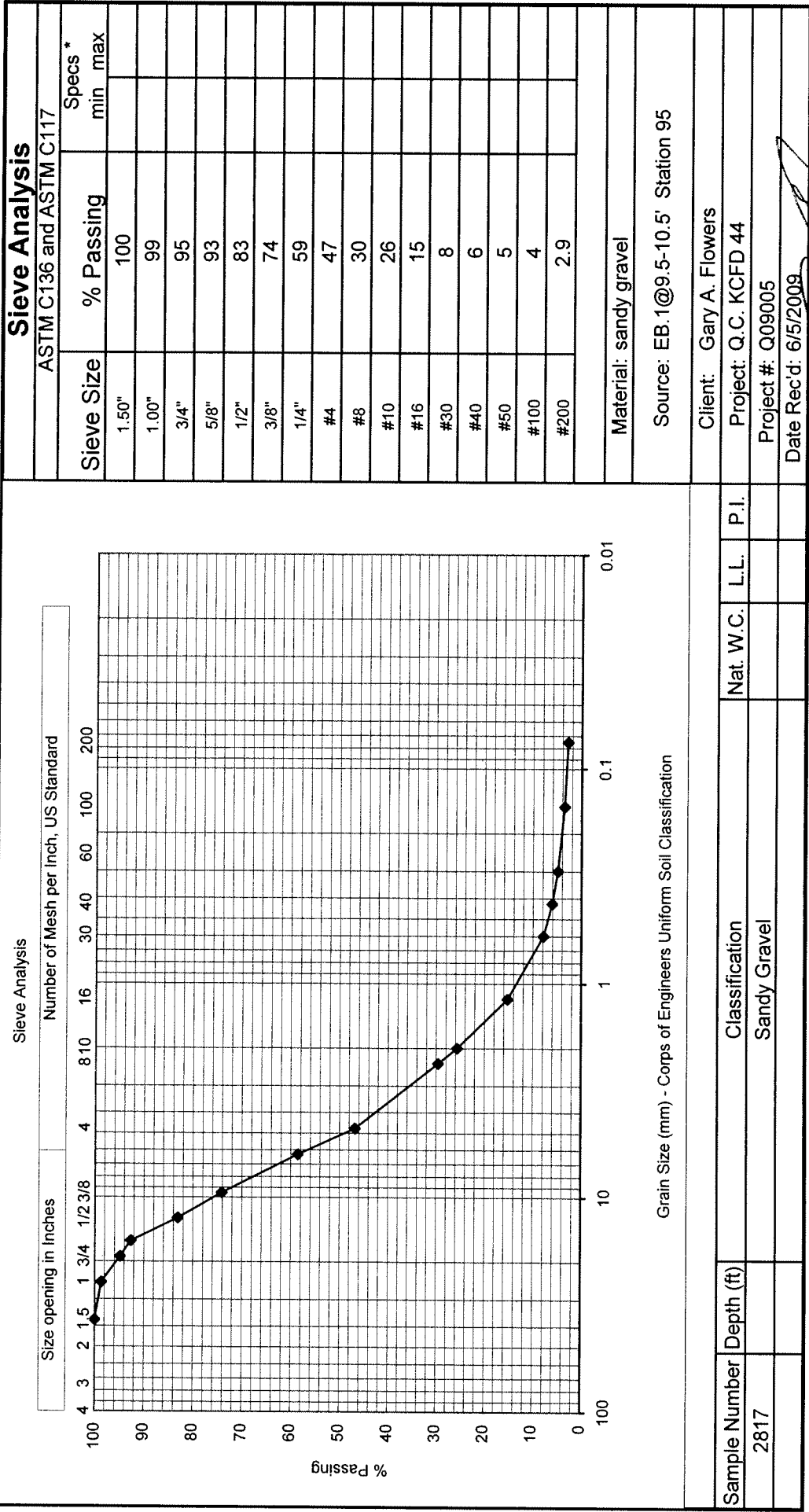
RECESSIONAL OUTWASH

0.0' – 0.7' sod and sandy topsoil
0.7' – 10.0' medium dense, damp to moist, brown, silty, sandy GRAVEL
9.0' – 19.0' medium dense, very moist to wet, brown, sandy GRAVEL with trace silt – gravel primarily about 1" in size with significant larger gravels and cobbles – multiple zones of primarily pea gravel size

BOH @ 19.0' No ground water observed throughout excavation. Moderate caving observed within pea gravel zones.

MAYES TESTING ENGINEERS, INC.

