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City of Olympia

November 2, 2007

Chris Aldrich
Hatton Godat Pantier
1840 Barnes Blvd. SW
Tumwater, WA 98512

Report File Number: S04-0041
Report Subject: Soils investigation preliminary
Location: The study site is located east of Cooper Point Road, south of 28th Avenue NW in Olympia's UGA, Thurston County, WA. It is in Section 9, Township 18N, Range 2W. (TPNs: 50400100100, 50400200100, 50400300100, 50400400100, 50400402100, 50400402300, 50400402500, 74202500100, 74202900000, 74202500200, 81700000000).

Dear Mr. Aldrich,

At your request, we carried out onsite soils investigations fir purposes of stormwater management and facility design on this site over a period of about a week in mid-October, 2007. The summary information below is provided to document preliminary soils investigations for stormwater facility design and overall stormwater management. We are providing summary soil pit information for a total of 21 pits. We also provide a map with pit locations. Great effort was taken to make these pit locations as precise as possible. However, it should be noted that surface topography has changed significantly relative to what is displayed on the Thurston County GeoData system, which is derived from 1996 aerial topography. We are providing a LiDar image of the gravel pit taken from a 2000 flight which might help with conceptual layouts. But for best results, surface elevation at the pit locations will help greatly with analysis of grading plans and potential.

The information below can be summarized to say that most of the pits evaluated had at least a disturbed surface or surface fill. Only 2 out of 21 were relatively undisturbed. Many pits had 10 or more feet of fill, and with enough coarse organic woody debris to make it potentially structurally unsound. Fill in at least two pits smelled of diesel or oil.

Because we encountered what we believe to be perched groundwater tables in several pits in concert with loose gravelly sandy native substrates at between 10 and 15 feet depth, it appears likely that the City of Olympia will require groundwater monitoring this coming winter in the areas slated for stormwater management. We are more than willing to cooperate with Robinson and Noble staff in this effort.

The substrate is more permeable in some places than previously anticipated from Soil Survey

maps, which identified the area as the Alderwood series – a soil with shallow glacial till that tends to perch seasonal groundwater. This appears to be due to mining and removal of the overlying impermeable ablative till, and subsequent exposure of underlying gravelly and sandy advance outwash glacial deposits. Unfortunately, because these exposed substrates have been weathering for such a short period of time (some less than 1 year, most less than 50), evidence of seasonal saturation in the substrates that would develop over decades or centuries of chemical and physical changes are for the most part lacking or inconclusive.

For reasons explained above, it may be prudent to engage for a Phase II site assessment to verify if there are buried contaminants in the very common deep fills that dominate the site, but also for a more extensive geotechnical site assessment to provide a formal evaluation of the type of fill, whether it is or is not structural, and whether it might be necessary to remove fill entirely in some areas.

Robinson and Noble does provide Phase II site assessments; they might also have staff that could provide geotechnical assessments in concert with the drilling needed for Phase II work – which might be less expensive overall.

Respectfully submitted,

Pacific Rim Soil and Water, Inc.
Lisa Palazzi, CPSS

Pit 1

Horiz	Dpth	Col	CF	Txt	Struc	Perc	Mott	Roots	OM	%C
A	0-9	10YR3/2	10	L	WFSBk	0.2-0.6	—	CF, CM	6	12
Bs	9-18	10YR3/3	15	GrSL	MMSBk	2-6	—	CF, CM	<3	15
2Bsm	18-27	10YR4/3	15	GrLFS	MA sw	0-0.06	CMD	FM, FF	—	<10
2Cd	27-48	10YR4/2	25	GrLFS	MA	0-0.06	CMD	—	—	<10

Pit 1 was excavated in the far southeast corner of the site, in an area proposed for a stormwater facility. It was typical Alderwood soils with densic till at 27+ inches depth; harder till at 48 inches.

