PEAK ENGINEERING, INC.

CONSTRUCTION DRAINAGE REPORT FOR TRENCHLESS CONSTRUCTION SERVICES

City of Arlington
CFN: PLN20080056

DATE: 6/11/09

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Peak Engineering, Inc.

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Revised per City's review: April 23, 2009 (brl)
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Peak Job #996

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DRAINAGE INFORMATION SUMMARY FORM

Project Total Area: 1.78 acres

Project Development Area: 1.84 acres

Number of Lots (if applies): n/a

Summary Table

Drainage Basin Information		Individual Basin Information			
		SITE			
On-Site Sub-basin Area (ac)		1.78			
Type of Storage Proposed		INFILTRATION			
Approx. Storage Volume (ft^3)		N/A			
Soil Type(s)		Everett			
Pre-developed Runoff Rates		N/A			
Q (cfs)	2 yr.				
	10 yr.				
	100 yr.				
Redevelopment Area		N/A			
Post-development Runoff Rates		N/A			
Q (cfs)	2yr.				
	10 yr.				
	100 yr.				
Offsite Upstream Area (ac)					
Number of acres					
Offsite Downstream Flow					
Q (cfs)					

SECTION I

INTRODUCTION AND EXISTING CONDITIONS

This project will construct a commercial development consisting of a building and parking area on approximately 1.78 acre site. The site is located at the southwest corner of 199th ST NE and 63rd Ave NE in the City of Arlington. The development area is relatively flat. The Soil Survey of Snohomish County identified the onsite soils as Everett gravelly sandy loam. (Hydrologic Soils Group A) The permeability of Everett soils is rapid and is suitable for infiltration, runoff is medium and hazard of water erosion is moderate.

There are no buildings on the site currently. As such, no demolition will be required on site prior to development. The site has been filled with recycled asphalt and will be regarded to a minimum 6" depth and compacted to a minimum of 92 percent maximum density in the yard area of the site.

DEVELOPED CONDITIONS

The site will be accessed from the northwest and southeast property corners. A Low Impact Development rain garden/infiltration basin will be installed along the 63rd Ave NE property boundary. The infiltration basin is sized per the January 2005 LID Technical Guidance Manual for Puget Sound to infiltrate runoff from the impervious surfaces to the natural ground up to and including the 100yr storm event. The infiltration basin is sized to include future impervious surfaces up to 78 % of lot coverage. A long term design infiltration rate of 2 in/hr was used for the design of the infiltration bed. For additional information see the Geotechnical Investigation as provided by Western Geotechnical Consultants, Inc attached to the Appendix of this report. The infiltration rain garden is approximately 335 ft long x 10 ft wide and utilizes the onsite native soil for infiltration. Frontage improvements will consist of a new sidewalk along 199th ST NE and 63rd Ave NE.

Runoff rates and volume calculations were performed, using the WWHM3 Hydrology Model as provided by Clear Creek Solutions and the Washington State Department of Ecology. (See Section II).

WATER QUALITY

To meet water quality criteria, storm drainage from pollution generating surfaces will be directed to a 5 ft wide grassed filter strip upstream of the rain garden / infiltration basin. The rain garden will be constructed with a 10 ft wide, 1.5 ft minimum depth of an amended soil (Planting soil mix compost) that will provide cation exchange prior to infiltration. The rain garden will be planted with native water tolerable plants will provide additional water quality benefits. No additional water quality measures are required when utilizing rain garden Bioretention areas.

OPERATION AND MAINTENANCE

The roof downspout, storm drainage piping system and rain garden shall be inspected annually to ensure that sediment is not filling up the catchments and shall be cleaned as necessary. Additionally, undesirable vegetation that has the potential to interfere with performance of or damage to the rain garden / infiltration system shall be removed. The drainage system shall be inspected after large storm events to ensure debris has not caused a blockage and is not hindering

the system's performance. Maintain a record of inspections and maintenance activities on site and made available upon request to the city. Note: Store all fluids (fuels, Lubricants, etc) and drilling mud in a covered area with full containment of their total volume. A Spill Control Plan (example) has been provided for reference and operator assistance at containing and clean-up of oil of any kind, including, but not limited to petroleum, fuel oil, sludge, oil refuse, and oil mixed with waste other than dredged spoil. For additional information see the Operation and Maintenance Manual and the Spill Control Plan (SCP) attached to Section III of this drainage report.

EROSION CONTROL RISK ASSESSMENT AND SWPPP

The project was evaluated to determine the erosion risk category and generate a Storm Water Pollution Prevention Plan (SWPPP). The soil on the proposed project site is classified as Everett gravelly sandy loam, which has a medium erosion risk categorization. The site is flat and the project is not located within ¼ mile of a critical area. Surface runoff does not leave the site in the existing condition; overall, the project is classified as low risk for erosion.

A Storm Water Pollution Prevention Plan (SWPPP) has been prepared for this project, which will comply with City and State of Washington D.O.E. standards for erosion control. The site is infiltrating runoff on site, so an NPDES construction permit is not required.

Erosion control BMP's will include leaving existing vegetation as much as practical around the site. Temporary cover and/or surface roughening of exposed areas (mulching, plastic, etc.) will be provided. Measures to limit the level of sediment leaving the site will include silt fences and inlet protection of catch basins.

CONVEYANCE SYSTEM

The design Q_{100yr} post-developed peak flow rate is 1.44 cfs. Storm water runoff from the development is conveyed to the rain garden / infiltration basin via 12" HDPE storm pipe. The shallowest slope leading to the drainage system is 0.50%. Conservatively, the 12" dia. conveyance pipe was evaluated using Manning's Equation and determined to have a normal flow depth of 0.52 ft (6.24") (calculations attached in the Section II of this report). No concerns regarding the proposed conveyance system's ability to convey the developed flow rates have been observed.

UPSTREAM/DOWNSTREAM CONDITIONS

No off site upstream areas contribute runoff to the Gustafson site. Stormwater runoff for the existing site currently infiltrates on site. Because storm runoff will be infiltrated on site in the developed condition, no downstream analysis is required for on-site drainage.

SECTION II

CONSTRUCTION DRAINAGE ANALYSIS

INFILTRATION DESIGN:

Western Washington Hydrology Model
PROJECT REPORT

Project Name: 996-GUSTAFSON INF BRL
Site Address:
City : Arlington
Report Date : 3/20/2009
Gage : Everett
Data Start : 1948/10/01
Data End : 1997/09/30
Precip Scale: 1.20
WWHM3 Version:

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	Acres
A B, Forest, Flat	1.84

Impervious Land Use	Acres

Element Flows To:

Surface	Interflow	Groundwater

Name : DEV Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	Acres
A B, Lawn, Flat	.46

Impervious Land Use	Acres
ROOF TOPS FLAT	0.22
DRIVEWAYS FLAT	1.16

Element Flows To:

Surface	Interflow	Groundwater
Trapezoidal Pond 1,	Trapezoidal Pond 1,	

Name : Gravel Trench Bed 1
Bottom Length: 335ft.
Bottom Width : 10ft.
Trench bottom slope 1: 0.001 To 1
Trench Left side slope 0: 0.0001 To 1
Trench right side slope 2: 0.0001 To 1
Material thickness of first layer : 1.5
Pour Space of material for first layer : 0.35
Material thickness of second layer : 4
Pour Space of material for second layer : 0.35
Material thickness of third layer : 0
Pour Space of material for third layer : 0
Infiltration On
Infiltration rate : 2
Infiltration saftey factor : 1
Discharge Structure
Riser Height: 5.45 ft.
Riser Diameter: 1000 in.

Element Flows To:

Outlet 1	Outlet 2

Gravel Trench Bed Hydraulic Table

Stage(ft)	Area(acr)	Volume(acr-ft)	Dschrg(cfs)	Infilt(cfs)
112.0	0.077	0.000	0.000	0.000
112.1	0.077	0.002	0.000	0.155
112.1	0.077	0.003	0.000	0.155
112.2	0.077	0.005	0.000	0.155
112.2	0.077	0.007	0.000	0.155
112.3	0.077	0.008	0.000	0.155
112.4	0.077	0.010	0.000	0.155
112.4	0.077	0.012	0.000	0.155
112.5	0.077	0.013	0.000	0.155
112.6	0.077	0.015	0.000	0.155
112.6	0.077	0.016	0.000	0.155
112.7	0.077	0.018	0.000	0.155
112.7	0.077	0.020	0.000	0.155
112.8	0.077	0.021	0.000	0.155
112.9	0.077	0.023	0.000	0.155
112.9	0.077	0.025	0.000	0.155
113.0	0.077	0.026	0.000	0.155
113.0	0.077	0.028	0.000	0.155
113.1	0.077	0.030	0.000	0.155
113.2	0.077	0.031	0.000	0.155
113.2	0.077	0.033	0.000	0.155
113.3	0.077	0.035	0.000	0.155
113.3	0.077	0.036	0.000	0.155

113.4	0.077	0.038	0.000	0.155
113.5	0.077	0.039	0.000	0.155
113.5	0.077	0.041	0.000	0.155
113.6	0.077	0.043	0.000	0.155
113.7	0.077	0.044	0.000	0.155
113.7	0.077	0.046	0.000	0.155
113.8	0.077	0.048	0.000	0.155
113.8	0.077	0.049	0.000	0.155
113.9	0.077	0.051	0.000	0.155
114.0	0.077	0.053	0.000	0.155
114.0	0.077	0.054	0.000	0.155
114.1	0.077	0.056	0.000	0.155
114.1	0.077	0.058	0.000	0.155
114.2	0.077	0.059	0.000	0.155
114.3	0.077	0.061	0.000	0.155
114.3	0.077	0.063	0.000	0.155
114.4	0.077	0.064	0.000	0.155
114.4	0.077	0.066	0.000	0.155
114.5	0.077	0.067	0.000	0.155
114.6	0.077	0.069	0.000	0.155
114.6	0.077	0.071	0.000	0.155
114.7	0.077	0.072	0.000	0.155
114.8	0.077	0.074	0.000	0.155
114.8	0.077	0.076	0.000	0.155
114.9	0.077	0.077	0.000	0.155
114.9	0.077	0.079	0.000	0.155
115.0	0.077	0.081	0.000	0.155
115.1	0.077	0.082	0.000	0.155
115.1	0.077	0.084	0.000	0.155
115.2	0.077	0.086	0.000	0.155
115.2	0.077	0.087	0.000	0.155
115.3	0.077	0.089	0.000	0.155
115.4	0.077	0.090	0.000	0.155
115.4	0.077	0.092	0.000	0.155
115.5	0.077	0.094	0.000	0.155
115.5	0.077	0.095	0.000	0.155
115.6	0.077	0.097	0.000	0.155
115.7	0.077	0.099	0.000	0.155
115.7	0.077	0.100	0.000	0.155
115.8	0.077	0.102	0.000	0.155
115.9	0.077	0.104	0.000	0.155
115.9	0.077	0.105	0.000	0.155
116.0	0.077	0.107	0.000	0.155
116.0	0.077	0.109	0.000	0.155
116.1	0.077	0.110	0.000	0.155
116.2	0.077	0.112	0.000	0.155
116.2	0.077	0.114	0.000	0.155
116.3	0.077	0.115	0.000	0.155
116.3	0.077	0.117	0.000	0.155
116.4	0.077	0.118	0.000	0.155
116.5	0.077	0.120	0.000	0.155
116.5	0.077	0.122	0.000	0.155
116.6	0.077	0.123	0.000	0.155
116.6	0.077	0.125	0.000	0.155
116.7	0.077	0.127	0.000	0.155
116.8	0.077	0.128	0.000	0.155
116.8	0.077	0.130	0.000	0.155

116.9	0.077	0.132	0.000	0.155
117.0	0.077	0.133	0.000	0.155
117.0	0.077	0.135	0.000	0.155
117.1	0.077	0.137	0.000	0.155
117.1	0.077	0.138	0.000	0.155
117.2	0.077	0.140	0.000	0.155
117.3	0.077	0.141	0.000	0.155
117.3	0.077	0.143	0.000	0.155
117.4	0.077	0.145	0.000	0.155
117.4	0.077	0.146	0.000	0.155
117.5	0.077	0.148	9.074	0.155

Name : Trapezoidal Pond 1
Bottom Length: 335ft.
Bottom Width: 1ft.
Depth : 1ft.
Volume at riser head : 0.0302ft.
Infiltration On
Infiltration rate : 2
Infiltration saftey factor : 1
Wetted surface area On
Side slope 1: 3 To 1
Side slope 2: 0.001 To 1
Side slope 3: 3 To 1
Side slope 4: 0.001 To 1
Discharge Structure
Riser Height: 0.98 ft.
Riser Diameter: 10000 in.

