ANCHOR QEA

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MEMORANDUM

To:	Libby Hudson, City of Bainbridge Island Chris Wierzbicki, City of Bainbridge Island	**Date:**	August 20, 2010
From:	John Laplante, PE	**Project:**	080510-04.01
Cc:	John Small, ASLA, Anchor QEA		
Re:	Review of Soil and Groundwater Chemistry Data Strawberry Plant Site – 240 NW Weaver Road Bainbridge Island, Washington		

This memorandum summarizes Anchor QEA's review of existing soil and groundwater chemistry data, and provides a summary of the lab results as compared to relevant Washington State Department of Ecology (Ecology) standards for the Strawberry Plant site (240 NW Weaver Road Property) located in Bainbridge Island, Washington.

SUMMARY OF ENVIRONMENTAL STUDIES

Several environmental studies have been performed at the Strawberry Plant site. Anchor QEA has reviewed the following reports from these studies:

- Subsurface Investigation at the Strawberry Plant site by Robinson & Noble and Saltbush Environmental Services, dated June 7, 2004 (Saltbush Report)
- Groundwater Sampling and Analysis Report at the Strawberry Plant site by Hart Crowser, dated August 2, 2004 (Hart Crowser Report)
- Sampling Activities Report at the Strawberry Plant site by Aspect Consulting, dated September 18, 2008 (Aspect Report)

The 2004 Saltbush work included advancing push probes at several locations, and submitting unfiltered, turbid (high total suspended solids) water samples collected directly from these push probes for laboratory analysis. The Saltbush Report stated that lead, chromium, cadmium, arsenic, and mercury were detected in one or more groundwater samples collected from the site at concentrations exceeding State of Washington Model Toxics Control Act (MTCA) Method A cleanup standards for groundwater. Based on these data, the Saltbush

Report stated that there was a potential for groundwater contamination at the Strawberry Plant site.

The Saltbush Report provided no analysis of the potential high bias in metal concentrations that result from analysis of unfiltered, turbid water samples. The Saltbush Report indicated that samples tested as groundwater were collected directly from the cased boreholes. However, based on data presented in the Saltbush Report, and considering the natural background concentration range of metals present in native Puget Sound soils, the "elevated" metals concentrations reported by Saltbush can be attributed entirely to the presence of suspended soils that were entrained in these water samples within the boreholes—these sample values are thus not representative of local groundwater conditions. Representative groundwater samples for metals can only be obtained through properly developed monitoring wells, which Saltbush did not install at the site. As described in technical publications such as U.S. Geological Survey (USGS) Report 96-4233 (*Guidelines and Standard Procedures for Studies of Groundwater Quality* 1997), soil material must be removed from the exploration well prior to groundwater sampling (a process called "development") so that high bias and associated errors are not introduced into the test results. Because of the presence of naturally occurring metals in native Puget Sound soils, this high bias is particularly problematic for metals and requires installation and proper development of monitoring wells to obtain representative groundwater samples.

Subsequent to publication of the Saltbush Report, (later in 2004) Hart Crowser performed follow-on work at the site to obtain representative groundwater samples for chemical analysis. The Hart Crowser work included installation of three monitoring wells, development of the wells using standard protocols, and collection of representative groundwater samples from the developed wells in accordance with USGS and Ecology protocols. Significantly, none of the groundwater samples collected by Hart Crowser exceeded MTCA Method A groundwater cleanup standards.

In preparation for the future Strawberry Plant work, the City of Bainbridge Island contracted with Anchor QEA and Aspect Consulting (Aspect) to collect additional groundwater samples in 2008 from a representative site monitoring well (EP-4-W), which was established in the area of planned excavation. Again, the groundwater sample collected by Aspect did not

exceed MTCA Method A groundwater cleanup standards, verifying the 2004 Hart Crowser results (Table 1).

The 2008 Aspect work also included collection of soil samples from three target locations at the site. Soil test results from the Aspect investigation were compared to MTCA Method A unrestricted use soil cleanup standards (the most stringent soil criteria promulgated under MTCA for protection of human health and the environment). All of the soil samples contained chemical concentrations below MTCA Method A unrestricted use soil cleanup standards (Table 2). Significantly, the metals reported as "elevated" in the Saltbush Report (i.e., lead, chromium, cadmium, arsenic, and mercury) were within the natural background concentration range (95 percent probability level) of metals present in native Puget Sound soils.