Pit 2

Horiz	Dpth	Col	CF	Txt	Struc	Perc	Mott	Roots	OM	%C
Fill1	0-23	mixed	25	GrLFS	MA	0-0.06	CMD	MF, CM	4	15
Fill2	23-33	10YR4/1	10	LFS	MA	0-0.06	CMD	CF	<3	<10
2Cd	33-60	10YR4/2	35	VGrLFS	MA	0-0.06	CMD	—	<3	<10
3C	60+	10YR4/3	--	LFS	WFSBk	0.6	—	—	<3	<10

Pit 2 was located farther north in the same proposed stormwater facility area. The surface was reworked fill and native surface over densic till and with loamy fine sand below.

Pit 3

Horiz	Dpth	Col	CF	Txt	Struc	Perc	Mott	Roots	OM	%C
Fill	0-19	10YR3/2	40	VGrLFS	MA	<0.2	--	MF, CM	4	<10
A	19-24	10YR3/2	40	VGRSL	MA	<0.2	--	MF	6	12
Bs	24-34	10YR3/3	40	VGRSL	MA	0.6-2	--	CF	<3	12
Bsm	34-38	10YR4/3	60	GrLFS	MA	<0.6	CMD	CF	<3	<10
2Cd	38-48	10YR4/3	60	GRLFS	MA/SG	<0.6	CMD	FF	<3	<10
2Cd2	48+	10YR4/2	50	VGrLFS	MA	0-0.06	—	—	<3	<10

Alderwood series. Fill over gravelly over densic till.

Pit 4

Horiz	Dpth	Col	CF	Txt	Struc	Perc	Mott	Roots	OM	%C
A	0-5	10YR3/2	15	GrSL	WFG	<0.6	—	MF, CM	6	12
Bs	5-18	10YR3/3	15	GrSL	WFSBk	06-2	—	CF	4	15
2Bsm	18-27	10YR4/3	35	VGrLFS	MA	<0.6	CMD	—	<3	12
2Cd	27-66+	10YR4/2	40	VGrLFS	MA	0-0.06	CMD	—	<3	<10

Alderwood series. Densic till at 27 inches; very gravelly

Pit 5

Horiz	Dpth	Col	CF	Txt	Struc	Perc	Mott	Roots	OM	%C
Fill	0-30	10YR5/4	15	GrSL	MIXED	2-6	—	CM	3	--
B1	30-39	10YR5/4	15	GrSL	MMSBk	2-6	—	CM	<3	18
B2	39-52	10YR5/4	15	GrSL	MMSBK	2-6	--	CM	<3	18
C1	52-90	10YR6/3	0	SiL	MA	0.6-2	--	FM	<3	18
C2m	90-120	10YR4/2	35	VGRSL	MA	0.06-0.2	CMD	—	<3	<10

Soil surface slopes to east. Soil pit measurements are taken from the high side. Base of pit varies from 5-7 feet below grade, dependent on where one take the measurement. From 0-30 is old fill – estimated at 50-100 years old. Below that, the buried surface is full of charcoal. The fill is about 40% coarse fragments with sandy loam fine fraction texture and weakly cemented zones. Estimated percolation rate of 2-6 inches per hour through the fill.

Pit 6

Horiz	Dpth	Col	CF	Txt	Struc	Perc	Mott	Roots	OM	%C
Fill	0-72	mixed	gravel – sandy loam – woody debris – concrete chunks....							
B	72-84	10YR5/4	40	VGRSL	WFSBK	6-20	--	--	<3	15
C1	84-156	2.5Y4/3	50	XGrLMS		SG	20+	--	--	<3<10
C2	156-192	2.5Y4/3	50	XGrLMS		SG	20+	--	--	<3<10

Six feet of mixed fill (not structural) overlying very to extremely gravelly sandy substrates with high infiltration potential.

Pit 7

This pit is located in the base of the gravel pit approximately 20 feet lower in elevation than Pit 6. Surface topo here is significantly different than what is shown on GeoData. The pit was dug to 7 feet, where groundwater was encountered. The surface to about 3 feet depth was mixed from gravel pit activities; substrate from 3-7 feet was clean sorted sand and gravel (glacial flood deposit).