Element Flows To:
Outlet 1 **Outlet 2**
Gravel Trench Bed 1,

Pond Hydraulic Table

Stage(ft)	Area(acr)	Volume(acr-ft)	Dschrg(cfs)	Infilt(cfs)
117.5	0.008	0.000	0.000	0.000
117.5	0.008	0.000	0.000	0.016
117.5	0.009	0.000	0.000	0.016
117.5	0.009	0.000	0.000	0.017
117.5	0.010	0.000	0.000	0.017
117.6	0.010	0.000	0.000	0.017
117.6	0.011	0.001	0.000	0.018
117.6	0.011	0.001	0.000	0.018
117.6	0.012	0.001	0.000	0.018
117.6	0.012	0.001	0.000	0.019
117.6	0.013	0.001	0.000	0.019
117.6	0.013	0.001	0.000	0.019
117.6	0.014	0.001	0.000	0.020
117.6	0.014	0.002	0.000	0.020
117.7	0.015	0.002	0.000	0.020
117.7	0.015	0.002	0.000	0.021
117.7	0.016	0.002	0.000	0.021
117.7	0.016	0.002	0.000	0.021

117.7	0.017	0.002	0.000	0.022
117.7	0.017	0.003	0.000	0.022
117.7	0.018	0.003	0.000	0.022
117.7	0.018	0.003	0.000	0.023
117.7	0.019	0.003	0.000	0.023
117.8	0.019	0.003	0.000	0.024
117.8	0.020	0.004	0.000	0.024
117.8	0.021	0.004	0.000	0.024
117.8	0.021	0.004	0.000	0.025
117.8	0.022	0.004	0.000	0.025
117.8	0.022	0.005	0.000	0.025
117.8	0.023	0.005	0.000	0.026
117.8	0.023	0.005	0.000	0.026
117.8	0.024	0.005	0.000	0.026
117.9	0.024	0.006	0.000	0.027
117.9	0.025	0.006	0.000	0.027
117.9	0.025	0.006	0.000	0.027
117.9	0.026	0.006	0.000	0.028
117.9	0.026	0.007	0.000	0.028
117.9	0.027	0.007	0.000	0.028
117.9	0.027	0.007	0.000	0.029
117.9	0.028	0.008	0.000	0.029
117.9	0.028	0.008	0.000	0.029
118.0	0.029	0.008	0.000	0.030
118.0	0.029	0.009	0.000	0.030
118.0	0.030	0.009	0.000	0.031
118.0	0.030	0.009	0.000	0.031
118.0	0.031	0.010	0.000	0.031
118.0	0.031	0.010	0.000	0.032
118.0	0.032	0.010	0.000	0.032
118.0	0.032	0.011	0.000	0.032
118.0	0.033	0.011	0.000	0.033
118.1	0.033	0.011	0.000	0.033
118.1	0.034	0.012	0.000	0.033
118.1	0.034	0.012	0.000	0.034
118.1	0.035	0.013	0.000	0.034
118.1	0.035	0.013	0.000	0.034
118.1	0.036	0.013	0.000	0.035
118.1	0.036	0.014	0.000	0.035
118.1	0.037	0.014	0.000	0.035
118.1	0.037	0.015	0.000	0.036
118.2	0.038	0.015	0.000	0.036
118.2	0.038	0.015	0.000	0.037
118.2	0.039	0.016	0.000	0.037
118.2	0.039	0.016	0.000	0.037
118.2	0.040	0.017	0.000	0.038
118.2	0.041	0.017	0.000	0.038
118.2	0.041	0.018	0.000	0.038
118.2	0.042	0.018	0.000	0.039
118.2	0.042	0.019	0.000	0.039
118.3	0.043	0.019	0.000	0.039
118.3	0.043	0.019	0.000	0.040
118.3	0.044	0.020	0.000	0.040
118.3	0.044	0.020	0.000	0.040
118.3	0.045	0.021	0.000	0.041
118.3	0.045	0.021	0.000	0.041
118.3	0.046	0.022	0.000	0.041

118.3	0.046	0.022	0.000	0.042
118.3	0.047	0.023	0.000	0.042
118.4	0.047	0.023	0.000	0.043
118.4	0.048	0.024	0.000	0.043
118.4	0.048	0.025	0.000	0.043
118.4	0.049	0.025	0.000	0.044
118.4	0.049	0.026	0.000	0.044
118.4	0.050	0.026	0.000	0.044
118.4	0.050	0.027	0.000	0.045
118.4	0.051	0.027	0.000	0.045
118.4	0.051	0.028	0.000	0.045
118.5	0.052	0.028	0.000	0.046
118.5	0.052	0.029	0.000	0.046
118.5	0.053	0.030	0.000	0.046
118.5	0.053	0.030	6.801	0.047
118.5	0.054	0.031	22.96	0.047
118.5	0.054	0.031	44.54	0.047

MITIGATED LAND USE

ANALYSIS RESULTS

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.000523
5 year	0.001192
10 year	0.001953
25 year	0.003475
50 year	0.005184
100 year	0.007574

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

Yearly Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1950	0.000	0.000
1951	0.001	0.000
1952	0.000	0.000
1953	0.000	0.000
1954	0.000	0.000
1955	0.002	0.000
1956	0.007	0.000
1957	0.000	0.000
1958	0.000	0.000
1959	0.001	0.000
1960	0.000	0.000

1961	0.000	0.000
1962	0.001	0.000
1963	0.000	0.000
1964	0.000	0.000
1965	0.000	0.000
1966	0.000	0.000
1967	0.000	0.000
1968	0.000	0.000
1969	0.000	0.000
1970	0.000	0.000
1971	0.000	0.000
1972	0.003	0.000
1973	0.000	0.000
1974	0.000	0.000
1975	0.001	0.000
1976	0.000	0.000
1977	0.000	0.000
1978	0.000	0.000
1979	0.000	0.000
1980	0.001	0.000
1981	0.000	0.000
1982	0.000	0.000
1983	0.002	0.000
1984	0.001	0.000
1985	0.000	0.000
1986	0.003	0.000
1987	0.000	0.000
1988	0.002	0.000
1989	0.000	0.000
1990	0.000	0.000
1991	0.000	0.000
1992	0.000	0.000
1993	0.000	0.000
1994	0.000	0.000
1995	0.000	0.000
1996	0.000	0.000
1997	0.007	0.000
1998	0.012	0.000

Ranked Yearly Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0121	0.0000
2	0.0066	0.0000
3	0.0065	0.0000
4	0.0033	0.0000
5	0.0027	0.0000
6	0.0024	0.0000
7	0.0019	0.0000
8	0.0017	0.0000
9	0.0011	0.0000
10	0.0010	0.0000
11	0.0008	0.0000
12	0.0007	0.0000
13	0.0007	0.0000
14	0.0006	0.0000
15	0.0005	0.0000

16	0.0004	0.0000
17	0.0004	0.0000
18	0.0004	0.0000
19	0.0004	0.0000
20	0.0004	0.0000
21	0.0004	0.0000
22	0.0004	0.0000
23	0.0004	0.0000
24	0.0004	0.0000
25	0.0004	0.0000
26	0.0004	0.0000
27	0.0004	0.0000
28	0.0004	0.0000
29	0.0004	0.0000
30	0.0004	0.0000
31	0.0004	0.0000
32	0.0004	0.0000
33	0.0004	0.0000
34	0.0004	0.0000
35	0.0004	0.0000
36	0.0004	0.0000
37	0.0004	0.0000
38	0.0004	0.0000
39	0.0004	0.0000
40	0.0004	0.0000
41	0.0004	0.0000
42	0.0004	0.0000
43	0.0003	0.0000
44	0.0003	0.0000
45	0.0003	0.0000
46	0.0003	0.0000
47	0.0003	0.0000
48	0.0003	0.0000
49	0.0003	0.0000

POC #1
The Facility PASSED

The Facility PASSED.

Flow(CFS)	Predev	Dev	Percentage	Pass/Fail
0.0003	1483	0	0	Pass
0.0003	652	0	0	Pass
0.0004	209	0	0	Pass
0.0004	135	0	0	Pass
0.0005	117	0	0	Pass
0.0005	104	0	0	Pass
0.0006	97	0	0	Pass
0.0006	87	0	0	Pass
0.0007	82	0	0	Pass
0.0007	77	0	0	Pass
0.0008	69	0	0	Pass
0.0008	65	0	0	Pass
0.0009	61	0	0	Pass
0.0009	58	0	0	Pass
0.0010	57	0	0	Pass

