A.C. Kindig & Co.
ENVIRONMENTAL CONSULTING

LAWSON HILLS MPD
WATER QUALITY TECHNICAL REPORT

SUPPLEMENTAL MEMORANDUM

Prepared for:

BD Lawson Partners, LP
825 Fifth Avenue, Suite 202
Kirkland, WA 98033

Prepared by:

A.C. Kindig & Co.
PO Box 2486
Redmond, WA 98073
425-638-0358

October 6, 2008
Project No. 310

1.0 INTRODUCTION

This supplemental memorandum to the A.C. Kindig & Co. May 5, 2008 *Lawson Hills MDP Water Quality Technical Report* (*Water Quality Report*) is prepared as a result of two subsequent requests summarized in Table 1 from the City of Black Diamond (City) to BD Lawson Partners, LP (Applicant).

Table 1. Supplemental Memorandum Content Summary

Issue	City Requests	Supplemental Memorandum Content
Stormwater Pond Configuration & Flow Management	The City asked for consideration of a new stormwater pond configuration (named Option 2) and a new flow control management option (named Option 3) in addition to the pond and flow control configuration evaluated in the May 2008 report (named Option 1).	The potential for differences in water quality impacts under pond configuration Option 2 and flow control Option 3 are evaluated relative to the Option 1 configuration with flow control evaluated in May 2008.
Storm Pond Temperature	The City's EIS consultant, Parametrix Inc., asked for additional details supporting the pond water temperature analysis in the May 2008 report (Section 3.2.2.8, pages 3-21 to 3-22).	Thermal monitoring data results summarized in the May 2008 report are provided in more detail.

2.0 STORMWATER POND CONFIGURATION OPTIONS 1 AND 2, AND FLOW MANAGEMENT OPTION 3

Stormwater pond configuration Option 1 with flow control was previously described and analyzed in the May 2008 *Water Quality Technical Report.* Figure 3-1 in the *Water Quality Report* shows the drainage basins A through D under the Option 1 pond configuration.

One new stormwater pond configuration named Option 2 with flow control is under consideration by the City, along with a flow control management Option 3. Both are described in the *Lawson Hills Stormwater Concept Memorandum* prepared by Triad Associates on October 3, 2008. The evaluation in this memorandum is based on those conceptual descriptions.

2.1 *Option 2*

Under Option 2, a single offsite pond, possibly located east of Jones Lake and adjacent to SR-169, would be constructed as an alternative to the four onsite ponds serving Basins A, B and C under Option 1. The Basin D pond would be constructed under both Options 1 and 2. There would be no difference to storm management for the North Triangle. Onsite rooftop runoff or treated stormwater would be routed to Lawson Creek,

Mud Lake, the Unnamed Creek, and onsite wetlands as needed to maintain existing flow conditions, just as under Option 1. The specific siting of the single offsite pond and its potential for environmental impacts would be subject to future environmental review.

There are no differences in stormwater quality pollution generating sources, treatment type (wet pond) or combined project discharge impacts on Rock Creek downstream of the Ginder Creek confluence, or Lake Sawyer further downstream, because at this point and downstream all stormwater influences from the Lawson Hills project are combined. There would be some differences between routing of stormwater after treatment and discharge between Option 2 relative to Option 1 as follows:

1. ***Basin A*** treated stormwater discharge to Lawson Creek would be nearly the same under both Option 1 and Option 2, because Option 1 included a bypass to Lawson Creek to maintain existing hydrology in Lawson Creek and avoid erosive impact to the steeply incised portion of the creek upstream of SR-169, as described previously. The impacts to Lawson Creek under Option 2 would be as described previously for Option 1 (see Table 3-12 in the *Water Quality Report)*.

   Depending on siting for the Option 2 offsite ponds, construction impacts may differ somewhat from those for the ponds under Option 1 because of differences in soils, slopes, or proximity of natural watercourses. However, it is reasonably expected that construction best management practices and mitigation described in the *Water Quality Report* would be sufficient to minimize or avoid impacts to the same degree under both options.