Pit 8

This pit is at the east end of an old gravel pit excavation near the northwest site corner, in an area proposed for stormwater facilities.

0-9 inches:	The surface was saturated and compacted fill;
9-16 inches:	10YR5/4 gravelly sandy loam – dry
16-84 inches:	Weakly cemented layered ablative till – expect to be saturated during winter months
84-138 inches:	Loose medium to fine sand with occasional lenses holding up water; damp but not saturated. May be wet in winter, but possibly dry between upper saturated layer and underlying groundwater table.
138-180 inches:	Wet but not saturated. No mottling, but deep enough that it may not have adequate OM content to support microbial population that creates the mottling patterns. Groundwater at 14.5 feet depth, expected to rise in winter months.

Pit 9

Pit is located at west end of same old excavation. The surface is not saturated, nor is there any ablative till layer as was observed in Pit 8. The substrate is medium to fine sand from surface to 14.5 feet depth. No gravels. Saturated at 14.5 feet. There was a buried, green plastic, 6" diameter perforated pipe extending to about 15 feet depth that appears to have been either an old monitoring well of some sort or a drain. There was no silica sand screen and no bentonite. Estimated to have been in place at least 10-20 years. It was full of sand, so long since non-functional.

Pit 10

Pit is located right at the southwest corner of Cooper Ridge parcel, or at NW corner of main (central) Sundberg parcel. Mixed fill (non-structural) to 10 feet depth. Possibly disturbed native at 11 feet. The fill smells of diesel or oil; it has large chunks of concrete, asphalt, large boles of wood and construction debris. May be an old dump.

Pit 11
Pit is located southeast of Pit 10 about 100 feet in an area where we noticed earlier had black, non-native material pushed out of scattered mole holes. Fill to 12 feet depth. Pit base at 13.5 feet. Surface 3 feet is compacted and saturated; has a lot of coarse woody debris – 12-18 inch diameter tree boles that may have been placed to create a "corduroy" road surface across the saturated fill. At 12 feet, we broke through the base of fill into clean gravelly to very gravelly medium sand that appeared to be draining. However, that rate of inflow from the saturated fill above was greater than the rate of drainage; the pit was filling. The lowest fill had old Olympia oyster shells, which suggests that some old road may have been surfaced with shell waste from the waterfront (about 100 years old).

Pit 12
Pit was located east of the dirt road running up the west side of the gravel pit, and directly northwest of a small sediment pond on the west side of the gravel pit. 0-8 feet of massive random fill; severely compacted and completely impermeable. Water ponding at 6 feet depth. From 8-10 feet, an old disturbed sandy native surface. Possibly seasonally saturated, but not saturated today.

Pit 13
Pit located in northern portion of proposed southwest stormwater facility. 0-4 feet was relatively clean loamy sand fill. From 4-10 feet, the fill was old asphalt and concrete – structural fill. From 10-11 feet (pit base) – loose 100% woody debris. Did not reach native material.

Pit 14
Pit located in southern portion of proposed southwest stormwater facility. 0-2 feet is mottled sandy loam and loam sand mixed; no woody debris. From 2-12 feet – mixed fill with large logs, chunks of concrete and asphalt (2 feet or more in diameter), rebar; metal strips, cedar planks. Most of the asphalt and concrete debris is at 8-11 feet depth. Water was seeping in rapidly at 12 feet. The substrate below 12 feet was coarse sand, and appears to be native material. Possible that the seeping was from water trapped in fill, but appears to be coming from sandy substrates.

Pit 15
Pit was located about 80 feet east of double-wide trailer south of entry road. Top foot is mottled sandy loam. From 1-7 feet, mixed extremely gravelly sandy loam fill with about 15% woody debris. Fill includes concrete chunks; burn debris, and the base of the fill slopes deeper to the south. So it appears we are digging at the northern edge of a deeper fill hole. Below 7 feet depth, the substrate is native material – extremely gravelly loamy sand with color suggesting that it might once have been within about 3 feet of a native surface. The substrates are seeping rapidly and saturated below 7 feet depth (fill interface).