While there have been no measured groundwater impacts in the project area, there is the potential that residual oil may be present in soils upgradient of the site related to the adjacent former Tosco bulk storage facility. This site has had active remediation and is currently undergoing long-term monitoring by Ecology. Based on groundwater test results at the project site, there is no reason to believe that contamination associated with the Tosco facility has impacted or will impact groundwater in the project area.

CONCLUSION

Upon review of the results of the recent work by Aspect, the prior work by Hart Crowser, and the recognition that the initial work by Saltbush would likely have resulted in erroneous conclusions about groundwater, there is no evidence that indicates the Strawberry Plant project site (i.e., the area of proposed habitat restoration) has impacted soils or groundwater, and no indication that the soils tested would be expected to pose a risk to environmental media or receptors.

Table 1
Groundwater Results

Task SampleID Sample Date	MTCA Method A Cleanup Levels for Groundwater	Strawberry Plant EP-4-W 8/25/08	
Metals (µg/L)			
Arsenic	5	**4.1**	
Barium	--	**20.8**	
Cadmium	5	1	U
Chromium	50	**2.08**	
Lead	15	1	U
Mercury	2	0.2	U
Selenium	--	**1.04**	
Silver	--	1	U
Volatile Organic Compounds (µg/L)			
1,1,1,2-Tetrachloroethane	--	1	U
1,1,1-Trichloroethane	200	1	U
1,1,2,2-Tetrachloroethane	--	1	U
1,1,2-Trichloroethane	--	1	U
1,1-Dichloroethane	--	1	U
1,1-Dichloroethene	--	1	U
1,1-Dichloropropene	--	1	U
1,2,3-Trichlorobenzene	--	1	U
1,2,3-Trichloropropane	--	1	U
1,2,4-Trichlorobenzene	--	1	U
1,2,4-Trimethylbenzene	--	1	U
1,2-Dibromo-3-chloropropane	--	1	U
1,2-Dibromoethane (EDB)	0.01	1	U
1,2-Dichlorobenzene	--	1	U
1,2-Dichloroethane (EDC)	5	1	U
1,2-Dichloropropane	--	1	U
1,3,5-Trimethylbenzene	--	1	U
1,3-Dichlorobenzene	--	1	U
1,3-Dichloropropane	--	1	U
1,4-Dichlorobenzene	--	1	U
2,2-Dichloropropane	--	1	U
2-Butanone (MEK)	--	10	U
2-Chlorotoluene	--	1	U
2-Hexanone	--	10	U
4-Chlorotoluene	--	1	U
4-Methyl-2-pentanone	--	10	U
Acetone	--	10	U
Benzene	5	1	U
Bromobenzene	--	1	U
Bromodichloromethane	--	1	U
Bromoform	--	1	U
Bromomethane	--	1	U
Carbon Tetrachloride	--	1	U
Chlorobenzene	--	1	U
Chloroethane	--	1	U
Chloroform	--	1	U
Chloromethane	--	1	U
cis-1,2-Dichloroethene	--	1	U
cis-1,3-Dichloropropene	--	1	U
Dibromochloromethane	--	1	U