2. ***Basin B*** treated stormwater discharge to Mud Lake would not occur under Option 2 as under Option 2, except as needed to maintain existing hydrology in Mud Lake, Mud Lake Creek, and Ginder Creek downstream. Therefore, potential impacts to Mud Lake, Mud Lake Creek, and Ginder Creek would be reduced under Option 2 relative to Option 1. However, no adverse impacts to water quality were forecast by the water quality model to any of these water bodies, so there would be no meaningful change in conclusions for water quality impact to these waters under Option 2 relative to Option 1 for drainage from Basin B (see Table 3-14 in the *Water Quality Report* for a forecast of treated discharge quality from Basin B.

3. ***Basin C*** treated stormwater discharge to Unnamed Creek would not occur under Option 2 as under Option 2, except as needed to maintain existing hydrology in Unnamed Creek. However, no adverse impacts to water quality were forecast by the water quality model to unnamed Creek, so there would be no meaningful change in conclusions for water quality under Option 2 relative to Option 1 for drainage from Basin C (see Table 3-13 in the *Water Quality Report* for a forecast of treated discharge quality from Basin C.

4. ***Combined discharges from Basins A through C*** to Lawson Creek at Jones Lake under Option 2 would only differ from Option 1 with regard to Basin B contributions. Under both Options 1 and 2, Basin A and Basin C treated storm discharges would combine at this point; under Option 2 Basin B discharges are added as well. This would increase the potential for water quality impact to lower Lawson Creek at Jones Lake, in Jones Lake, and in Rock Creek downstream to the Ginder Creek confluence. Basin B influences reach Rock Creek at the

Ginder Creek confluence under Option 1, but are moved higher in the Rock Creek watershed under Option 2.

The effect of combined Basin A and C discharges on Jones Lake is shown in Table 3-18 and described in the *Water Quality Report*. Under Option 2, influences of Basin B treated discharge (shown in Table 3-14 in the *Water Quality Report*) would be added. Qualitatively, these tables show that the Basin B and Basins A and C discharge quality is very similar, with no important differences in any of the constituents analyzed. Therefore, constituent concentrations of combined stormwater from the Lawson Hills project at the point of discharge from the offsite Option 2 pond would be similar to those already analyzed for impacts in the Water Quality Report for Option 1 to lower Lawson Creek, Jones Lake and upper Rock Creek.

2.2 *Option 3*

Under Option 3 being considered by the City, the City would apply for and obtain a Basin/Watershed Plan for the Jones Lake and Rock Creek basins. This could potentially allow the City to alter flow control requirements from those required under the 2005 Ecology *Stormwater Management Manual for Western Washington.* Under Option 3, the City would explore the potential to provide flow control within the Jones Lake and Rock Creek wetland complex rather than provide stormwater detention onsite. Water quality treatment would still be required in wet ponds, which could be placed onsite (as under Option 1) or offsite (as under Option 2). The impacts of Option 3 would be subject to future environmental review. Baseflow requirements for onsite streams and wetlands would be provided by rooftop drainage and treated stormwater as under Options 1 and 2.

Option 3 pertains only to flow control, not to stormwater quality treatment. Therefore, none of the Option 1 stormwater quality analysis in the *Water Quality Report* pertaining to the quality of pond discharge or its impacts would be changed. Baseflow protections would be the same under Option 3 as under Options 1 and 2, so no water quality differences that pertain to changes in base flow, such as temperature or dissolved oxygen, would occur under the different options. No significant differences in construction discharge or best management practices would be expected under Option 3 relative to Options 1 or 2.

Under Option 3, it is unknown if erosion in Rock Creek could increase under high flow conditions, unless the flow control afforded by the natural wetlands attenuated stream energy enough to prevent these impacts. If stream erosion was increased, there could be increased phosphorus loading to Lake Sawyer because of the natural phosphorus content in soil. Since Lake Sawyer is a phosphorus sensitive lake, this would increase potential for eutrophic impact. The degree of flow control that could be provided by the Jones Lake and Rock Creek wetland complex, and the degree of mitigating flow control that may be necessary to avoid water level fluctuation or flow impacts on the wetland/lake/stream complex or further waterbodies downstream is unknown and subject to future environmental review.