0.0010	53	0	0	Pass
0.0011	50	0	0	Pass
0.0011	50	0	0	Pass
0.0012	46	0	0	Pass
0.0012	45	0	0	Pass
0.0013	42	0	0	Pass
0.0013	42	0	0	Pass
0.0014	40	0	0	Pass
0.0014	40	0	0	Pass
0.0015	39	0	0	Pass
0.0015	38	0	0	Pass
0.0016	36	0	0	Pass
0.0016	36	0	0	Pass
0.0017	34	0	0	Pass
0.0017	33	0	0	Pass
0.0018	29	0	0	Pass
0.0018	26	0	0	Pass
0.0019	22	0	0	Pass
0.0019	20	0	0	Pass
0.0020	19	0	0	Pass
0.0020	19	0	0	Pass
0.0021	18	0	0	Pass
0.0021	18	0	0	Pass
0.0022	17	0	0	Pass
0.0022	17	0	0	Pass
0.0023	17	0	0	Pass
0.0023	16	0	0	Pass
0.0023	15	0	0	Pass
0.0024	15	0	0	Pass
0.0024	14	0	0	Pass
0.0025	14	0	0	Pass
0.0025	13	0	0	Pass
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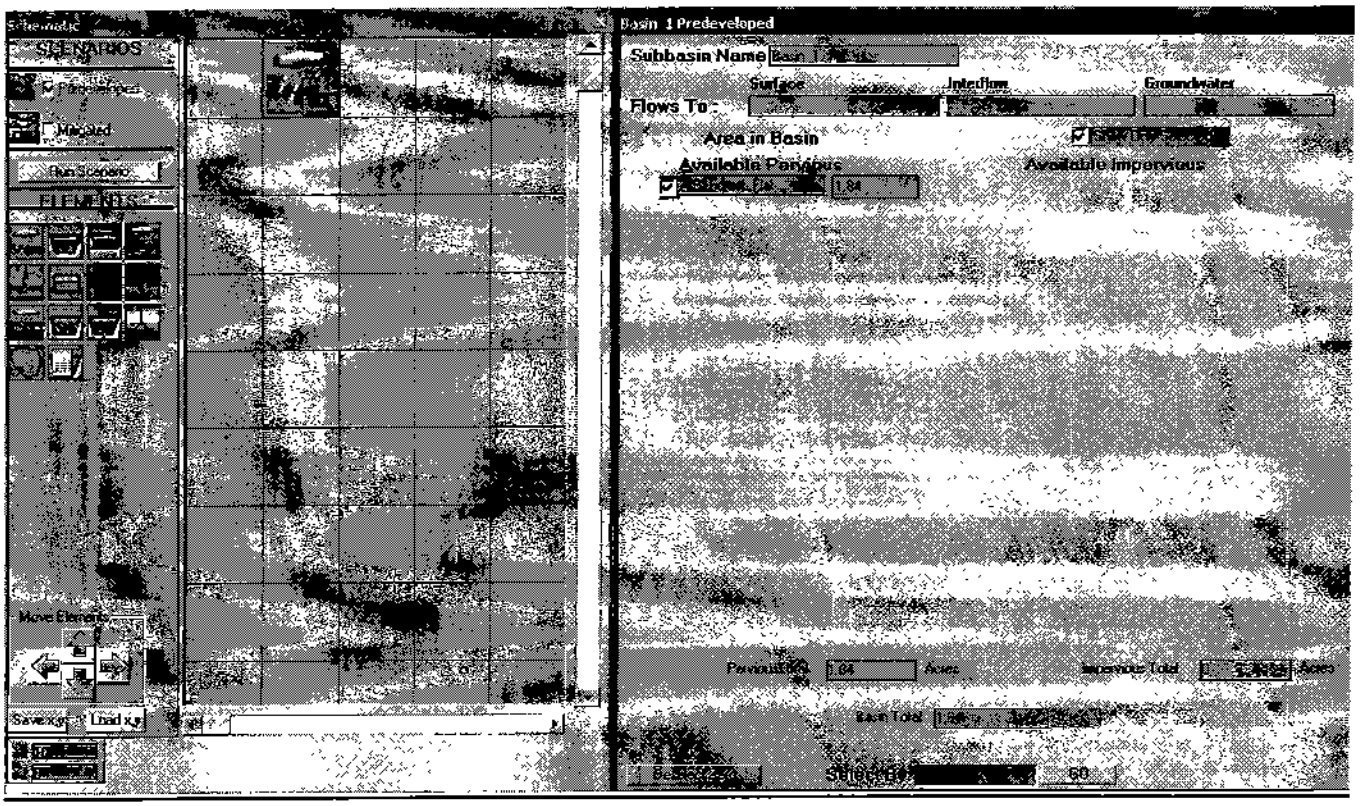
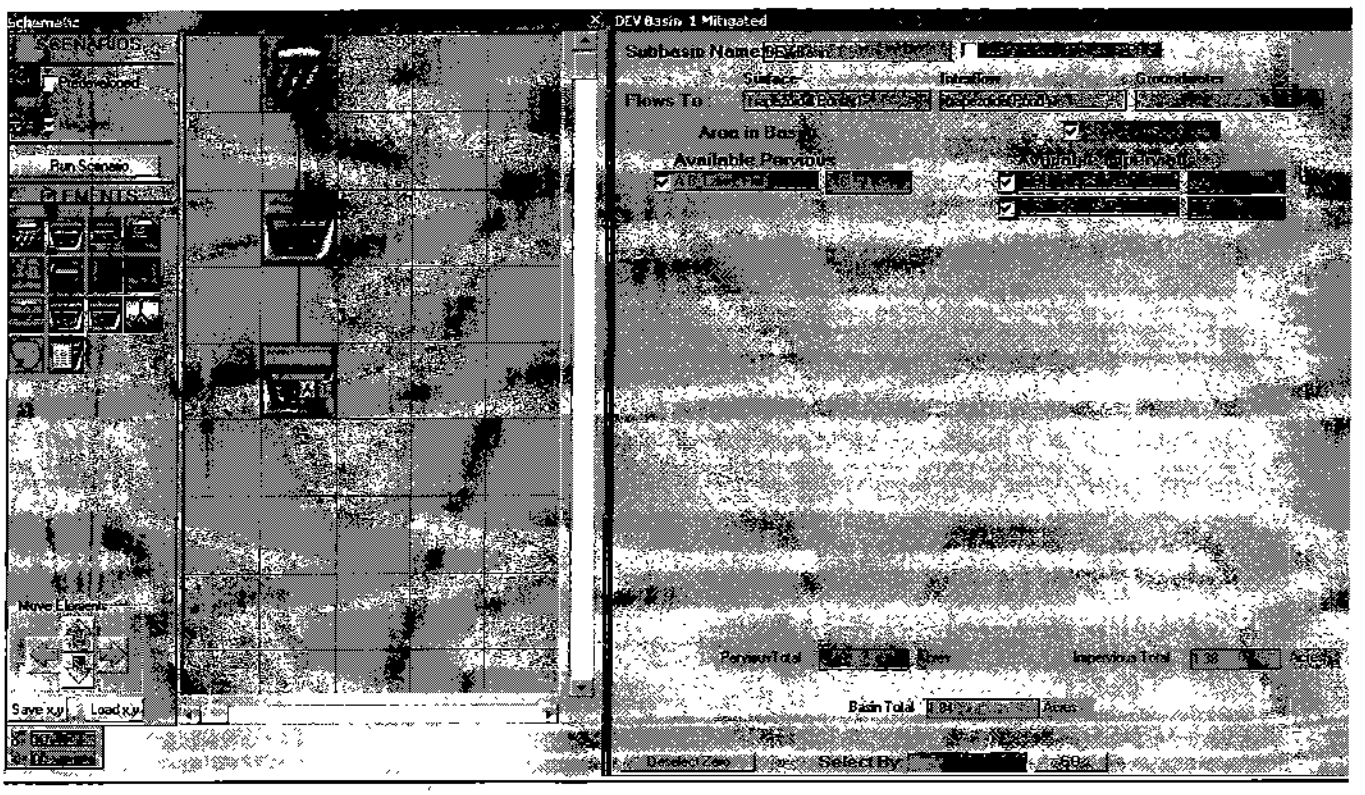
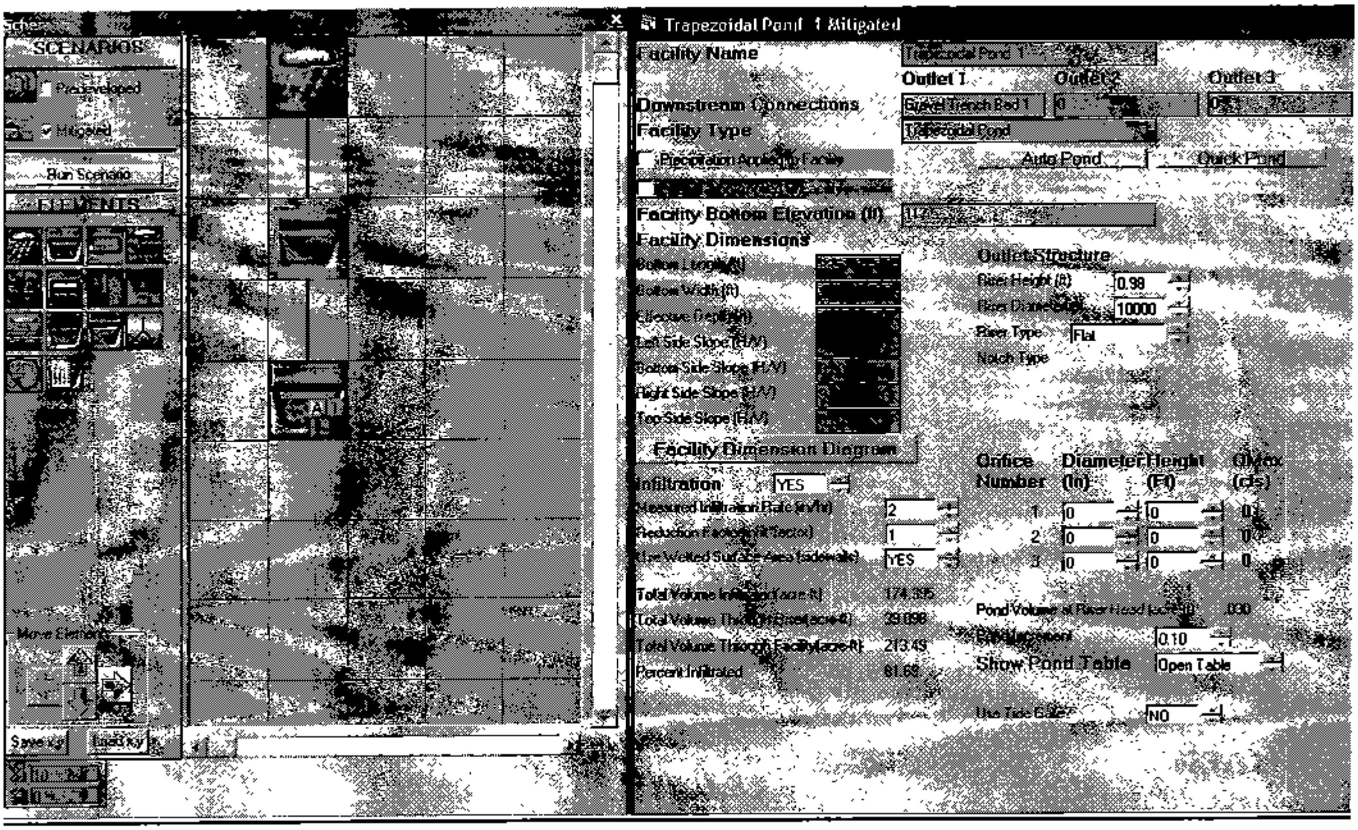
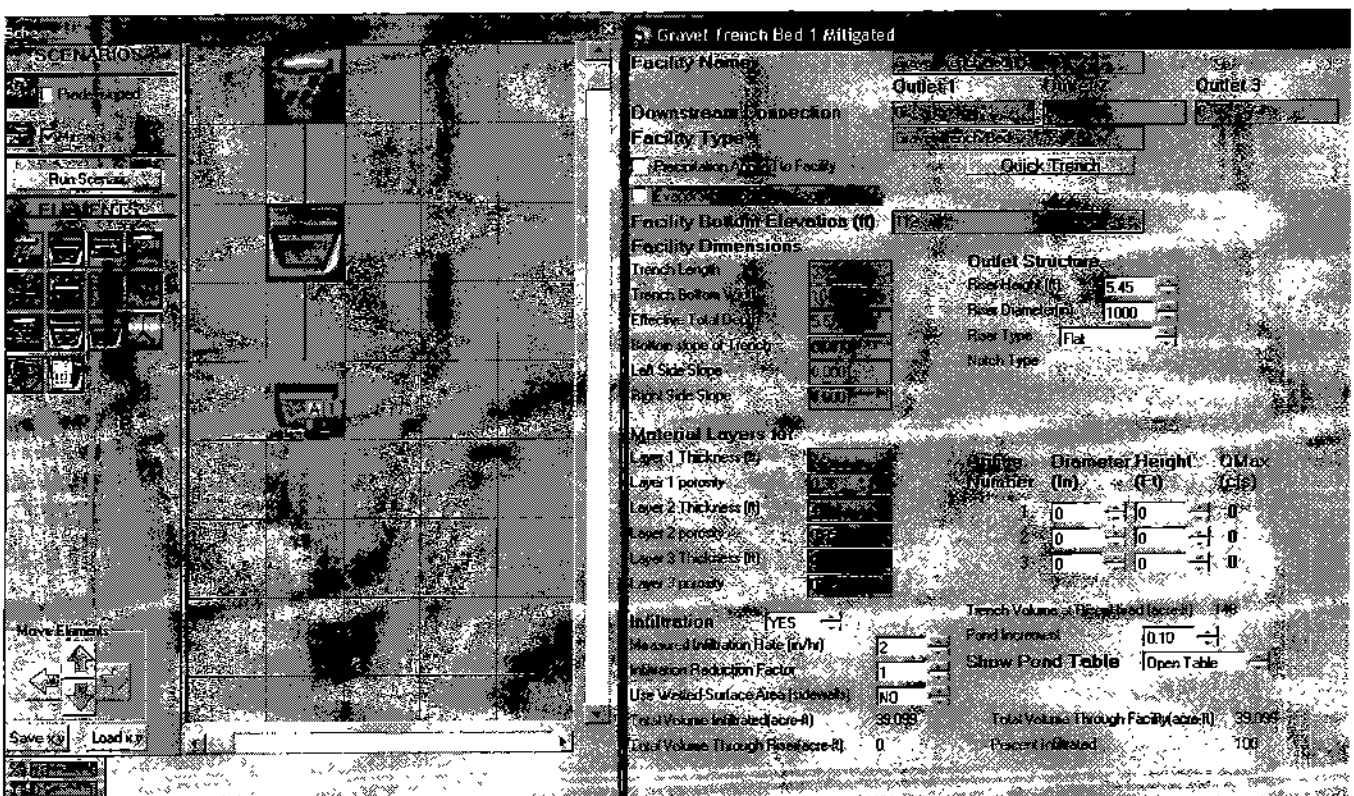
Water Quality BMP Flow and Volume for POC 1.
On-line facility volume: 0.1559 acre-feet
On-line facility target flow: 0.01 **cfs.**
Adjusted for 15 min: 0.4992 **cfs.**
Off-line facility target flow: 0.1281 **cfs.**
Adjusted for 15 min: 0.2861 **cfs.**

SCREEN CAPTURES:






Trapezoidal Pond 1 Mitigated
Facility Name
Outlet 1
Outlet 2
Outlet 3
Downstream Connections
Facility Type
Auto Pond
Quick Pond
Facility Bottom Elevation (ft)
Facility Dimensions
Outlet Structure
Riser Height (ft)
Riser Type
Notch Type
Facility Dimension Diagram
Orifice Number
Diameter (In)
Height (Ft)
QMax (cfs)
Infiltration
Show Pond Table
Open Table
Run Scenario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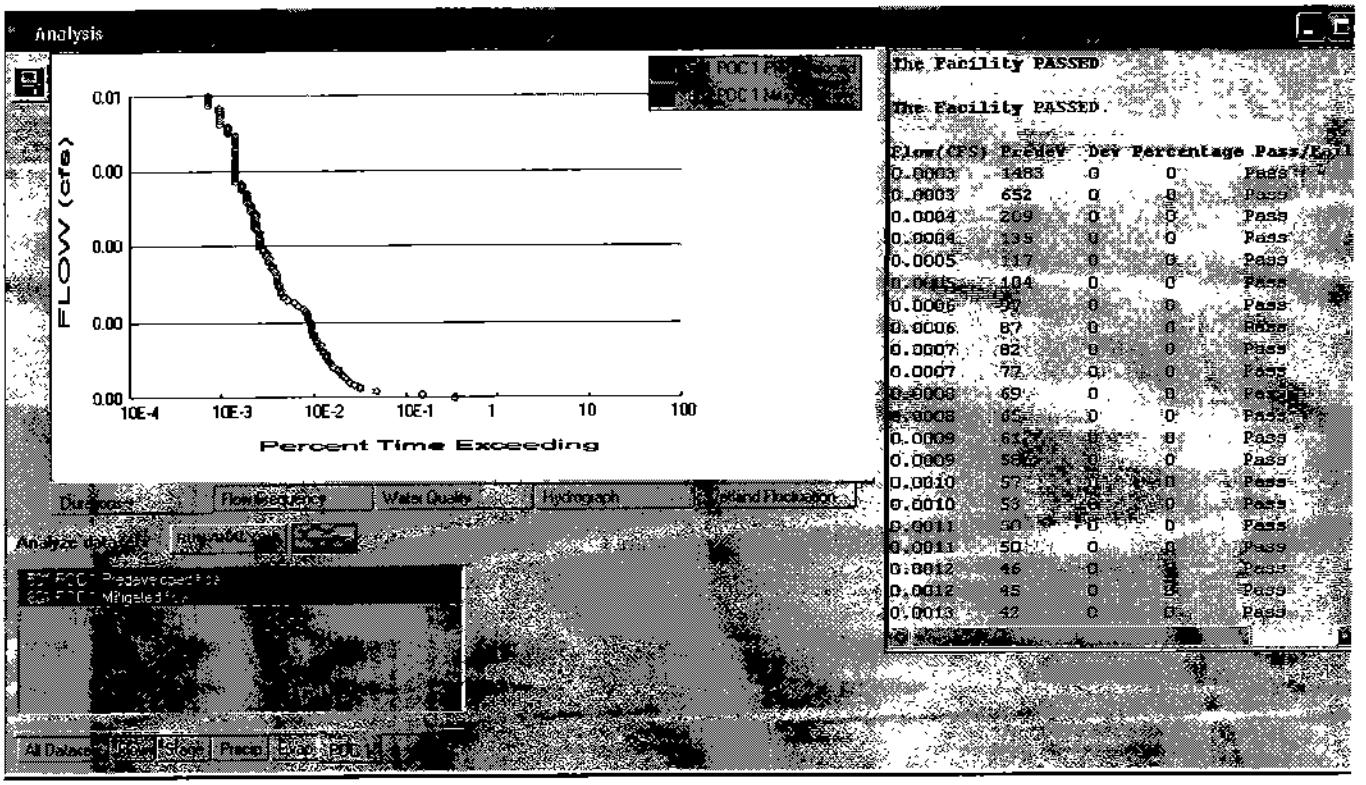
Facility Name
Outlet 1
Outlet 3
Downstream Connection
Facility Type
Quick Trench
Facility Bottom Elevation (ft)
Facility Dimensions
Outlet Structure
Material Layers for
Orifice Number
Diameter (In)
Height (Ft)
QMax (cfs)
Infiltration
Show Pond Table
Open Table
Move Elements
Run Scenario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FLOW (cfs)
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0.00
0.00
0.00
10E-4
10E-3
10E-2
10E-1
1
10
100
Percent Time Exceeding
Flow Frequency
Water Quality
Hydrograph
Extend Fluctuation
The Facility PASSED
The Facility PASSED
Flow(CFS) Predev Dev Percentage Pass/Fail
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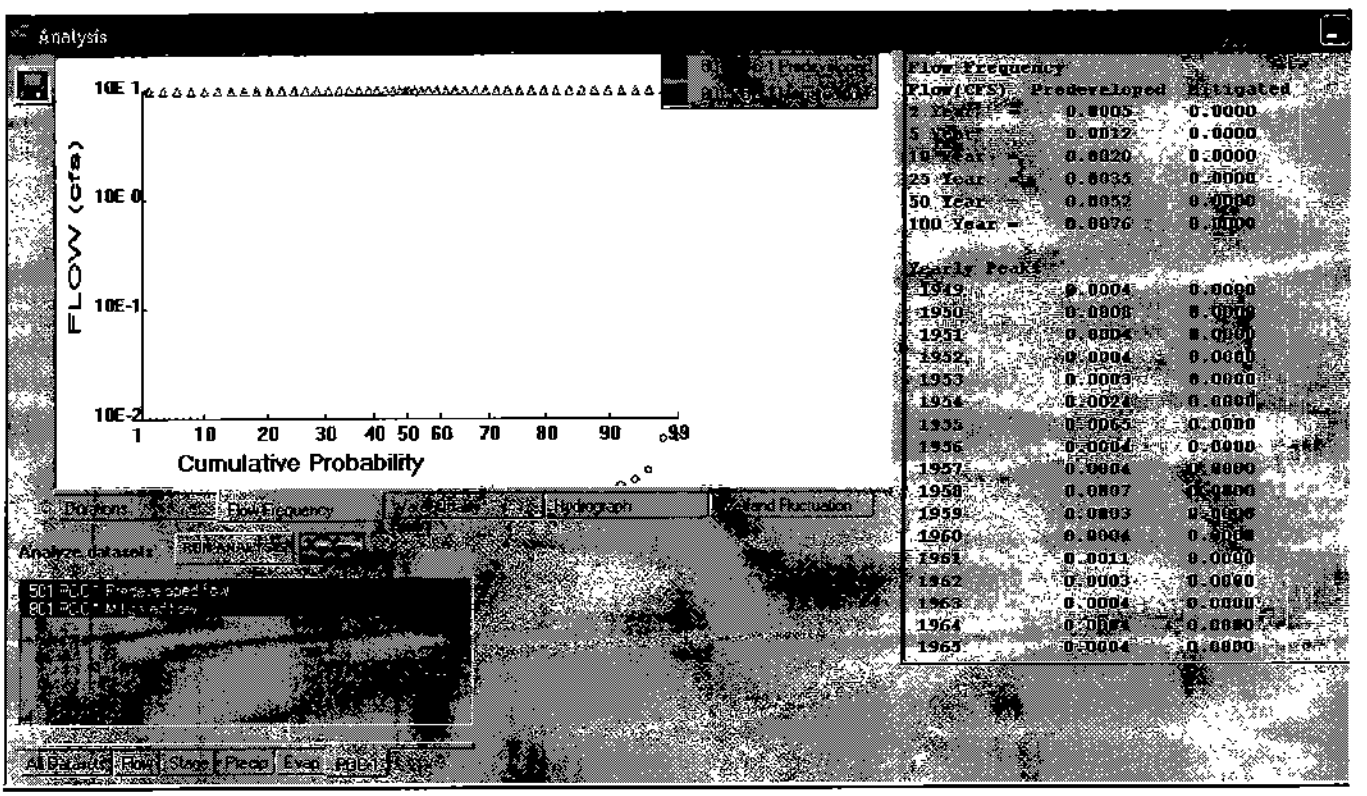
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FLOW (cfs)
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10E-2
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10
20
30
40
50
60
70
80
90
99
Cumulative Probability
Flow Frequency
Hydrograph
Extend Fluctuation
Flow Frequency
Flow(CFS) Predeveloped Mitigated
2 Year = 0.0005 0.0000
5 Year = 0.0012 0.0000
10 Year = 0.0020 0.0000
25 Year = 0.0035 0.0000
50 Year = 0.0052 0.0000
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Yearly Peaks
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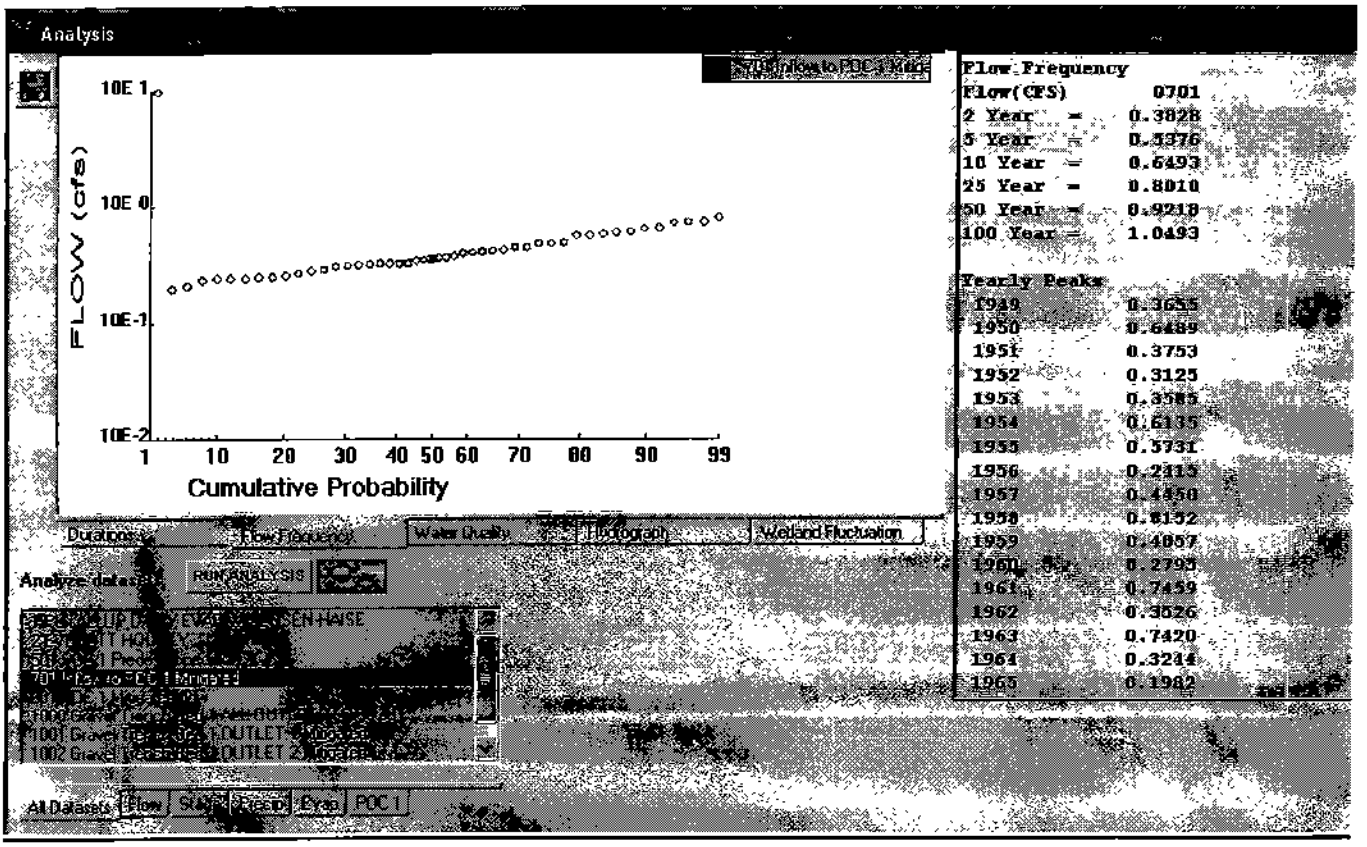


CONVEYANCE ANALYSIS: DRAFT

SECTION III

OPERATIONS & MAINTENANCE MANUAL

SECTION III

Table of Contents

CATCH BASINS/MANHOLES

Maintenance Component	Defect	Conditions When Maintenance is Needed	Desired Conditions
General	Trash & debris (Includes Sediment)	Trash or debris of more than ½ ft^3 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 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 (i.e. methane).	No dead animals or vegetation present within the catch basin.
		Deposits of garbage exceeding 1 ft^3 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" past curb face into the street (if applicable).	Frame is even with curb.
		Top slab has holes larger that 2 in^2 or cracks wider than ¼" (intent is to make sure all material is running into basin.	Top slab is free of holes & cracks.
		Frame not sitting flush on top slab; i.e. separation of more than ¾" of the frame from the top slab.	Frame is sitting flush on top slab.
	Cracks in Basin Walls/ Bottom	Cracks wider than ½" and longer than 3 ft, 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" and longer than 1 ft at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	No cracks more than ¼" wide at the joint of inlet/outlet pipe.
	Sediment/Mis-alignment	Basin has settled more than 1" or has rotated more than 2" out of alignment.	Basin replaced or repaired to design standards.
	Fire Hazard	Presence of chemicals such as natural gas, oil, and/or gasoline.	No flammable chemicals present.
	Vegetation	Vegetation growing across & 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" tall and less than 6" apart.	No vegetation or root growth present.
	Pollution	Non-flammable chemicals of more than ½ ft^3 per 3 ft of basin length.	No pollution present other than surface film.

CATCH BASINS/MANHOLES

Maintenance Component	Defect	Conditions When Maintenance is Needed	Desired Conditions
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 1 maint. person with proper tools. Bolts into frame have less than ½" of thread.	Mechanism opens with proper tools.
	Cover Difficult to Remove	1 Maint. person cannot remove lid after applying 80 lbs of lift; intent is to keep cover from sealing off access to maintenance personnel.	Cover can be removed by 1 maint. person.
Ladder	Ladder rungs Unsafe	Ladder is unsafe due to missing rungs, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards & allows maint. personnel safe access.
Metal Grates (if applicable)		Grate with opening wider than 7/8"	Grate meets design standards.
	Trash & Debris	Trash & debris that is blocking more than 20% of grate surface.	Grate is free of trash & debris.
	Damaged or Missing	Grate missing or broken member(s) of the grate.	Grate is in place & meets design standards.

CONVEYANCE SYSTEMS (PIPES)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Desired Conditions
Pipes	Sediment & Debris	Accumulated sediment that exceeds 20% of the pipe.	Pipe cleaned of all sediment & debris.
	Vegetation	Vegetation that reduces free movement of water through pipes.	All vegetation removed so water flows freely through pipe.
	Damaged	Protective coating is damaged; rust is causing more than 50% deterioration to any part of the pipe.	Pipe repaired or replaced.
		Any dent that decreases the cross sectional area of the pipe by more than 20%.	Pipe repaired or replaced.
Catch Basins		See "Catch Basins" standard.	See "Catch Basins" standard.
Debris Barriers (e.g. Trash Rack)	Sediment & Debris	Accumulated sediment/debris that exceeds 20% the inlet opening.	Debris barrier is free of sediment & debris.
	Vegetation	Vegetation obstructs more than 20% of the inlet opening.	Debris barrier is free of obstructing vegetation.

RAIN GARDEN / INFILTRATION BASIN

Maintenance Component	Defect	Conditions When Maintenance is Needed	Desired Conditions
General	Trash & debris build-up in D box.	Accumulation that exceeds 1 ft^3.	Trash & debris removed from pond.
Rain Garden	Poisonous Vegetation Vegetation	Vegetation such as grass and weeds need to be mowed when it starts to impede aesthetics of pond. Mowing is generally required when height exceeds 18". Mowed vegetation should be removed from areas where it could enter the trench, either when the water level risers, or by rainfall runoff.	Vegetation should be mowed to 4-5" in height. Threes and bushes should be removed where they are interfering with pond maintenance activities.
	Fire Hazard	Presence of chemicals such as natural gas, oil, and/or gasoline.	No flammable chemicals present.
	Vegetation	Vegetation growing across & blocking more than 10% of the basin opening.	No Vegetation blocking opening to basin.
	Rodent Holes	Any evidence of rodent holes if facility is acting as a dam or berm, or evidence of water piping through dam or berm via rodent holes.	Rodents destroyed and the dam or berm repaired.
	Insects	When insects such as wasps and hornets interfere with maint. activities.	Insects destroyed or removed from site.
	Tree Growth	Tree growth does not allow maintenance access or interferes with maintenance activity (i.e. slope mowing, silt removal, vactoring, or equipment movements). If trees are not interfering with access, leave trees alone.	No trees are to be allowed in infiltration areas.
Storage Area	Sediment build-up in system	A soil texture test indicates facility is not working at its designed capabilities or was incorrectly designed.	Sediment is removed and/or facility is cleaned so that infiltration system works according to design. A sediment trapping area is installed to reduce sediment transport into infiltration area.
	Storage area drains slowly (more than 48 hours) or overflows	A soil texture test indicates facility is not working at its designed capabilities or was incorrectly designed.	Additional volume is added through excavation to provide needed storage. Soil is aerated and rototilled to improve drainage.
	Sediment trapping area	Any sediment and debris filling area to 10% of depth from sump bottom to bottom of outlet pipe or obstructing flow into the connector pipe.	Clean out sump to design depth.
Rock Filters	Sediment & debris	By visual inspection little or no water flows through filter during heavy rain storms.	Replace gravel in rock filter.

GATES

Maintenance Component	Defect	Conditions When Maintenance is Needed	Desired Conditions
General	Damaged or missing components	Gate is broken, jammed, or missing.	Pond has a functioning gate to allow entry of people and maintenance equipment such as mowers and backhoe.
		Broken or missing hinges such that gate cannot be easily opened and closed by a maintenance person.	Hinges intact and lubed. Gate is working freely.
		Gate is out of plumb more than 6" and more than 1 ft out of design alignment.	Gate is aligned and vertical.
		Missing stretcher bands and ties.	Stretcher bar, bands, and ties in place.

ACCESS ROADS/EASMENTS

Maintenance Component	Defect	Conditions When Maintenance is Needed	Desired Conditions
General	Blocked Roadway	Debris which could damage vehicle tires (glass or metal).	Roadway free of debris which could damage tires.
		Any obstructions which reduce clearance above road surface to less than 14 ft.	Roadway overhead clear to 14 ft high.
		Any obstructions restricting the access to less than 15 ft width.	Obstruction removed to allow at least 15 ft wide access.
Road Surface	Settlement, potholes, mush spots, ruts	When any surface irregularity exceeds 6" in depth and 6 ft^2. 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. Occasionally application of additional gravel or pitrun rock will be needed.
	Vegetation in road surface	Woody growth that could block vehicular access. Excessive weed cover.	Remove woody growth at early stage to prevent vehicular blockage. Cut back weeds if they begin to encroach on road surface.
Shoulders & Ditches	Erosion damage	Erosion within 1ft of the roadway more than 8" wide and 6" deep.	Shoulder free of erosion and matching the surrounding road.