20225 Cedar Valley Road Suite 110
Lynwood, WA 98036 Fax 425-745-1737



Sieve Analysis

ASTM C136 and ASTM C117

Sieve Size	% Passing	Specs * min max
1.50"	100	
1.00"	99	
3/4"	95	
5/8"	93	
1/2"	83	
3/8"	74	
1/4"	59	
#4	47	
#8	30	
#10	26	
#16	15	
#30	8	
#40	6	
#50	5	
#100	4	
#200	2.9	

Material: sandy gravel

Source: EB.1@9.5-10.5' Station 95

Client: Gary A. Flowers

Project: Q.C. KCFD 44

Project #: Q09005

Date Rec'd: 6/5/2009

Reviewed by: Dale Yoder, Lab Manager

Sample Number	Depth (ft)	Classification	Nat. W.C.	L.L.	P.I.
2817		Sandy Gravel			

Tested By: Dan Hootman Date Tested: 6/11/2009

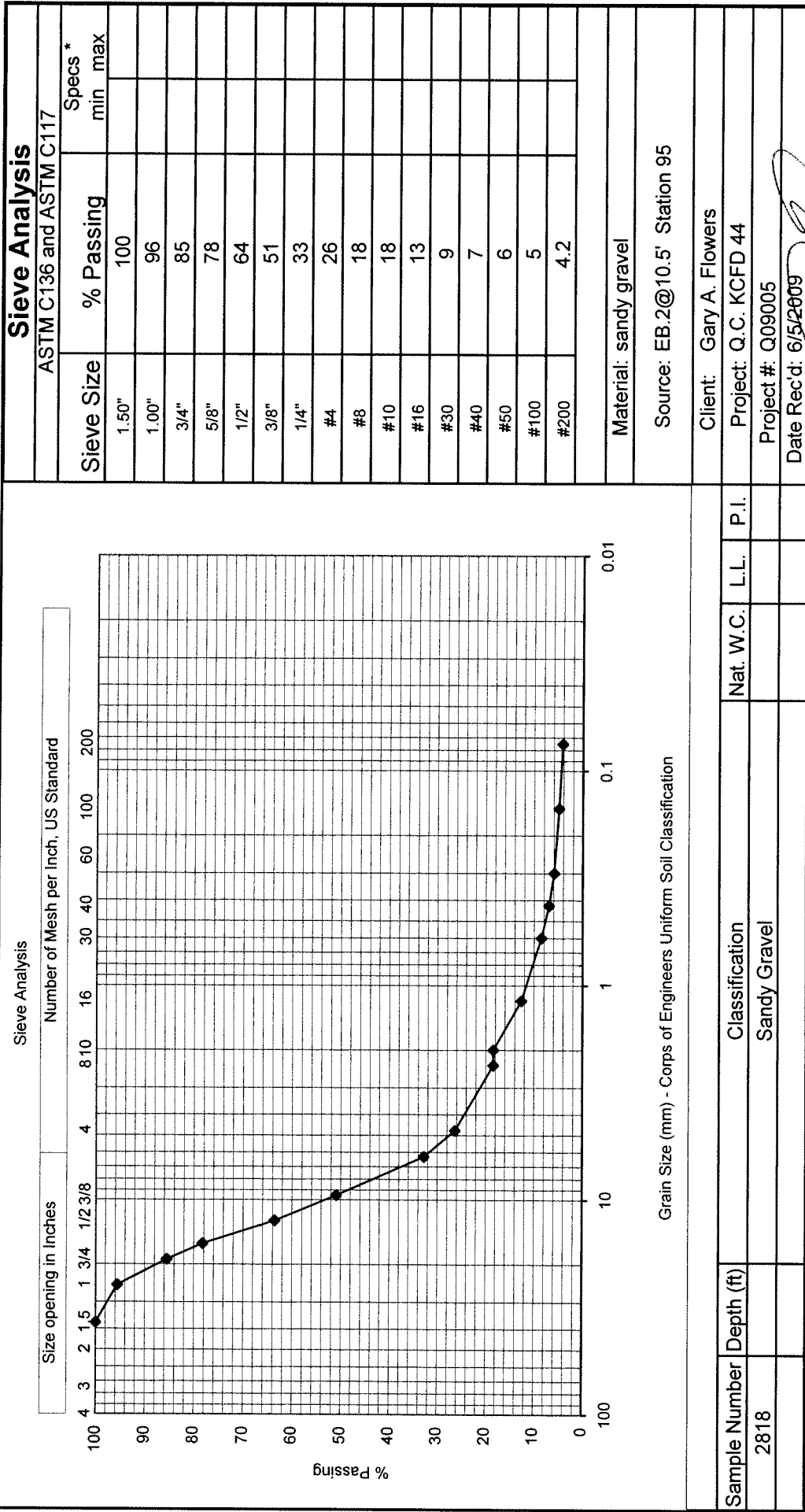
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Tested By: Dan Hootman Date Tested: 6/11/2009

