Brown Plat Detention Pond
Winter water quality monitoring 2009

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Introduction and Methods:

In 2003, a Hearing Examiner took testimony concerning a SEPA appeal on the permit for development of a piece of land within the City of Maple Valley known as the "Brown Plat." The appeal was based in part on the potential for adverse effects from the development on water quality in Lake Lucerne. The document entitled Findings, Conclusions and Decision on the Shoreline Substantial Development Permit (Case no. PP01-1482/CD0207-001) included instructions to the City of Maple Valley to monitor water quality of the outflow from the detention pond that was constructed as part of permit requirements, as well as to carry out professionally-collected water quality sampling of Lake Lucerne in tandem with the long-term volunteer-assisted lake monitoring by the King County Lake Stewardship Program.

The cost for the monitoring program was to be borne by the developer through payment to the City. A proposed monitoring program beginning at 50% build-out was outlined by A. C. Kindig &Co and subsequently accepted by the Hearing Examiner. It was agreed that the primary reason for measuring water quality of stormwater outflow coming from the Brown Plat detention pond was to meet the requirements of the Hearing Examiner's decision, as well as to assure the City and nearby residents that the surface water runoff treatment put in place would work over the long term to retain the excellent water quality of Lake Lucerne.

Phosphorus was the algal nutrient specifically called out in the monitoring plan, and it was noted that the King County Surface Design Manual standard of 50% removal by treatment was in practice very hard to assess. While a specific threshold for phosphorus concentrations was not set by the Hearing Examiner's decision, the plan devised by the A.C. Kindig & Co. mentioned that a range of 0.05 – 0.25 mg/L total phosphorus would be 50% of the range found in stormwater in the Puget lowlands. Thus, finding values within or below that range should be assurance that the stormwater treatment was providing protection as described in the design manual guidelines for sensitive lakes.

This report contains results from the wet weather samples taken from the outflow structure of the detention pond in winter 2008-2009. Water was collected by King County staff trained in field sampling and analyzed at the King County Environmental Laboratory (KCEL) using approved methods and QA/QC procedures. The work was performed under the King County inter-local agreement with the City of Maple Valley.

The detention pond sampling design called for field trips to the site on 5 dates during the wet season, to be selected by the "random block design method" in order to avoid bias from sampling during particular storm events that might not represent the majority of water moving from the pond to the lake. A further consideration was that there were times when KCEL would not accept samples for analysis (weekends and holidays). An

unforeseen complication involved the hazardous driving conditions in December that necessitated rescheduling the first chosen date. The final list of dates sampled included December 30th, January 21st, January 26th, February 17th and February 19th.

Figure 1. Aerial photo and map of Brown Plat boundaries, location of detention pond and outlet, pipeline, and pipe outfall to Lake Lucerne.

The goal was to determine the concentration of phosphorus in the water exiting the detention pond and entering the lake (Figure 1). A sampling site at the pipe outflow to Lake Lucerne was rejected for two reasons: (1) it was discovered that surface water flowing from another part of the watershed was connected to the pipe between the detention pond outlet and the pipe outfall into the lake; and (2) lake water levels were high enough to extend into the outfall pipe, mixing with the water coming from the detention pond; thus phosphorus data from that water would not represent only runoff from the detention pond. Instead, a site upstream at the pipe exit from the detention pond was chosen. This was located deep in a large standing pipe on the detention pond property behind a locked fence (Figure 2).

Figure 2: Standing pipe containing outlet from the detention pond (seen in the distance)

Sampling was accomplished by lowering a Van Dorn grab sampler to the level of the exit pipe (which could seen during all 5 visits) and triggering water collection at a point immediately in front of the outlet pipe. Water samples taken by this method were analyzed for total phosphorus, total nitrogen, and total suspended solids. In addition, a Hydrolab field probe was lowered to the same depth to get information on temperature, pH, conductivity, and dissolved oxygen in order to get a more complete picture of the water quality of the outflow.

Results and discussion:

The results of the five sampling dates showed great consistency in water quality parameters between sample sets (Table 1). Part of this is probably due to the relatively cold and dry weather experienced during the period. Field notes included the observation that the pond surface was frozen on the first three dates (December 30th, January 21st, and January 26th). Although water was exiting through the outlet on each occasion, the volume was never high, and it had slowed to a trickle by February 19th.