Table 1
Groundwater Results

Task SampleID Sample Date	MTCA Method A Cleanup Levels for Groundwater	Strawberry Plant EP-4-W 8/25/08	
Dibromomethane	--	1	U
Ethylbenzene	700	1	U
Hexachlorobutadiene	--	1	U
Isopropylbenzene	--	1	U
m,p-Xylene	1000	2	U
Methyl t-butyl ether (MTBE)	20	1	U
Methylene chloride	5	5	U
Naphthalene	--	1	U
n-Propylbenzene	--	1	U
o-Xylene	1000	1	U
p-Isopropyltoluene	--	1	U
sec-Butylbenzene	--	1	U
Styrene	--	1	U
tert-Butylbenzene	--	1	U
Tetrachloroethene	5	1	U
Toluene	1000	1	U
trans-1,2-Dichloroethene	--	1	U
trans-1,3-Dichloropropene	--	1	U
Trichloroethene	5	1	U
Trichlorofluoromethane	--	1	U
Vinyl chloride	0.2	0.2	U
Semivolatile Organic Compounds (µg/L)			
1,2,4-Trichlorobenzene	--	1	U
1,2-Dichlorobenzene	--	1	U
1,3-Dichlorobenzene	--	1	U
1,4-Dichlorobenzene	--	1	U
2,4,5-Trichlorophenol	--	10	U
2,4,6-Trichlorophenol	--	10	U
2,4-Dichlorophenol	--	10	U
2,4-Dimethylphenol	--	10	U
2,4-Dinitrophenol	--	30	U
2,4-Dinitrotoluene	--	1	U
2,6-Dinitrotoluene	--	1	U
2-Chloronaphthalene	--	1	U
2-Chlorophenol	--	10	U
2-Methylnaphthalene	160	1	U
2-Methylphenol	--	10	U
2-Nitroaniline	--	1	U
2-Nitrophenol	--	10	U
3-Nitroaniline	--	3	U
4,6-Dinitro-2-methylphenol	--	30	U
4-Bromophenyl phenyl ether	--	1	U
4-Chloro-3-methylphenol	--	10	U
4-Chloroaniline	--	3	U
4-Chlorophenyl phenyl ether	--	1	U
4-Methylphenol	--	10	U
4-Nitroaniline	--	10	U
4-Nitrophenol	--	10	U
Acenaphthene	--	1	U
Acenaphthylene	--	1	U

Table 1
Groundwater Results

Task SampleID Sample Date	MTCA Method A Cleanup Levels for Groundwater	Strawberry Plant EP-4-W 8/25/08	
Anthracene	--	1	U
Benz[a]anthracene	--	1	U
Benzo(a)pyrene	--	1	U
Benzo(b)fluoranthene	--	1	U
Benzo(ghi)perylene	--	1	U
Benzo(k)fluoranthene	--	1	U
Benzoic acid	--	100	U
Benzyl alcohol	--	1	U
Benzyl butyl phthalate	--	1	U
Bis(2-chloroethoxy)methane	--	1	U
Bis(2-chloroethyl) ether	--	1	U
Bis(2-chloroisopropyl) ether	--	1	U
Bis(2-ethylhexyl) phthalate	--	10	U
Carbazole	--	1	U
Chrysene	--	1	U
Dibenzo(a,h)anthracene	--	1	U
Dibenzofuran	--	1	U
Diethyl phthalate	--	1	U
Dimethyl phthalate	--	1	U
Di-n-butyl phthalate	--	1	U
Di-n-octyl phthalate	--	1	U
Fluoranthene	--	1	U
Fluorene	--	1	U
Hexachlorobenzene	--	1	U
Hexachlorobutadiene	--	1	U
Hexachlorocyclopentadiene	--	3	U
Hexachloroethane	--	1	U
Indeno(1,2,3-cd)pyrene	--	1	U
Isophorone	--	1	U
Naphthalene	160	1	U
Nitrobenzene	--	1	U
N-Nitroso-di-n-propylamine	--	1	U
N-Nitrosodiphenylamine	--	1	U
Pentachlorophenol	--	10	U
Phenanthrene	--	1	U
Phenol	--	10	U
Pyrene	--	1	U

Notes:

Bold = Detected result

U = Compound analyzed, but not detected above detection limit

Detected concentration is greater than MTCA Method A Cleanup Level

Non-detected value exceeds screening level

Draft, Unvalidated

Table 2
Soil Results

Task SampleID Sample Date	Sediment Quality Standard	Cleanup Screening Level	MTCA Method A [a]	Strawberry Plant EP-2/3-7 8/25/08		Strawberry Plant EP-4/5-8 8/25/08		Strawberry Plant EP-6/7-7 8/25/08	
Metals (mg/kg)									
Arsenic	57	93	20	**4.28**		**4.47**		**8.43**	
Barium	--	--	--	**20.7**		**15.2**		**72.6**	
Cadmium	5.1	6.7	2	1	U	1	U	1	U
Chromium	260	270	19[b]	**16.9**		**8.99**		**13.4**	
Lead	450	530	250	**14.7**		**7.76**		**39.8**	
Mercury	0.41	0.59	2	0.2	U	0.2	U	**0.26**	
Selenium	--	--	--	1	U	1	U	1	U
Silver	6.1	6.1	--	1	U	1	U	1	U
Volatile Organic Compounds (mg/kg)									
1,1,1,2-Tetrachloroethane	--	--	--	0.05	U	0.05	U	0.05	U
1,1,1-Trichloroethane	--	--	2	0.05	U	0.05	U	0.05	U
1,1,2,2-Tetrachloroethane	--	--	--	0.05	U	0.05	U	0.05	U
1,1,2-Trichloroethane	--	--	--	0.05	U	0.05	U	0.05	U
1,1-Dichloroethane	--	--	--	0.05	U	0.05	U	0.05	U
1,1-Dichloroethene	--	--	--	0.05	U	0.05	U	0.05	U
1,1-Dichloropropene	--	--	--	0.05	U	0.05	U	0.05	U
1,2,3-Trichlorobenzene	--	--	--	0.1	U	0.1	U	0.1	U
1,2,3-Trichloropropane	--	--	--	0.05	U	0.05	U	0.05	U
1,2,4-Trichlorobenzene	--	--	--	0.1	U	0.1	U	0.1	U
1,2,4-Trimethylbenzene	--	--	--	0.05	U	0.05	U	0.05	U
1,2-Dibromo-3-chloropropane	--	--	--	0.05	U	0.05	U	0.05	U
1,2-Dibromoethane (EDB)	--	--	0.005	0.05	U	0.05	U	0.05	U
1,2-Dichlorobenzene	--	--	--	0.05	U	0.05	U	0.05	U
1,2-Dichloroethane (EDC)	--	--	--	0.05	U	0.05	U	0.05	U
1,2-Dichloropropane	--	--	--	0.05	U	0.05	U	0.05	U
1,3,5-Trimethylbenzene	--	--	--	0.05	U	0.05	U	0.05	U
1,3-Dichlorobenzene	--	--	--	0.05	U	0.05	U	0.05	U
1,3-Dichloropropane	--	--	--	0.05	U	0.05	U	0.05	U
1,4-Dichlorobenzene	--	--	--	0.05	U	0.05	U	0.05	U
2,2-Dichloropropane	--	--	--	0.05	U	0.05	U	0.05	U
2-Butanone (MEK)	--	--	--	0.5	U	0.5	U	0.5	U
2-Chlorotoluene	--	--	--	0.05	U	0.05	U	0.05	U
2-Hexanone	--	--	--	0.5	U	0.5	U	0.5	U
4-Chlorotoluene	--	--	--	0.05	U	0.05	U	0.05	U
4-Methyl-2-pentanone	--	--	--	0.5	U	0.5	U	0.5	U
Acetone	--	--	--	0.5	U	0.5	U	0.5	U
Benzene	--	--	0.03	0.03	U	0.03	U	0.03	U
Bromobenzene	--	--	--	0.05	U	0.05	U	0.05	U
Bromodichloromethane	--	--	--	0.05	U	0.05	U	0.05	U
Bromoform	--	--	--	0.05	U	0.05	U	0.05	U
Bromomethane	--	--	--	0.5	U	0.5	U	0.5	U
Carbon Tetrachloride	--	--	--	0.05	U	0.05	U	0.05	U
Chlorobenzene	--	--	--	0.05	U	0.05	U	0.05	U
Chloroethane	--	--	--	0.5	U	0.5	U	0.5	U
Chloroform	--	--	--	0.05	U	0.05	U	0.05	U
Chloromethane	--	--	--	0.05	U	0.05	U	0.05	U
cis-1,2-Dichloroethene	--	--	--	0.05	U	0.05	U	0.05	U
cis-1,3-Dichloropropene	--	--	--	0.05	U	0.05	U	0.05	U
Dibromochloromethane	--	--	--	0.05	U	0.05	U	0.05	U
Dibromomethane	--	--	--	0.05	U	0.05	U	0.05	U
Dichlorodifluoromethane	--	--	--	0.5	U	0.5	U	0.5	U
Ethylbenzene	--	--	6	0.05	U	0.05	U	0.05	U
Hexachlorobutadiene	--	--	--	0.1	U	0.1	U	0.1	U
Isopropylbenzene	--	--	--	0.05	U	0.05	U	0.05	U
m,p-Xylene	--	--	9	0.1	U	0.1	U	0.1	U
Methyl t-butyl ether (MTBE)	--	--	0.1	0.05	U	0.05	U	0.05	U