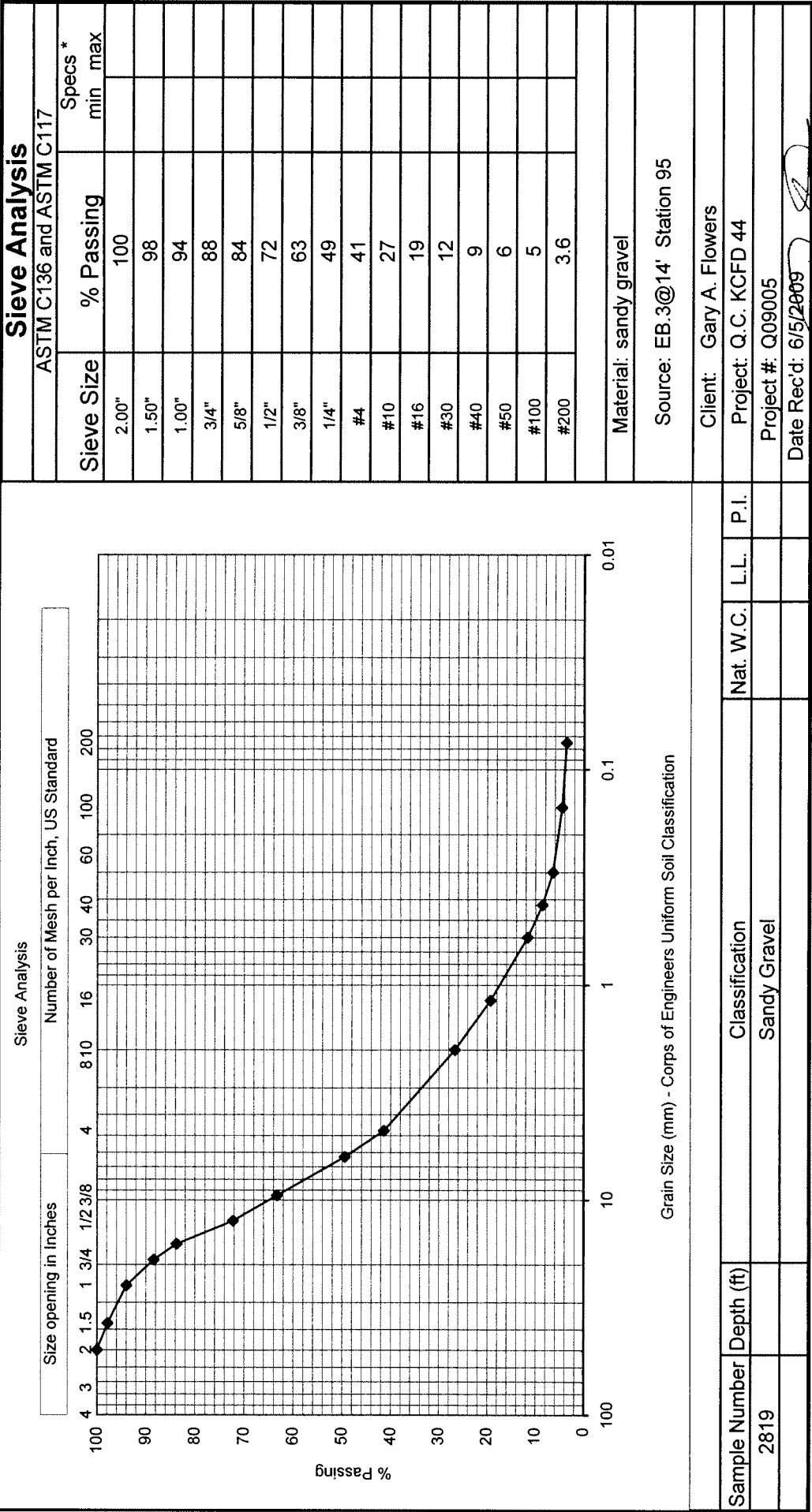
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Sieve Analysis

ASTM C136 and ASTM C117

Sieve Size	% Passing	Specs *	
		min	max
2.00"	100		
1.50"	98		
1.00"	94		
3/4"	88		
5/8"	84		
1/2"	72		
3/8"	63		
1/4"	49		
#4	41		
#10	27		
#16	19		
#30	12		
#40	9		
#50	6		
#100	5		
#200	3.6		

Material: sandy gravel

Source: EB.3@14' Station 95

Client: Gary A. Flowers

Project: Q.C. KCFD 44

Project #: Q09005

Date Rec'd: 6/5/2009

Reviewed by: Dale Yoder, Lab Manager

Sample Number	2819	Depth (ft)		Classification	Sandy Gravel	Nat. W.C.		L.L.		P.I.	
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Tested By: Dan Hootman Date Tested: 6/11/2009

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