Table 1. Water quality data for 5 sampling dates. Detention Pond outlet site.

	degrees Celsius	µsiemens / cm		mg/L	mg/L	mg/L	mg/L
date	**Temper-ature**	**Specific Conductivity**	**pH**	**Dissolved Oxygen**	**Total Phosphorus**	**Total Nitrogen**	**Total Suspended Solids**
12/30/2008	3.5	98	5.85	12.24	0.0270	0.496	2.11
1/21/2009	5.8	89	7.07	11.03	0.0189	0.416	1.20
1/26/2009	5.4	91	6.21	12.47	0.0176	0.361	1.30
2/17/2009	7.6	108	6.57	10.19	0.0189	0.322	0.50
2/19/2009	7.7	114	7.12	9.83	0.0241	0.340	0.50
average	6.0	100	6.56	11.15	0.0213	0.387	1.12
maximum	7.7	114	7.12	12.47	0.0270	0.496	1.30
minimum	3.5	89	5.85	9.83	0.0176	0.322	0.50

The most notable point in terms of the Hearing Examiner's decision and the 50% removal requirement of the Design Manual is that total phosphorus concentrations in the water leaving the detention pond were consistently an order of magnitude (10x) lower than the upper end of the range depicted as meeting the 50% removal guideline. In fact, they averaged less than half of the lower end of the range. However, there was an exceptionally dry period during the last 2/3 of the sample period of sampling (Figure 3), and it could be argued that three of the five samples may not adequately represent the effects of wet weather. Certainly the first sample date followed a wet period, yet the phosphorus concentrations were still well below the lower end of the suggested range of acceptance. The next sampling series will be conducted along the same lines in winter 2009-2010 and may have more dates that follow rainy periods to compare to the values measured during this season.

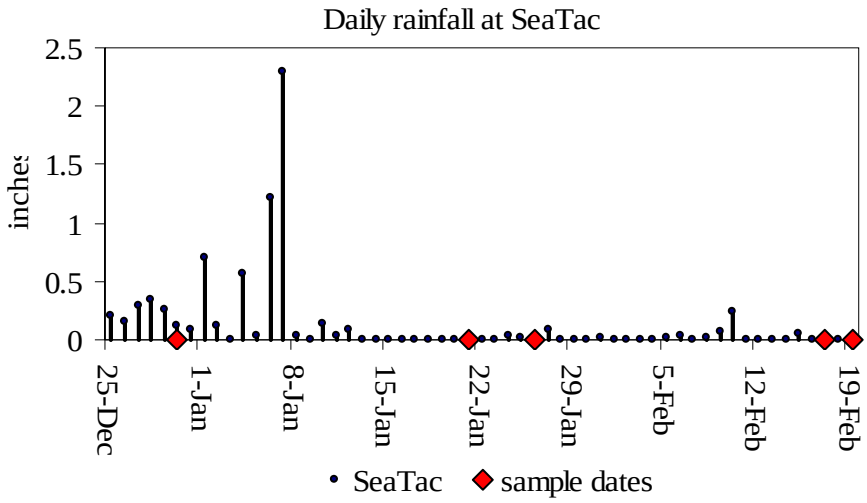

Figure 3. Relationship between daily precipitation totals and detention pond sample events based on rainfall record at Seattle-Tacoma International Airport.

The data for pH of the stormwater indicated that it is neutral to slightly acidic, very much in line with commonly found values for water in the region. It should be noted that the sample taken during wet weather had the lowest pH of the set. For all samples, the water was well oxygenated, and the total nitrogen values were similar to those found in Lake Lucerne. Conductivity values are also within the range to be found in waters of the area. The values for total dissolved solids were low as well, close to the minimum detection level for the last two samples. Here again, the December 30th sample had the highest value at 2.1l mg/L; however, this is a fairly low value for flowing waters and should probably be considered as indicating success.

In summary, the data from this set of samples strongly suggests that the water leaving the pond and entering Lake Lucerne is currently meeting the requirements of the Hearing Examiner's decision for water quality protection of the lake. If wet weather conditions are different for the randomized sample dates next year and the results are similar, the evidence will be very strong for accepting the surface drainage treatment as adequate.