FENCING/SHRUBBERY SCREEN/OTHER LANDSCAPING

Maintenance Component	Defect	Conditions When Maintenance is Needed	Desired Conditions
General	Missing or broken/dead shrubbery	Any defect in the fence or screen that permits easy entry to a facility.	Fence is mended or shrubs replaced to form a solid barrier to entry.
	Erosion	Erosion has resulted in an opening under a fence that allows entry by people or pets.	replace soil under fence so that no opening exceeds 4" in height.
	Unruly vegetation	Shrubbery is growing out of control or is infested with weeds.	Shrubbery is trimmed and weeded to provide appealing aesthetics. Do not use chemicals to control weeds.
Wire Fences	Damaged parts	Posts out of plumb more than 6".	Posts plumb to within 1-1/2" of plumb.
		top rails bent more than 6".	Top rail free of bends greater than 1".
		Any part of fence (including posts, top rails, and fabric) more than 1 ft out of design alignment.	Fence is aligned and meets design standards.
		Missing or loose tension wire.	Tension wire in place and holding fabric.
		Missing or lose barbed wire that is sagging more than 2-1/2" between posts.	Barbed wire in place with less than ¾" sag between posts.
		Extension arm missing, broken, or bent out of shape more than 1-1/2".	Extension arm in place with no bends larger than ¾".
	Deteriorated paint or protective coating	Part or parts that have a rusting or scaling condition that has affected structural adequacy.	Structurally adequate posts or parts with a uniform protective coating.
	Openings in fabric	Openings in fabric are such that an 8" diameter ball could fit through.	No openings in fabric.

SPILL CONTROL PLAN

(SCP)

TRENCHLESS CONSTRUCTION SERVICES
SPILL CONTROL PLAN
(SCP)

POTENTIAL POLLUTANTS

There are three types of potential pollutants that this Spill Control Plan is intended to address:

1. Hazardous chemicals
2. Petroleum products
3. Sediment

Reasonable care and discretion shall be exercised to prevent damaging the environment through a release of toxic and hazardous substances of any of the three types of pollution. This Spill Control Plan is to be considered a guide, and represent only the minimum standard of care to be practiced during the operation of the Trenchless Construction Services site. The owner and operator shall be responsible for evaluating the conditions and pollution potential on the site at all times and determining what additional measures need to be enacted to protect human, wildlife and the environment. This may include stopping site activities until conditions change such that the danger to human, wildlife and the environment has been minimized or eliminated.

Hazardous Chemicals

Hazardous chemicals, such as cleaning agents and solvents, shall be stored in an approved chemical storage facility (ies), located in the equipment staging area. When using chemicals during work activity, care shall be taken to guard against spillage. In the event of a chemical release, the appropriate authorities are to be notified and the spill is to be cleaned up immediately.

Petroleum Products

The site is to be protected against excessive petroleum pollution. All equipment and vehicles onsite shall have a regular maintenance schedule, as recommended by the product manufacturer, with particular attention/care being paid locations that are commonly known to leak lubricants. Upon discovery of an unsatisfactory part, that vehicle/equipment shall not be operated until it has been fixed. Additionally, all oil and refueling operations are to be conducted in a designated area that has been prepared to prevent the loss of spilled oil/fuel to the environment through the use of a liner, spill trap, or other means.

Sediment

The release of sediment to the environment shall be prevented at all times. The distribution/tracking of mud/sediment onto paved and unpaved areas from equipment/vehicles shall be prevented. The site shall be accessed via the paved access drive and gated access driveways. The entrance shall provide access to the employee parking and equipment staging areas. Prior to leaving the site, construction equipment/vehicles shall be inspected for mud/sediment, and all wheels and surfaces are to be brushed/cleaned/washed as necessary prior to leaving the construction site. Additionally, the existing road shall be swept adjacent the driveways of the site.

SCP IMPLEMENTATION

Prior to occupancy the owner shall prepare and receive an approval by the City a site specific "Spill Control Plan" dealing with any toxic and hazardous substances that he is aware of as outlined in the attached Spill Prevention and Control Plan Checklist and Certification. (See Attached)

An Emergency Spill Response Kit as manufactured by MRO Co. (or equivalent) shall be kept and maintained on site at all times. (See attached)

Spill Prevention and Control Plan Checklist and Certification

All applicants for permits to discharge any wastewater must complete and submit this Spill Prevention and Control Plan Checklist and Certification. All applicants for permits to discharge process wastewater must also submit the actual Spill Prevention and Control Plan with this Plan Checklist and Certification.

Review the following plan elements to ensure that each element is included and adequately addressed in your Spill Prevention and Control Plan. A copy of this plan must be maintained on site at all times. Certify that the plan is adequate with respect to each element by inserting your initials in the space provided. For elements which are determined to be not applicable to the facility, please indicate "N/A" next to the element and provide a brief explanation.

Plan Elements	Initial/Not Applicable
1. A copy of the site plan and topographic map, drawn to scale with scale shown, including a north meridian arrow, exactly as prepared in Part VI: Supporting Documents, Attachment D and F of this application (DEP-PERD-APP-100).	Site Plan
2. Supplemental layout drawings must be prepared as necessary to illustrate any item which is not included on the site plan or topographic map including: a. A General Layout of the Facility b. Property Boundaries c. Entrance and Exit Routes to/from the Facility d. Areas Occupied by Manufacturing or Commercial Facilities e. Hazardous Materials Process and Storage Areas f. Waste Handling, Storage and Treatment Facilities g. Loading and Unloading Areas h. Direction of Drainage from Hazardous Material and Waste Handling, Storage and Treatment Areas i. Floor Drains, Pipes, and Channels which lead away from Potential Leak or Spill Areas and where these drain to j. Spill Prevention Structures	Site Plan
3. A copy of the inventory of toxic and hazardous substances prepared in Part V: Facility or Activity Information, question 4 of this application (DEP-PERD-APP-100), amended to include *all* substances which are stored on-site, including oil.	N/A No chemicals will be stored onsite.
4. A description of all spill prevention equipment and structures employed including underground seepage protection, cathodic protection of underground tanks, leak detection equipment, liquid level sensing devices, alarms, collision protection, diversionary structures, dikes, berms, sealed drains, etc. All such equipment and structures should be shown or referenced on the layout drawings required by element 2 of this checklist.	A MRO® Emergency Spill Responce Kit Cart on wheels (or equall) will be on site. See Attached. Note: The MRO kit will be for leakage from Construction Equipment
5. A description of each facility used for the storage, collection, transfer, transport, treatment, loading or	N/A No chemicals will be stored onsite

Plan Elements	Initial/Not Applicable
unloading of the substances listed in the plan as required by element 3 of this checklist and an evaluation of each facility's potential to generate a spill, leak or other unplanned release and the potential magnitude of such a release as related to the containment capacities of the various spill control structures described in the plan required by element 4 of this checklist. The evaluation must demonstrate that good engineering practices are satisfied, including the spill prevention and control requirements of 40 CFR 112, 40 CFR 264 and the General Permit for the Discharge of Stormwater Associated with Industrial Activities issued October 1, 1992 as applicable. At a minimum, the plan should provide that all areas in which chemicals are stored are provided with impermeable containment which will hold at least the volume of the largest chemical container, or 10% of the total volume of all containers in the area, whichever is larger, without overflow from the containment area. In addition, no interior building floor drains shall exist which are connected to any storm drainage system or which may otherwise direct interior floor drainage to exterior surfaces, unless such floor drain connection has been approved and permitted by DEP.	
6. A description of spill prevention procedures including practices to ensure tanks are not overfilled, chemical transfer procedures, chemical disposal practices, security measures, and operation and maintenance procedures. Descriptions of the type and frequency of inspections and monitoring for leaks or other conditions that could lead to spills shall be included in the plan.	N/A No chemicals will be stored on site
7. A list of available emergency response equipment at the site including a physical description of such equipment and its location. The location should be indicated on the facility layout required by element 2 of this checklist. The list of equipment should include, at a minimum, the following: a. Communication Equipment and Alarms b. Spill Containment and Control Equipment and Tools c. Spilled Material Storage Containers d. Protective Clothing and Respirators N/A e. First Aid Kits f. Decontamination Equipment N/A g. Ventilation Equipment N/A	

Plan Elements	Initial/Not Applicable
8. A detailed description of procedures to be followed when responding to a spill at the facility. This description should cover the following items: a. Notification of Facility Personnel for Responding to Spills b. Chain of Command for Spill Response c. Evacuation Procedures d. Notification of Response Agencies and Contractors e. Spill Assessment and Response Procedures f. Procedures for Preventing Contact between Incompatible Materials g. Procedures for Disposing or Treating Spilled Material	N/A No chemicals will be stored on site.
9. A description of follow-up reporting and documentation procedures to be followed in the event of a spill. A copy of the forms used should be included.	N/A No chemicals will be stored onsite.
10. A detailed outline of the training program or programs given to employees which will enable them to understand the processes and materials with which they are working, the safety and health hazards of such processes and materials, and the procedures and practices for preventing and responding to spills. A discussion of the appropriateness of training provided to each employee or group of employees should also be included in the plan.	N/A No chemicals will be stored on site.
11. A history of spills and leaks of five gallons or more of toxic or hazardous substances as defined in RCSA Section 22a-430-4 Appendix B and Appendix D and 40 CFR Part 116.4, oil, and process wastewaters that occurred at the facility within the last three years. As applicable, include at a minimum, the following information: a. Type and amount of substance spilled b. Location, date, and time of spill c. Watercourse, soil or ground water affected d. Cause of Spill e. Action taken to prevent recurrence	N/A No chemicals will be stored onsite.

Note: If any plan element in this checklist has not been addressed in your Spill Prevention and Control Plan at the time you submit your application, in the space provided next to such element provide: 1) a brief explanation indicating why it has not yet been addressed and 2) if applicable, a proposed time schedule indicating when the element will be addressed in your Spill Prevention and Control Plan.

Applicant Certification of the Spill Prevention and Control Plan Checklist

Applicant Name: John Gustafson
(as indicated on the *Permit Application Transmittal Form*)

Application Number (if known):

Facility I.D. Number (renewals only):

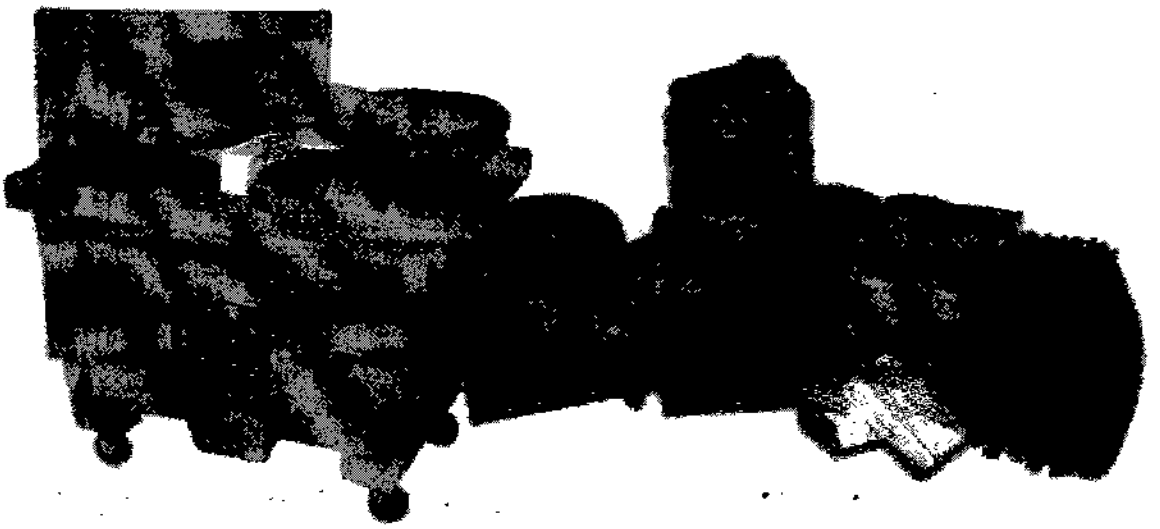
Permit Number (renewals only):

I have personally examined and am familiar with the information contained in the Spill Prevention and Control Plan required for this application, and I certify that based on reasonable investigation, including my inquiry of the individuals responsible for preparing the Spill Prevention and Control Plan, such plan contains all applicable information listed in the Spill Prevention and Control Plan Checklist.

John Gustafson 6,10,09
Applicant Signature Date

In the space below, please provide the names of the persons who prepared the Spill Prevention and Control Plan and a brief description of the qualifications of each preparer, (i.e., professional certifications, education background, related work experience, etc.).

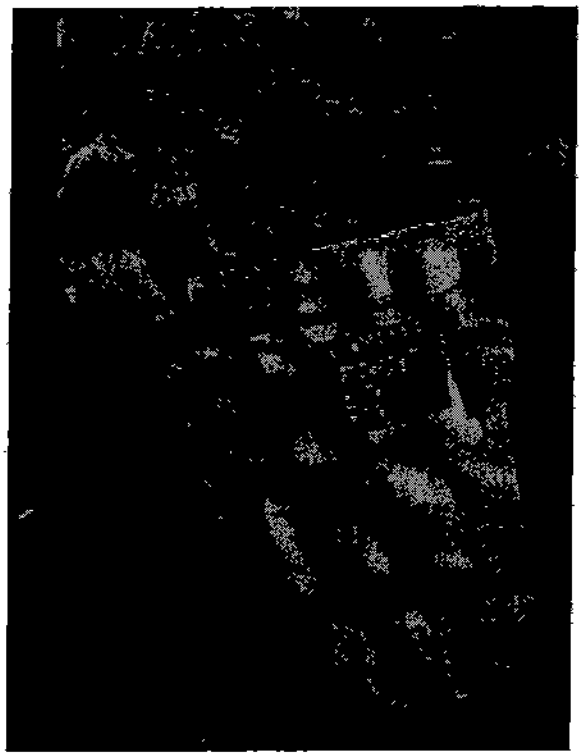
MRO Emergency Spill Response Kit Cart On Wheels Brings You Right To The Spill - Cart Packed With Absorbent Socks, Pads, Pillows and More.



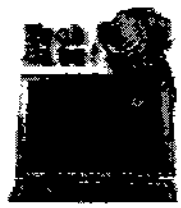
Dawg® Spill Response Cart offers mobility with big spill protection!

The Dawg® Spill Response Cart enables you to get to big spills quickly. Packed with a large variety of absorbents to handle large spills makes it excellent for spill response contingency planning. For added convenience, absorbents are compartmentalized for quick and easy retrieval. The weather-proof lid removes easily and keeps absorbents free from dirt and moisture.

- Absorbs up to 84 gallons
- Emergency Spill Response Kit is excellent for spill response contingency planning.
- Spill Response Cart is compartmentalized for quick and easy retrieval of absorbents.
- Maneuver to big spills quickly.
- Assists you in complying with SPCC Regulations 112.7.
- Available in 8" pneumatic wheels for rough terrain, call for pricing and details.
- This specific kit is UNIVERSAL NON-AGGRESSIVE which will absorb oil, coolants, solvents, water and other non-aggressive fluids.
- We offer two other choices of spill kits in these sizes OIL-ONLY and HAZMAT.