Table 2
Soil Results

Task SampleID Sample Date	Sediment Quality Standard	Cleanup Screening Level	MTCA Method A [a]	Strawberry Plant EP-2/3-7 8/25/08	Strawberry Plant EP-4/5-8 8/25/08	Strawberry Plant EP-6/7-7 8/25/08
Methylene chloride	--	--	0.02	0.5 U	0.5 U	0.5 U
Naphthalene	--	--	--	0.05 U	0.05 U	0.05 U
n-Propylbenzene	--	--	--	0.05 U	0.05 U	0.05 U
o-Xylene	--	--	9	0.05 U	0.05 U	0.05 U
p-Isopropyltoluene	--	--	--	0.05 U	0.05 U	0.05 U
sec-Butylbenzene	--	--	--	0.05 U	0.05 U	0.05 U
Styrene	--	--	--	0.05 U	0.05 U	0.05 U
tert-Butylbenzene	--	--	--	0.05 U	0.05 U	0.05 U
Tetrachloroethene	--	--	0.05	0.025 U	0.025 U	0.025 U
Toluene	--	--	7	0.05 U	0.05 U	0.05 U
trans-1,2-Dichloroethene	--	--	--	0.05 U	0.05 U	0.05 U
trans-1,3-Dichloropropene	--	--	--	0.05 U	0.05 U	0.05 U
Trichloroethene	--	--	0.03	0.03 U	0.03 U	0.03 U
Trichlorofluoromethane	--	--	--	0.5 U	0.5 U	0.5 U
Vinyl chloride	--	--	--	0.05 U	0.05 U	0.05 U
Semivolatile Organic Compounds (mg/kg)						
1,2,4-Trichlorobenzene	--	--	--	0.03 U	0.03 U	0.03 U
1,2-Dichlorobenzene	--	--	--	0.03 U	0.03 U	0.03 U
1,3-Dichlorobenzene	--	--	--	0.03 U	0.03 U	0.03 U
1,4-Dichlorobenzene	--	--	--	0.03 U	0.03 U	0.03 U
2,4,5-Trichlorophenol	--	--	--	0.3 U	0.3 U	0.3 U
2,4,6-Trichlorophenol	--	--	--	0.3 U	0.3 U	0.3 U
2,4-Dichlorophenol	--	--	--	0.3 U	0.3 U	0.3 U
2,4-Dimethylphenol	--	--	--	0.3 U	0.3 U	0.3 U
2,4-Dinitrophenol	--	--	--	0.9 U	0.9 U	0.9 U
2,4-Dinitrotoluene	--	--	--	0.03 U	0.03 U	0.03 U
2,6-Dinitrotoluene	--	--	--	0.03 U	0.03 U	0.03 U
2-Chloronaphthalene	--	--	--	0.03 U	0.03 U	0.03 U
2-Chlorophenol	--	--	--	0.3 U	0.3 U	0.3 U
2-Methylnaphthalene	--	--	5	0.03 U	0.03 U	0.03 U
2-Methylphenol	--	--	--	0.3 U	0.3 U	0.3 U
2-Nitroaniline	--	--	--	0.03 U	0.03 U	0.03 U
2-Nitrophenol	--	--	--	0.3 U	0.3 U	0.3 U
3-Nitroaniline	--	--	--	0.9 U	0.9 U	0.9 U
4,6-Dinitro-2-methylphenol	--	--	--	0.9 U	0.9 U	0.9 U
4-Bromophenyl phenyl ether	--	--	--	0.03 U	0.03 U	0.03 U
4-Chloro-3-methylphenol	--	--	--	0.3 U	0.3 U	0.3 U
4-Chloroaniline	--	--	--	3 U	3 U	3 U
4-Chlorophenyl phenyl ether	--	--	--	0.03 U	0.03 U	0.03 U
4-Methylphenol	--	--	--	0.3 U	0.3 U	0.3 U
4-Nitroaniline	--	--	--	0.9 U	0.9 U	0.9 U
4-Nitrophenol	--	--	--	0.3 U	0.3 U	0.3 U
Acenaphthene	--	--	--	0.03 U	0.03 U	0.03 U
Acenaphthylene	--	--	--	0.03 U	0.03 U	0.03 U
Anthracene	--	--	--	0.03 U	0.03 U	0.03 U
Benz[a]anthracene	--	--	--	0.03 U	0.03 U	**0.033**
Benzo(a)pyrene	--	--	0.1	0.03 U	0.03 U	**0.038**
Benzo(b)fluoranthene	--	--	--	0.03 U	0.03 U	**0.053**
Benzo(ghi)perylene	--	--	--	0.03 U	0.03 U	**0.039**
Benzo(k)fluoranthene	--	--	--	0.03 U	0.03 U	0.03 U
Benzoic acid	--	--	--	3 U	3 U	3 U
Benzyl alcohol	--	--	--	0.03 U	0.03 U	0.03 U
Benzyl butyl phthalate	--	--	--	0.03 U	0.03 U	0.03 U
Bis(2-chloroethoxy)methane	--	--	--	0.03 U	0.03 U	0.03 U
Bis(2-chloroethyl) ether	--	--	--	0.03 U	0.03 U	0.03 U
Bis(2-chloroisopropyl) ether	--	--	--	0.03 U	0.03 U	0.03 U
Bis(2-ethylhexyl) phthalate	--	--	--	0.3 U	0.3 U	0.3 U