Pit 16
Pit is located in what may have been parking area west of old shop about 500 feet east and slightly north of Pit 15.
0-32 inches: The surface is clean fill – extremely gravelly loam sand with no wood and no garbage.
32-65 inches: Extremely gravelly loam sand native material with weakly cemented gravels.
65 inches to 11 feet depth: Extremely gravelly coarse sand with Mn stains on rock bases in a series of lenses of gravel.
11-12 feet: Uncemented medium sand – not wet or mottled.

Pit 17
Pit is located in southern portion of a secondary potential stormwater area west of wetland and east of shop (about 400 feet east of Pit 16). This pit had fill to 10+ feet. From 0-6 feet, the upper fill was mixed sandy loam with construction debris and a strong odor of diesel or oil. Below 6 feet, the fill was mostly large logs and lumber, possibly from an old log building. The lumber was squared off logs with notched ends – most pieces about 6-8 feet long (RR ties?). The pit base at 10 feet was still in fill, but was saturated, so we stopped digging since the fill pit sidewalls were unstable. Water was also seeping from 3 feet depth – from above a secondary fill layer. We thought it possible that the water at 10 feet was the same surface elevation as in the wetland to the east?

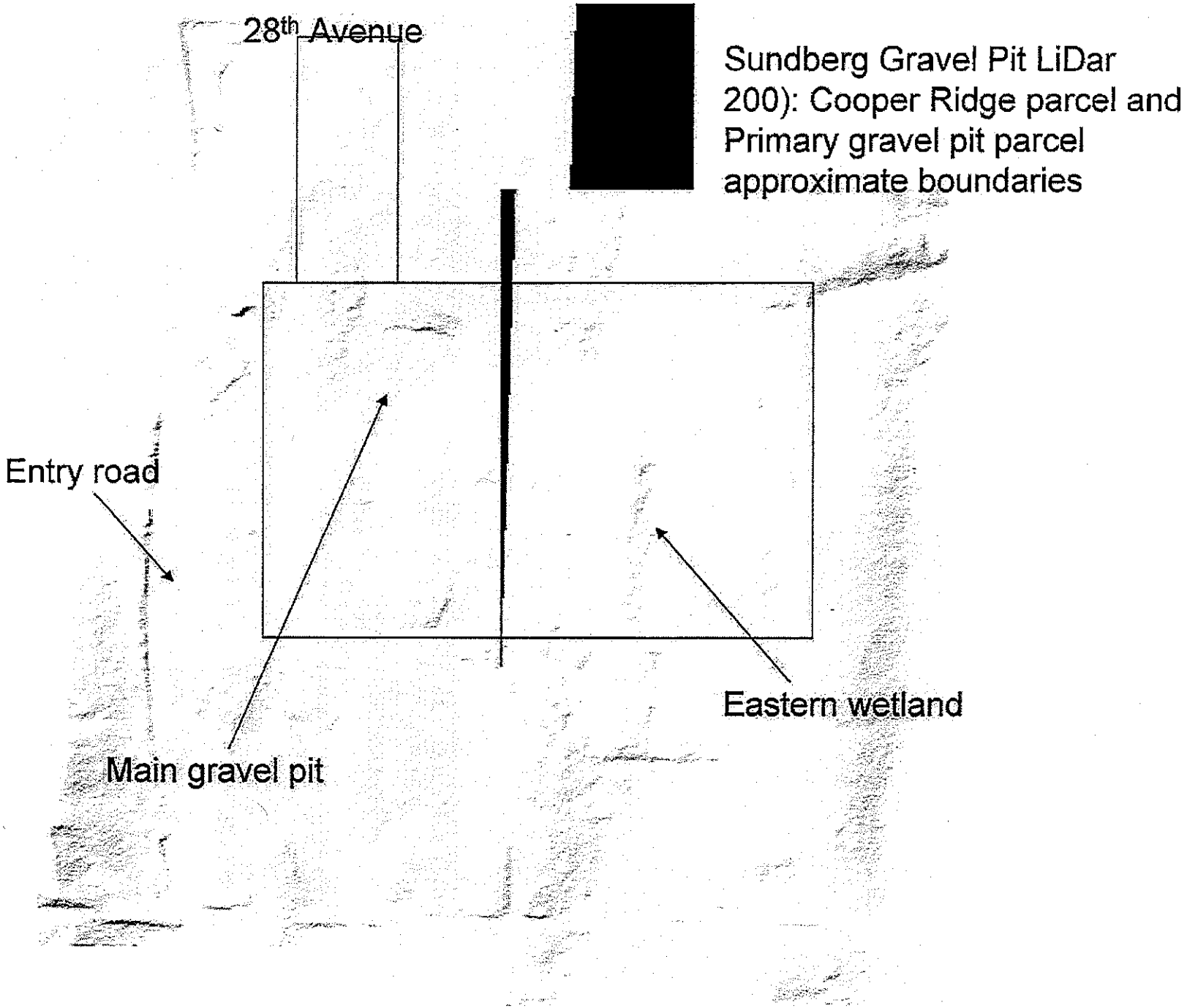
Pit 18
Pit located farther north, and slightly west of Pit 17 (about 300 feet).
0-7 feet: Relatively clean very gravelly sandy loam fill, massive and mixed with minor amounts of wire, coarse wood, etc. Seeping at 7 feet.
7-9 feet: Older fill with about 60% by volume coarse and fine woody debris and other fill material, including an old tire sidewall.
9-15 feet: The substrate was gleyed and mottled massive coarse sandy loam. Colors indicate saturation, but it is not saturated today. This material is possibly a native material base, but is disturbed and mixed.