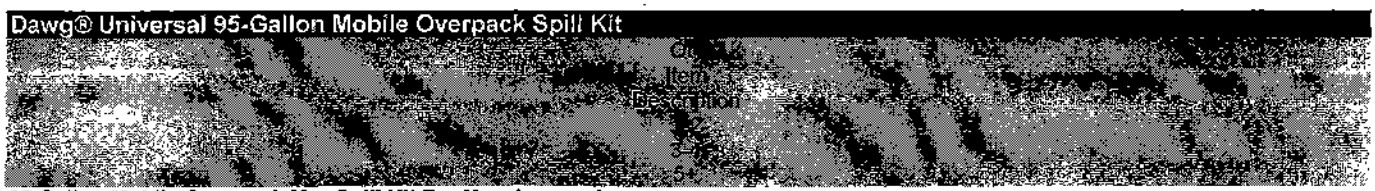
Our new Dawg one-piece Mobile Overpack Spill Kit on wheels solves your need for immediate, reliable and portable spill response. Take this overpack kit anywhere in a hurry.



- This specific kit is UNIVERSAL NON-AGGRESSIVE which will absorb oil, coolants, solvents, water and other non-aggressive fluids.
- We offer two other choices of spill kits in these sizes OIL-ONLY and HAZMAT.
- 95 Gal (UN/1H2/X113/S) rated salvage drum.

MSDS Articles Reference Comply With Regulations

Dawg® Universal 95-Gallon Mobile Overpack Spill Kit



95-Gallon Mobile Overpack Mro Spill Kit For Non Aggressive
Absorbs 70 Gallons Of Oil, Coolants, Solvents, Water
Seen this product for less?

554.00
532.00
492.00

APPENDIX


563380
563390
563400
563410
563420
563430
563440
563450
563460
563470
563480
5336270
5336260
5336250
5336240
5336230
5336220
5336210
5336200
5336190
5336180
5336170
199TH ST NE
83RD AVE NE
N
0
10
20
40
60
Meters
0
40
80
160
240
Feet

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features

Municipalities
- Cities
- Urban Areas

Water Features
- Oceans
- Streams and Canals

Transportation
- Rails

Roads
- Interstate Highways
- US Routes
- State Highways
- Local Roads
- Other Roads

MAP INFORMATION

Original soil survey map sheets were prepared at publication scale. Viewing scale and printing scale, however, may vary from the original. Please rely on the bar scale on each map sheet for proper map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 10N

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Snohomish County Area, Washington
Survey Area Data: Version 4, Dec 12, 2006

Date(s) aerial images were photographed: 7/10/1990; 7/18/1990

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Snohomish County Area, Washington (WA661)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
17	Everett gravelly sandy loam, 0 to 8 percent slopes	2.0	99.2%
30	Lynnwood loamy sand, 0 to 3 percent slopes	0.0	0.8%
Totals for Area of Interest (AOI)		2.0	100.0%

Western Geotechnical Consultants, Inc.

4183 Saltsprings Dr., Ferndale, WA 98248 Phone/FAX (360)380-2507

November 20, 2008

John Gustafson
Trenchless Construction Services, LLC
4103 241st St. NE
Arlington, WA 98223

Re: Addendum to Report
Lot 10, Airport 37 Industrial Park Plat
Tax# 007 463 0000 1000
Arlington, WA

This report provides an addendum to our geotechnical investigation report dated February 20, 2008 for the above referenced property. Specifically, we returned to the site to read water levels in test pits 1 through 3 and we also measured the water table in a monitoring well on the property. The distance of the monitoring well from Test Pit 1 was measured with a cloth tape and found to be 184 feet at approximate azimuth 200 degrees. Figure 1 is a Site Plan showing the location of the monitoring well together with the locations of the three test pits excavated for Western Geotechnical Consultants, Inc. on February 18, 2008. The water table in Test Pits 1, 2 and 3 was measured and all of the test pits were dry. The water level in the monitoring well was measured and found to be 40.77 feet below grade.

Based on our site measurements of the water table it is our opinion that the infiltration facilities will have adequate separation from the seasonal high water table. Our conclusions are based on the measurement of the water table at almost 41 feet below grade in a monitoring well that is less than 200 feet from the infiltration beds.

Thank you for the opportunity to be of assistance to you on this project. If you have any questions regarding the contents of this report or if we can be of further assistance please contact our office.

Sincerely,

Western Geotechnical Consultants, Inc.

Theodore A. Hammer, P.E.
Geotechnical Engineer

EXPIRES 12/21/08

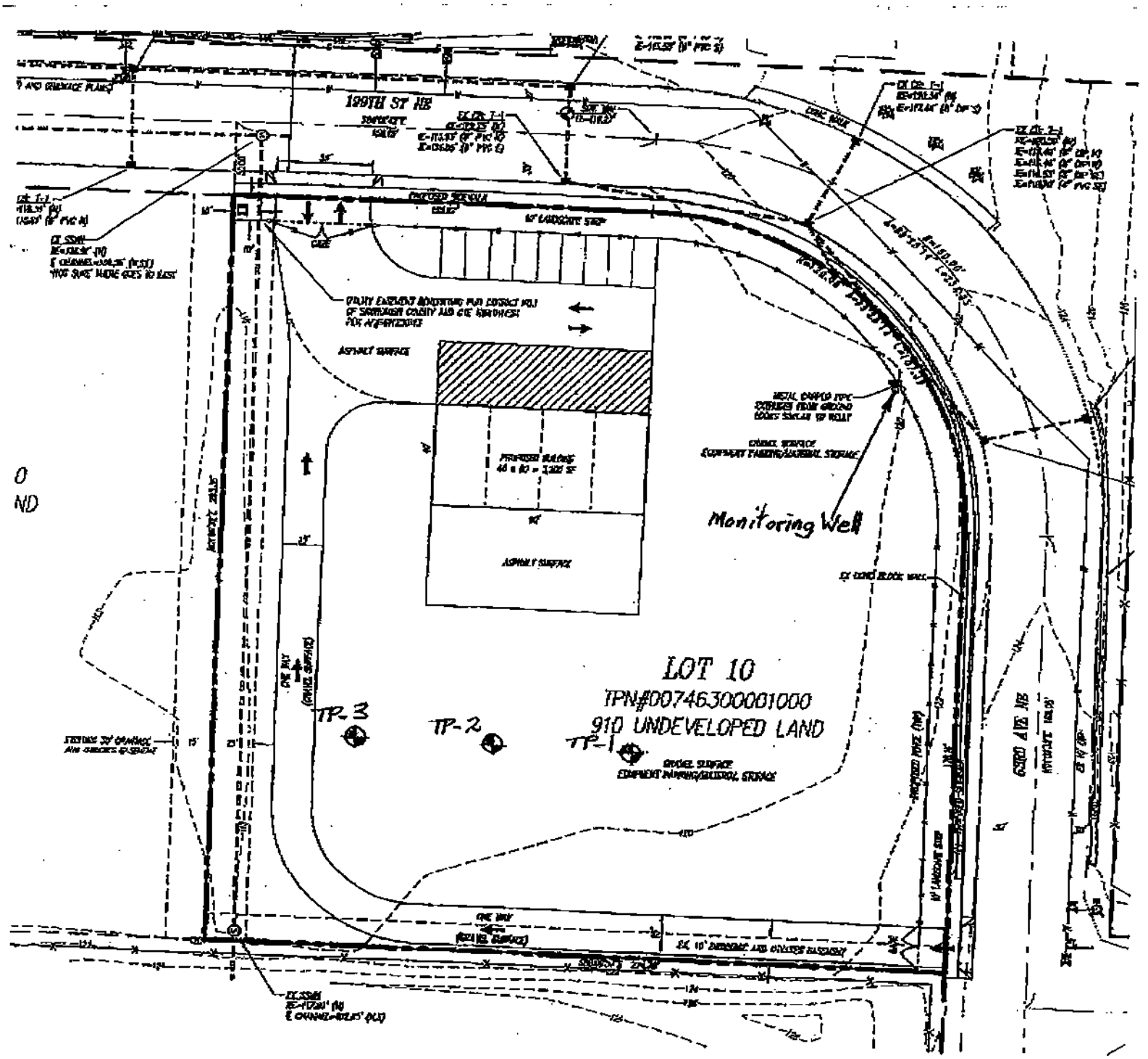
Attachments: Site Plan

File: 08 10 2

Addendum to Report
Gustafson Property
Trenchless Construction Services, LLC
4103 241st St. NE
Arlington, WA 98223
November 20, 2008

Western Geotechnical Consultants, Inc.
08 10 2

Figure 1
Site Plan & Test Pit Locations
Dennis Property – 159th St. SE
Monroe, Washington



Western Geotechnical Consultants, Inc.

4183 Saltsprings Dr., Ferndale, WA 98248 Phone/FAX (360)380-2507

February 27, 2009

John Gustafson
Trenchless Construction Services, LLC
4103 241st St. NE
Arlington, WA 98223

Re: Report - Geotechnical Investigation
Lot 10, Airport 37 Industrial Park Plat
Tax# 007 463 0000 1000
Arlington, WA

Western Geotechnical Consultants, Inc. is pleased to provide this geotechnical engineering report prepared for the above referenced property. The property is a rectangular shaped parcel that is about 1-3/4 acres in size and the property is located on the southwest side of the intersection of 199th St. NE and 63rd Ave. NE in the City of Arlington, Washington. The project plan is to construct an infiltration trench and an industrial building on the site. Figure 1 is a partial site plan showing the site layout at the infiltration trench location.

The purpose of our investigation was to evaluate the site with respect to developing the site using infiltration facilities. The specific scope of our investigation for the site included the following services:

- Review available published geologic, geotechnical and topographic information for the area including soil and groundwater information for nearby properties contained in our files.
- Excavate two test pits and obtain samples to explore soil and groundwater conditions across the proposed infiltration facility site. Piezometers were installed in both of the test pits for future monitoring of groundwater levels.
- Classify soils in accordance with the Unified Soils Classification System (USCS).
- Perform field and laboratory testing as deemed necessary in support of our conclusions and recommendations. Lab testing included grain size/hydrometer analyses performed in accordance with the USDA textural triangle methodology so as to determine design infiltration rates for the site soils.
- Prepare this engineering report including a summary of work performed and our conclusions and recommendations regarding:
  - Soil and groundwater information for use in designing infiltration facilities.
  - Provide design infiltration rates for use in stormwater facilities design.
  - Provide seismic design parameters for structural design. Seismic hazard will also be addressed.
  - General site development recommendations with respect to geotechnical issues identified during our field investigation.

Site Conditions

Surface Conditions

The property is a near rectangular shaped parcel that is grass and weed covered. The property; is bounded on the north by 99th St. NE, on the east by 63rd Ave. NE, on the south by a fence and berm along the property line and on the west by a drainage ditch. The parcel is approximately 1-3/4 acres in size and is relatively flat.

Subsurface Conditions

Subsurface soil and groundwater conditions were explored on February 23, 2009 when a total of two test pits were advanced using a rubber tire backhoe with a 1.5-foot wide bucket. The test pits were excavated at the approximate locations shown on the attached Site Plan, Figure 1. Soil and groundwater conditions were continuously logged using the Unified Soils Classification System (USCS) and soil samples were obtained for inspection and testing. Edited tabulated test pit logs are included in this report together with a USCS chart explaining soil descriptions.

Subsurface conditions were found to be very similar at the 2 test pit sites. Test Pits revealed consistent soils across the trench site. The subsurface profile consists of about 1/2 foot of silty, angular GRAVEL fill material (GM by USCS) which is underlain by a silty sandy GRAVEL (GM by USCS) that extend to a depth of about 2 feet below grade. This soil unit is underlain by relatively clean sandy GRAVEL and gravelly SAND (GP, GW & SP by USCS) that extended to the depth of the test pits (14.8 feet max.).

The USDA Soil Conservation Service (SCS) "Soil Survey of Snohomish County Area, Washington" has mapped the site soils as Everett gravelly sandy loam. Everett soils are very deep, somewhat excessively drained soils, located on terraces and outwash plains. Everett soils formed in glacial outwash. The permeability of the soil is rapid, runoff is slow and the hazard of water erosion is only slight. The soils identified in our investigation are consistent with the Soil Conservation Service (SCS) soil description.

Groundwater

Groundwater was not encountered in either of the test pits at the time of the investigation on 2/23/2009. Piezometers were installed in both test pits for future monitoring of the groundwater levels.

While on site we read the groundwater monitoring well that is present on the property to the north of the proposed water infiltration facility and the water table was measured at 38.93 feet below the ground surface.

We returned to the site on March 2, 2009 to read the piezometers and we determined that the piezometers were dry. The results of the piezometer readings are summarized below.

Test Pit No.	Depth of Test Pit (feet)	Water Level (BGS)
4	14.8'	Dry
5	14.6'	Dry

Laboratory Testing

Laboratory tests were performed on selected soil samples obtained during our test pit investigation. Laboratory testing included soil inspection under controlled laboratory conditions, moisture content determination, and grain size analyses performed in accordance with the USDA textural triangle methodology. The moisture content test results are included in the tabulated log of test pits and the results of the grain size analyses are attached to this report in the form of grain size distribution curves. The results of the USDA grain size tests are also plotted on the attached USDA Textural Triangle.

Conclusions and Recommendations

General

Based on our geotechnical investigation, we conclude that stormwater infiltration will be feasible for the property. The following section provides our analyses and recommendations for the infiltration rate based on our geotechnical investigation and subsequent laboratory testing of the representative relatively clean granular soils located below the silty soil layer.

Infiltration Rate

We determined the infiltration rate for representative soils encountered in the Test Pits at the site in accordance with the 2005 edition of the Washington Department of Ecology (DOE) Stormwater Management Manual for Western Washington. Representative, relatively free-draining soil samples taken from the proposed infiltration zone. The soils were classified in the field as gravelly SAND (SP by the USCS). The results of our test pit investigation are documented on the test pit logs. A total of 2 were performed and the test results are attached to this report in the form of grain size distribution curves. We also plotted the grain size analyses results on a USDA textural triangle for use in determining infiltration rates.