Table 2
Soil Results

Task SampleID Sample Date	Sediment Quality Standard	Cleanup Screening Level	MTCA Method A [a]	Strawberry Plant EP-2/3-7 8/25/08		Strawberry Plant EP-4/5-8 8/25/08		Strawberry Plant EP-6/7-7 8/25/08	
Carbazole	--	--	--	0.03	U	0.03	U	0.03	U
Chrysene	--	--	--	0.03	U	0.03	U	**0.039**	
Dibenzo(a,h)anthracene	--	--	--	0.03	U	0.03	U	0.03	U
Dibenzofuran	--	--	--	0.03	U	0.03	U	0.03	U
Diethyl phthalate	--	--	--	0.03	U	0.03	U	0.03	U
Dimethyl phthalate	--	--	--	0.03	U	0.03	U	0.03	U
Di-n-butyl phthalate	--	--	--	0.03	U	0.03	U	0.03	U
Di-n-octyl phthalate	--	--	--	0.03	U	0.03	U	0.03	U
Fluoranthene	--	--	--	0.03	U	0.03	U	**0.067**	
Fluorene	--	--	--	0.03	U	0.03	U	0.03	U
Hexachlorobenzene	--	--	--	0.03	U	0.03	U	0.03	U
Hexachlorobutadiene	--	--	--	0.03	U	0.03	U	0.03	U
Hexachlorocyclopentadiene	--	--	--	0.09	U	0.09	U	0.09	U
Hexachloroethane	--	--	--	0.03	U	0.03	U	0.03	U
Indeno(1,2,3-cd)pyrene	--	--	--	0.03	U	0.03	U	**0.03**	
Isophorone	--	--	--	0.03	U	0.03	U	0.03	U
Naphthalene	--	--	5	0.03	U	0.03	U	0.03	U
Nitrobenzene	--	--	--	0.03	U	0.03	U	0.03	U
N-Nitroso-di-n-propylamine	--	--	--	0.03	U	0.03	U	0.03	U
N-Nitrosodiphenylamine	--	--	--	0.03	U	0.03	U	0.03	U
Pentachlorophenol	--	--	--	0.3	U	0.3	U	0.3	U
Phenanthrene	--	--	--	0.03	U	0.03	U	0.03	U
Phenol	--	--	--	0.3	U	0.3	U	0.3	U
Pyrene	--	--	--	0.03	U	0.03	U	**0.064**	
Carcinogenic PAH TEC	--	--	0.1	0.02265	U	0.02265	U	**0.05299**	

Notes:

Bold = Detected result

U = Compound analyzed, but not detected above detection limit

a MTCA Method A Soil Cleanup Levels for Unrestricted Land Uses

b Value is for Chromium IV cleanup level

Total PAHs were calculated using 1/2 of the reporting limit for non-detected results

Detected concentration is greater than MTCA Method A Cleanup Level

Non-detected value exceeds screening level

Draft, Unvalidated