Pit 19

Pit is located farther north and slightly west (about 300 feet from Pit 18), just south of cross-site gravel road.
0-30 inches: Massive, dark-brown fine sandy loam fill.
30-40 inches: Massive, severely gleyed silt loam fill.
40 inches to 11 feet: Older fill with dark brownish black color and a great deal of bark (about 25%). The balance is very gravelly sandy loam fill. Possibly a place where logs were stripped of bark?
Seeping at 40 inches, but not below.

Pit 20
Pit is located about 200-300 feet north and slightly west of Pit 19; Profile very similar to Pit 19
0-26 inches: Massive, dark-brown fine sandy loam fill.
26-36 inches: Massive, severely gleyed silt loam fill.
36 inches to 11 feet: Older fill with dark brownish black color and a great deal of bark (about 25%). The balance is very gravelly sandy loam fill.
11 feet+: started to hit a lighter colored layer with concrete chunks.

Pit 21
Pit is located on a wide flat area northwest of the double-wide trailer, and north of the main west to east gravel road. Surface here looks very different than what is shown on GeoData topography maps.
0-13 inches: Very gravelly sandy loam/ loamy sand fill surface; brown colored
13-30 inches: Very gravelly sandy loam/ loamy sand fill; gleyed and mottled (suggesting seasonal saturation)
30 inches to 6 feet: dark brown very gravelly sandy loam with about 10% metal debris
6 feet to 12 feet: Extremely gravelly coarse sand – almost blue in color, indicating seasonally saturated, but no mottles and not 100% saturated today. Water was seeping from top of occasional weakly cemented lenses of sandy gravelly material. Expect more water later in the winter as series of perched water tables develop in this zone.


28th Avenue
Sundberg Gravel Pit LiDar 200): Cooper Ridge parcel and Primary gravel pit parcel approximate boundaries
Entry road
Main gravel pit
Eastern wetland

P4
P13
P7
P16
P10
COOPER PT RD NW