Based on the testing the soil is a sand. The D_{10} of the samples is 0.14 mm and 0.16 mm. The 2005 Stormwater Management Manual recommends a long term (design) infiltration rate of 2.0 inches an hour for sandy gravel with a $D_{10} \geq 0.1$mm but < 0.2 (see Table 3.8 in the Stormwater Management Manual).

General Site Development

The following sections of this report contain recommendations for general site development. These recommendations are also contained in our February 20, 2008 report but are repeated for continuity in this report. Note that these recommendations are based on the limited scope of subsurface exploration performed as a part of our geotechnical services for the project.

Site Preparation: All topsoil or other organic, soft or deleterious material must be stripped and removed from those areas to be developed. Based on our test pit investigation, a stripping depth of about 1/2-foot should be anticipated. Note that deeper over-excavation may be required where deeper unsuitable soils such as old tree root balls are encountered.

IBC Site Classification: Based on our geotechnical investigation the site soils are classified as soil type D, stiff soil profile. The earthquake spectral responses (S_{ms} and S_{m1}) may be computed using Soil Class D and Tables 1615.1.2 (1) and 1615.1.2(2) of the IBC (2003 ed.).

Access Road Subgrade Strength Design Parameters

On the basis of our review of site soil conditions mapped by the SCS and soil conditions along the Dennis way road alignment, a minimum CBR value of 7 has been assumed for the near surface soils. This value is based on correlation of soil type and our experience at sites with similar soil conditions.

Some of the important factors that affect the durability of pavement surfacing include stability and permeability of the subgrade soils and base materials, the presence of ground water, design life of the road section, the traffic volume, and the frequency of heavy truck traffic. The road section design should include the factors listed above or should meet the Snohomish County standards for low volume residential roads.

The pavement section should be installed over firm sub-grade. Following excavation and/or filling to establish sub-grade elevation, but immediately prior to paving, the sub-grade surface should be proof rolled with a loaded 10 cubic yard dump truck, or equivalent. Any soft areas exposed by the proof rolling, which cannot be easily compacted should be over-excavated and back filled with compacted granular fill.

Erosion Control: Erosion control during construction of the proposed facilities can be accomplished through placement of proper sedimentation control facilities. We recommend siltation control facilities, consisting of either hay bales or silt fences, be fabricated around all construction areas. Typical details for siltation control facilities using either hay bales or silt fences are attached to this report.

Siltation devices should be placed down gradient of all construction areas and cleared areas to provide siltation control during construction. All siltation control devices should be maintained in operable condition during construction, and left in operable condition until the site has been revegetated and siltation is no longer a threat. At that time the siltation facilities should be removed.

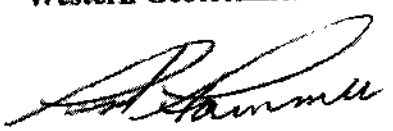
Closure

The scope of our services was limited to two test pits excavated at the location of the proposed infiltration site to obtain subsurface information for stormwater infiltration design and general site development. If subsurface soil conditions encountered during the site development are different or appear to be different from those indicated in this report, we should be advised immediately so we can review and revise our recommendations, if necessary.

Thank you for the opportunity to be of assistance to you on this project. If you have any questions regarding the contents of this report or if we can be of further assistance please contact our office.

Sincerely,

Western Geotechnical Consultants, Inc.



Theodore A. Hammer, P.E.
Geotechnical Engineer

Inclusions: Figure 1, Site Plan
USCS Classification Chart
Log of Test Pits 4 & 5
Log of Test Pits 1 through 4 (from 2008 report)
Attachments: Grain Size Distribution Curves
USDA Textural Triangle

File: 08 10 4

Figure 1
Site Plan & Test Pit Locations
Gustafson Property – Arlington, WA

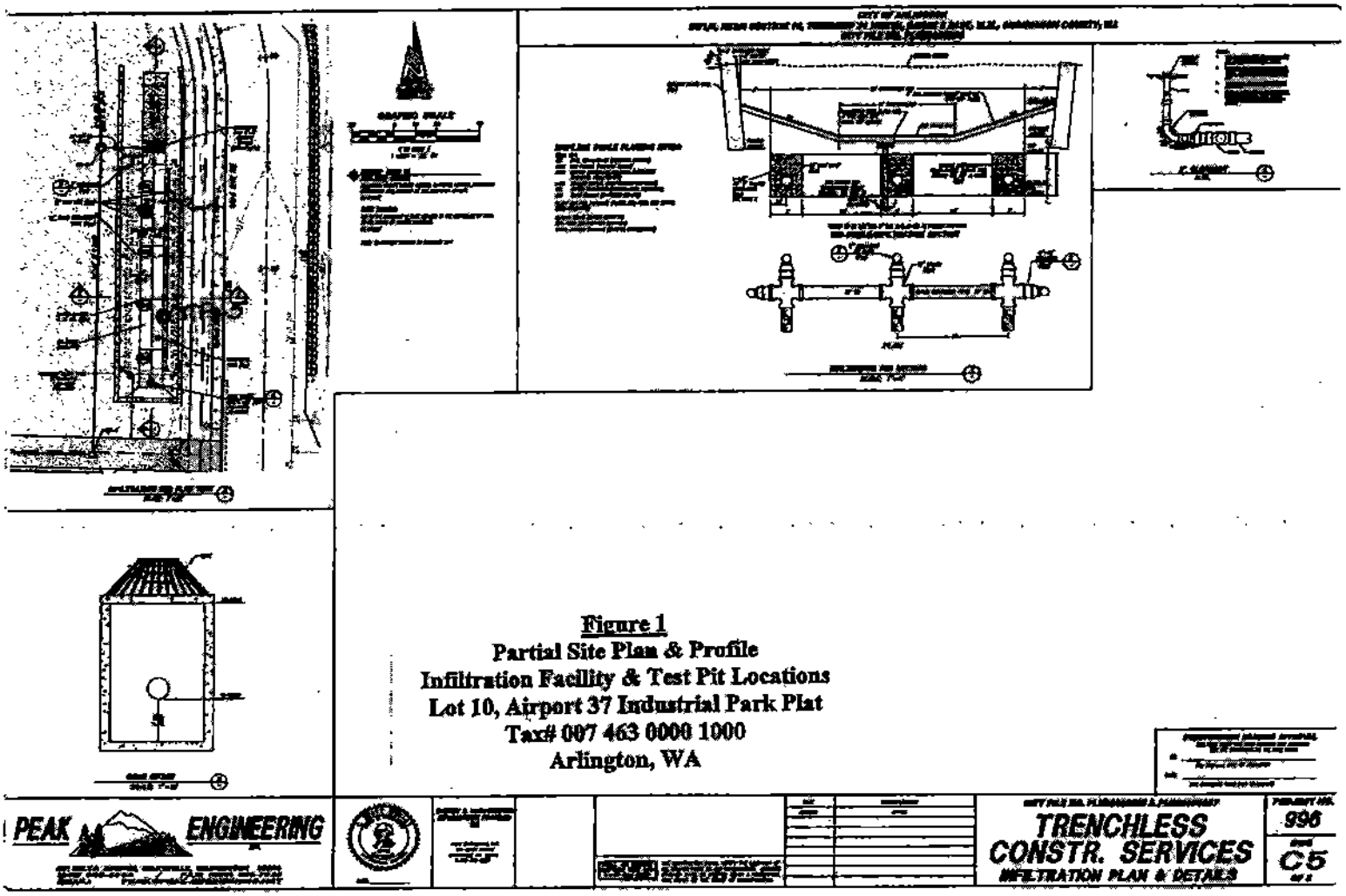
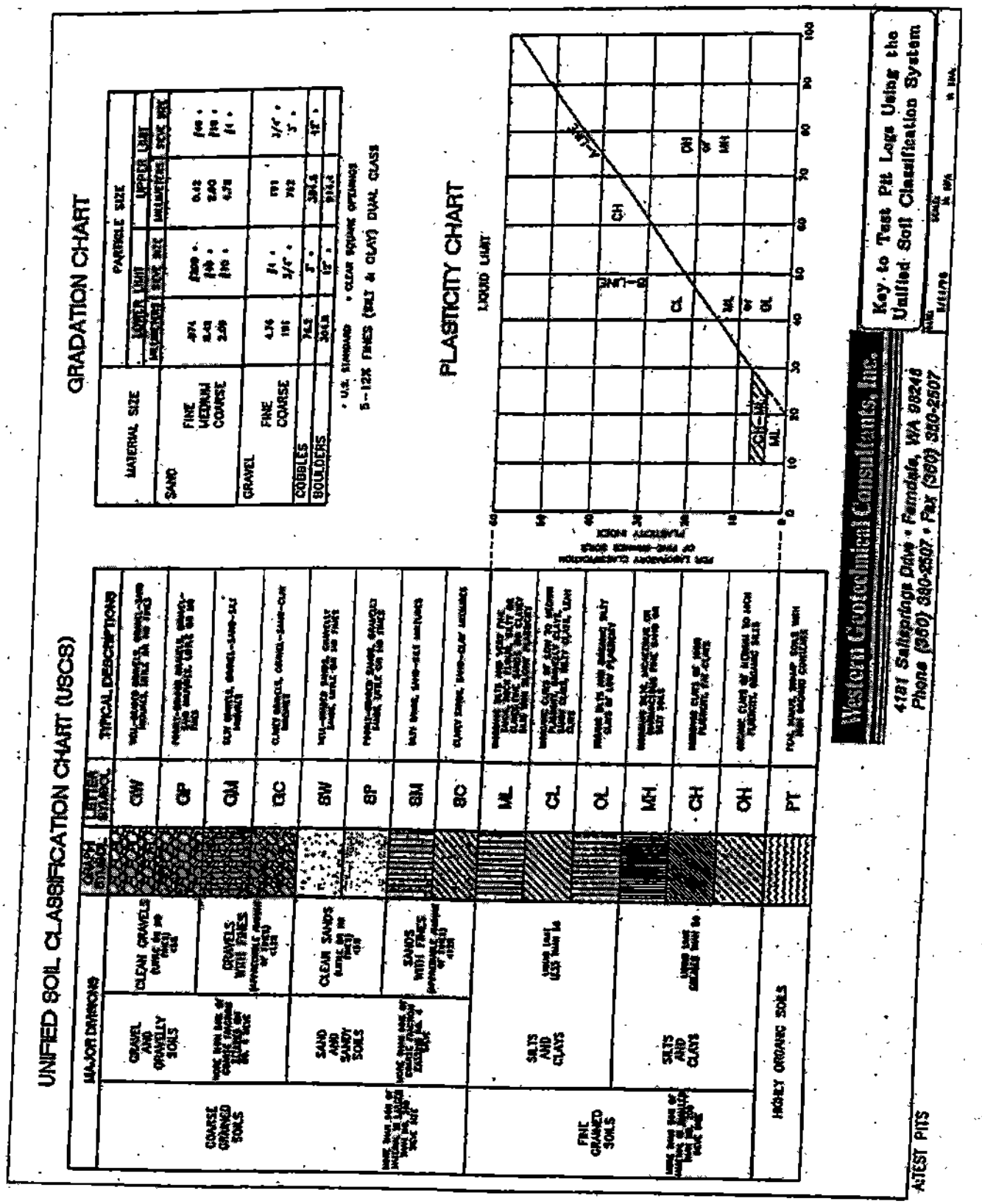


Figure 1
Partial Site Plan & Profile
Infiltration Facility & Test Pit Locations
Lot 10, Airport 37 Industrial Park Plat
Tax# 007 463 0000 1000
Arlington, WA

USCS Chart & Key to Test Pit Descriptions



Log of Test Pits					File: 08 10 4	
Test Pit No.	Depth Interval (feet)	USCS Class.	Soil Description	Sample No./ Depth (feet)	Water Content (%)	Lab Testing
TP-4	0.0-0.5	GM (fill)	Gray silty sandy angular GRAVEL with some asphalt fragments (moist, relatively compact) (fill) (gravel is 1-1/2 inch minus)			
	0.5-2.0	GM	Light brown silty sandy gravel, some cobbles (moist, relatively compact) (gravel is rounded)			
	2.0-5.4	GP/GW	Gray brown fine to course sandy gravel (moist, relatively compact) (contains well graded zones and sandy gap graded zones)			
	5.4-14.8	SP	Brown fine to medium SAND with some rounded gravel (moist, relatively compact (occasional gravel zones)	4-1/7.0' 4-2/9.5' 4-3/14.0'	9.0% 5.2% 5.6%	*GC *CE

Notes:

- Test Pit terminated on 02/23/09 at 14.8 feet.
- No groundwater seepage encountered.
- Piezometer installed full depth.
- Piezometer read on ------- and test pit was dry.
- Test pit backfilled upon completion.
- * GS is Grain size Test (textural triangle methodology)
- ** CE is Cation Exchange Capacity Test

			Log of Test Pits		File: 08 10 1	
Test Pit No.	Depth Interval (feet)	USCS Class.	Soil Description	Sample No./ Depth (feet)	Water Content (%)	Lab Testing
TP-5	0.0-0.6	GM (fill)	Gray silty sandy angular GRAVEL with some asphalt fragments (moist, relatively compact) (fill) (gravel is 1-1/2 inch minus)			
	0.6-1.8	GM	Light brown silty sandy gravel, some cobbles (moist, relatively compact) (gravel is rounded)			
	1.8-14.6	SP	Brown fine to medium SAND with some rounded gravel (moist, relatively compact (occasional gravel zones)	5-1/5.0' 5-2/9.0' 5-3/14.0'	4.4% 4.8% 5.6%	 *GS *CE

Notes:4.8%

- Test Pit terminated on 02/23/09 at 14.6 feet.
- No groundwater seepage encountered.
- Piezometer installed full depth.
- Piezometer read on ------- and test pit was dry.
- Test pit backfilled upon completion.
- * GS is Grain size Test (textural triangle methodology)
- ** CE is Cation Exchange Capacity Test

Log of Test Pits					File: 08 10 1	
Test Pit No.	Depth Interval (feet)	USCS Class.	Soil Description	Sample No./ Depth (feet)	Water Content (%)	Lab Testing
TP-1	0.0-0.3	OL/SM	Dark brown gravelly SILT to silty gravelly SAND with numerous roots and organic mater (soft to loose) (topsoil)			
	0.3-2.0	GM	Red brown silty fine to course sandy GRAVEL, occasional roots (moist, relatively compact) (gravel is rounded 2 in. minus)	1-1/0.2'	9.1%	
	2.0-7.8	GW	Gray brown fine to course sandy GRAVEL (moist, relatively compact) (gravel is rounded 3 in. minus)	1-2/1.5' 1-3/4.0' 1-4/6.5'	8.7% 5.4% 5.2%	*GS
	7.8-10.0	SP	Gray brown gravelly fine to course SAND (very moist, relatively compact)	1-5/9.3'	6.9%	

Notes:

- Test Pit terminated on 02/18/08 at 10.0 feet.
- No groundwater seepage encountered.
- Piezometer installed full depth.
- Piezometer read on 2/21/08 and test pit was dry.
- Test pit backfilled upon completion.

*GS indicates a grain size test was performed in accordance with the textural triangle methodology.

Log of Test Pits					File: 08 10 1	
Test Pit No.	Depth Interval (feet)	USCS Class.	Soil Description	Sample No./ Depth (feet)	Water Content (%)	Lab Testing
TP-2	0.0-0.7	OL/SM	Dark brown gravelly SILT to silty gravelly SAND with numerous roots and organic mater (soft to loose) (topsoil)			
	0.7-1.5	GM	Red brown silty fine to course sandy GRAVEL, occasional roots (moist, relatively compact) (gravel is rounded 2 in. minus)			
	1.5-10.0	GW	Gray brown fine to course sandy GRAVEL (moist, relatively compact) (gravel is rounded 3 in. minus) (sandy zone @ 8-1/2, SP)	2-1/4.0' 2-2/6.0' 2-3/7.5' 2-4/9.3'	5.4% 5.8% 4.0% 6.7%	*GS

Notes:

- Test Pit terminated on 02/18/08 at 10.0 feet.
- No groundwater seepage encountered.
- Piezometer installed full depth.
- Piezometer read on 2/21/08 and test pit was dry.
- Test pit backfilled upon completion.

*GS indicates a grain size test was performed in accordance with the textural triangle methodology.

			Log of Test Pits		File: 08 10 1	
Test Pit No.	Depth Interval (feet)	USCS Class.	Soil Description	Sample No./ Depth (feet)	Water Content (%)	Lab Testing
TP-3	0.0-0.6	OL/SM	Dark brown gravelly SILT to silty gravelly SAND with numerous roots and organic mater (soft to loose) (topsoil)			
	0.6-1.5	GM	Red brown silty fine to course sandy GRAVEL, occasional roots (moist, relatively compact) (gravel is rounded 2 in. minus)			
	1.5-5.8	GW	Gray brown fine to course sandy GRAVEL (moist, relatively compact) (gravel is rounded & grades finer, 1 in. minus)	3-1/5.5'	5.0%	
	5.8-10.0	SP	Gray brown gravelly fine to course SAND (very moist, relatively compact) (gravel is rounded 1 in. minus)	3-2/6.3' 3-3/8.5'	5.2% 5.2%	*GS

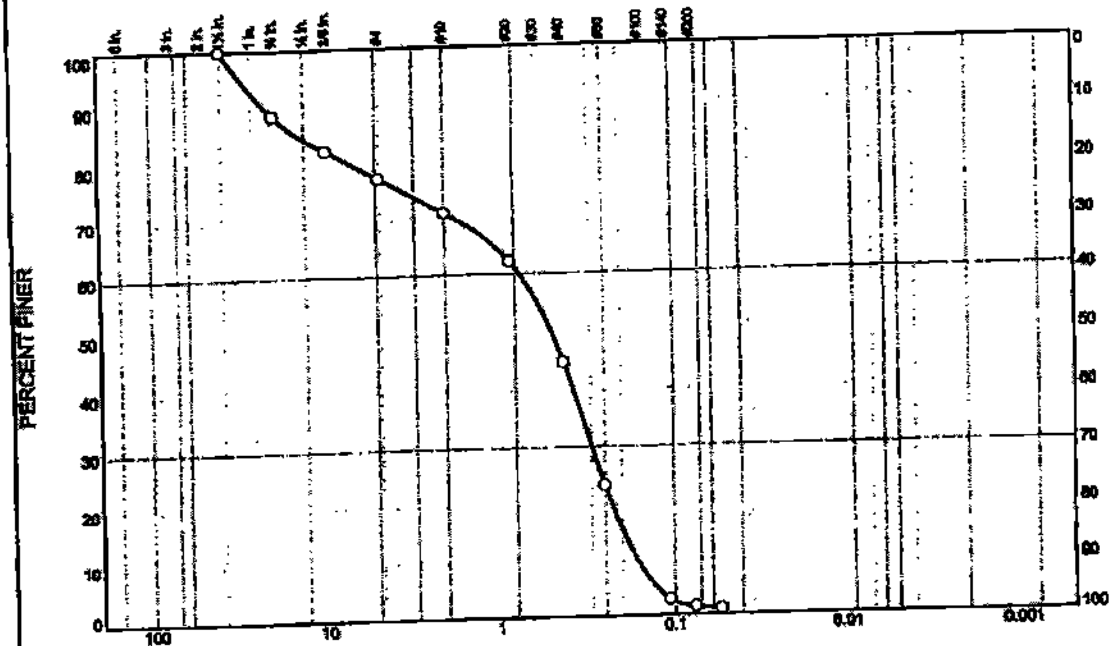
Notes:

- Test Pit terminated on 02/18/08 at 10.0 feet.
- No groundwater seepage encountered.
- Piezometer installed full depth.
- Piezometer read on 2/21/08 and test pit was dry.
- Test pit backfilled upon completion.

*GS indicates a grain size test was performed in accordance with the textural triangle methodology.

Attachments

Sieve Analysis Report - ASTM D422



% +3"	% Gravel Coarse	% Gravel Fine	% Sand Coarse	% Sand Medium	% Sand Fine	% Fines Silt	% Fines Clay
0	11	11	7	26	44	1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1-1/2"	100		
3/4"	89		
3/8"	83		
#4	78		
#10	71		
#20	62		
#40	45		
#60	23		
#140	3		
#200	1.4		
#270	0.9		

* (no specification provided)

Material Description

poorly graded sand with gravel (USCS)
sand (USDA)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 21.1368 D_{85}= 13.2583 D_{60}= 0.7528
D_{50}= 0.4939 D_{30}= 0.2953 D_{15}= 0.1966
D_{10}= 0.1641 C_u= 4.59 C_c= 0.71

Classification

USCS= SP AASHTO=

Remarks

Organic Content = 0.11 %

Location: Christopherson Native (4-3)
Sample Number: 6839

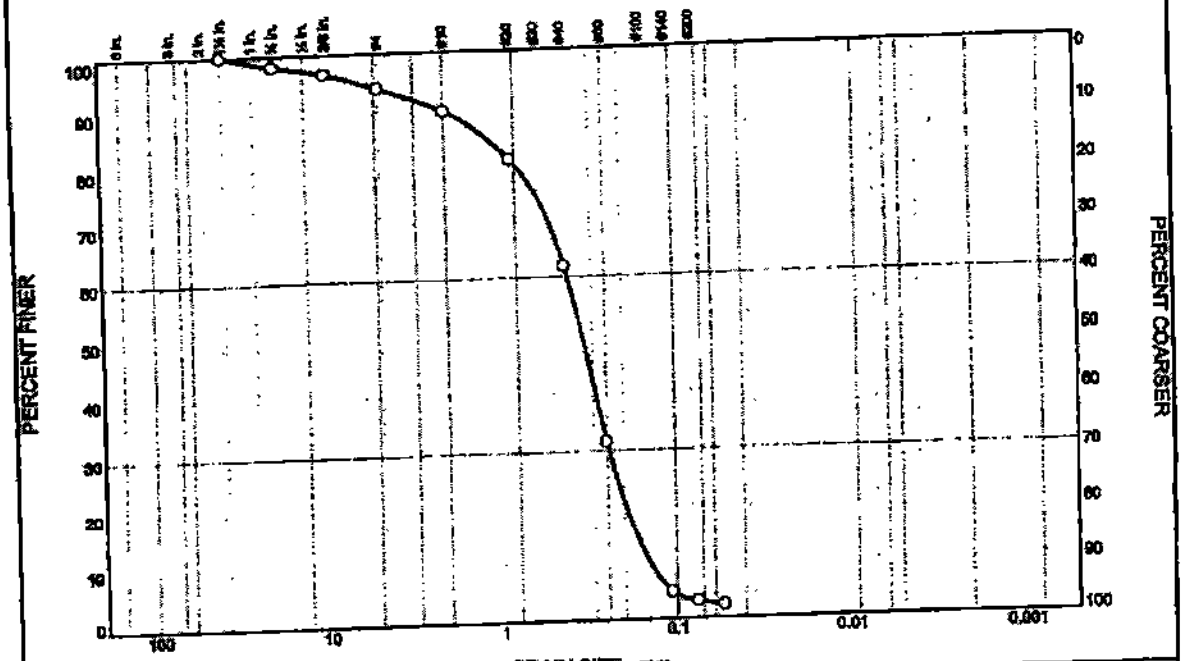
Date: 2-24-09

GEOTEST

Client: Western Geotechnical
Project: General Services
Project No: 08-0042 **Report** S37-6839

Tested By: ES **Checked By:** GR

Sieve Analysis Report - ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	2	4	4	28	59	3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1-1/2"	100		
3/4"	98		
3/8"	97		
#4	94		
#10	90		
#20	81		
#40	62		
#60	32		
#140	5		
#200	2.9		
#270	2.2		

* (no specification provided)

Material Description

poorly graded sand (USCS)
sand (USDA)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 2.1024 D_{85}= 1.1400 D_{60}= 0.4098
D_{50}= 0.3424 D_{30}= 0.2429 D_{15}= 0.1714
D_{10}= 0.1446 C_u= 2.83 C_c= 1.00

Classification

USCS= SP AASHTO=

Remarks

Organic content < 0.16%

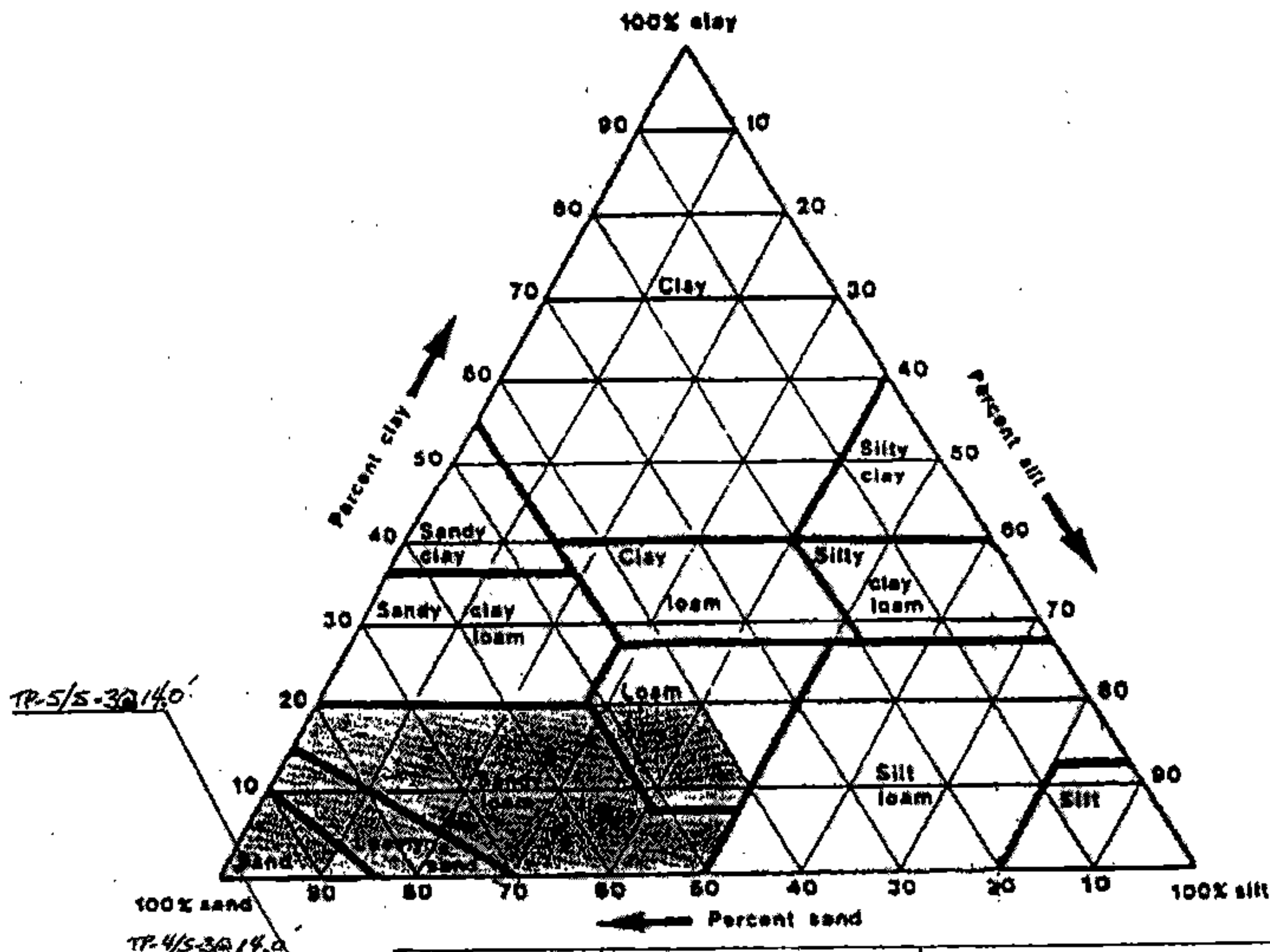
Location: Christopherson Native (S-3) Date: 2-24-09
Sample Number: 6840

GEOTEST

Client: Western Geotechnical
Project: General Services
Project No: 08-0042 Report S38-6840

Tested By: ES Checked By: GR

Textural Triangle U.S.D.A.



Western Geotechnical Consultants

Scale: N/A