3.0 STORM POND TEMPERATURE

Section 3.2.2.8 of the *Water Quality Report* explained why wet ponds for stormwater treatment are not expected to increase water temperatures in receiving waters. This section used continuous temperature recording data to examine water inflow, pond water, and pond outflow during spring, summer and late summer conditions in the Puget Lowlands. The analysis was focused on storm discharges during July through early September, which is the hottest period in the Puget Sound lowlands and the period during which receiving waters would have the greatest susceptibility to thermal impact. It is important to keep in mind that thermal inputs are not conservative in nature; that is, temperature in water will always tend towards thermal equilibrium. The cooler the ambient condition, the faster thermal equilibrium to ambient conditions will occur. Even with continuous thermal inputs to streams during the warmest time of the year, thermal impacts of forest clearing, for example, were found to extend no more than about 2,000 feet downstream before returning to the ambient temperature in non-harvested forests.[1] Storm ponds do not discharge coincident with warmest temperatures. Therefore, there is no possibility that any Lawson Hills pond, whether onsite under Option 1 or offsite under Option 2, could extend thermal impact very far down stream, including to Rock Creek or Lake Sawyer, before equilibrium was reached. The analysis in the Water Quality Report was intended to address the potential for localized temperature impacts at the points of discharge during the warm summer season.

The City's consultant Parametrix Inc. expressed concern that any stormwater pond may be a source of thermal impact to receiving waters, and that the larger regional wet pond that would be constructed offsite under Option 2, relative to Option 1, may exacerbate any thermal impact. This section of the memorandum addresses that concern by expanding on the discussion and elaborating on the source data for the previous analysis.

Urban runoff from summer storms is often thought to be warm because of the influence of impervious surfaces and wet ponds which warm from sunlight and warm air temperatures. However, measurement of air and wet pond temperatures during the summer demonstrates that storm runoff in western Washington rarely coincides with warmer weather. In the Puget Lowlands, most storms and the vast majority of runoff volume occurs during the cooler weather seasons (late fall through early spring). A temperature monitoring study was conducted by A.C. Kindig & Co. at Trossachs, a residential development in the City of Sammamish, Washington in the Puget Lowlands. Continuous gages measured stormwater and air temperatures from May 2000 through September 2000. Temperature gages were installed at inflow to the combined wet detention pond, in the wet pond, at the wet pond outflow (which was inflow to a sand filter), and at the sand filter outflow[2] (A.C. Kindig 2000). An ambient air temperature gage was installed out of direct sunlight at the site. From July through early September, the period of greatest susceptibility of receiving water impacts from temperature change, runoff from summer storms never overcame evaporative losses in the wet pond to cause discharge to occur (Figures 1 through 3). From May through September 2000 storm runoff entered the wet pond at temperatures consistently below 62 ºF (16.7^{o}C) due to

[1] J.E. Caldwell, K. Doughty, and K. Sullivan. 1991. Evaluation of Downstream Temperature Effects of Type 4/5 Waters.

[2] A.C. Kindig & Co. 2000. Unpublished runoff data from Trossachs Residential Development inflow, wet pond and sand filter. Issaquah, Washington.

evaporative cooling, and because of the cooler air temperatures measured during all storms (A.C. Kindig 2000). Water within the wet pond cooled rapidly during all storms in 2000, both because of cooler air temperatures and because of mixing with the cooler inflow water. Pond discharge occurred in 2000 for the first time after several days of rain between September 5th and September 11th. The series of storms that resulted in pond outflow followed periodic storms and cooler weather starting in late August. When pond outflow began, the pond temperature had dropped to about 60 to 61ºF (15.6 to 16.1^{o}C), and continued to drop as the storm and discharge continued. The peak water temperature expected in discharge from wet ponds in late summer is therefore under or around 16°C.

These peak summer discharge temperatures are within the range of water quality standard criteria. More importantly, storm discharge does not occur during the hottest ambient conditions when surface receiving waters would be warmest and therefore most susceptible to thermal impact. When storm discharge does occur, ambient conditions are cooler, receiving water temperatures would be cooler, and thermal equilibrium mechanisms would be stronger, preventing thermal impacts from storm discharge.

For these reasons, the *Water Quality Report* concluded no adverse impacts from storm ponds, regardless of location. Pond size would make no difference, since the surface to volume ratio tends to increase for larger ponds (because they can only be constructed within a narrow wet pond storage depth range), which makes thermal equilibrium to cooler storm temperatures just as fast as in smaller ponds.

Figure 1 Trossachs Wet Pond and Sand Filter Continuous Temperature Record and Daily Rainfall May 25 through June 30, 2000

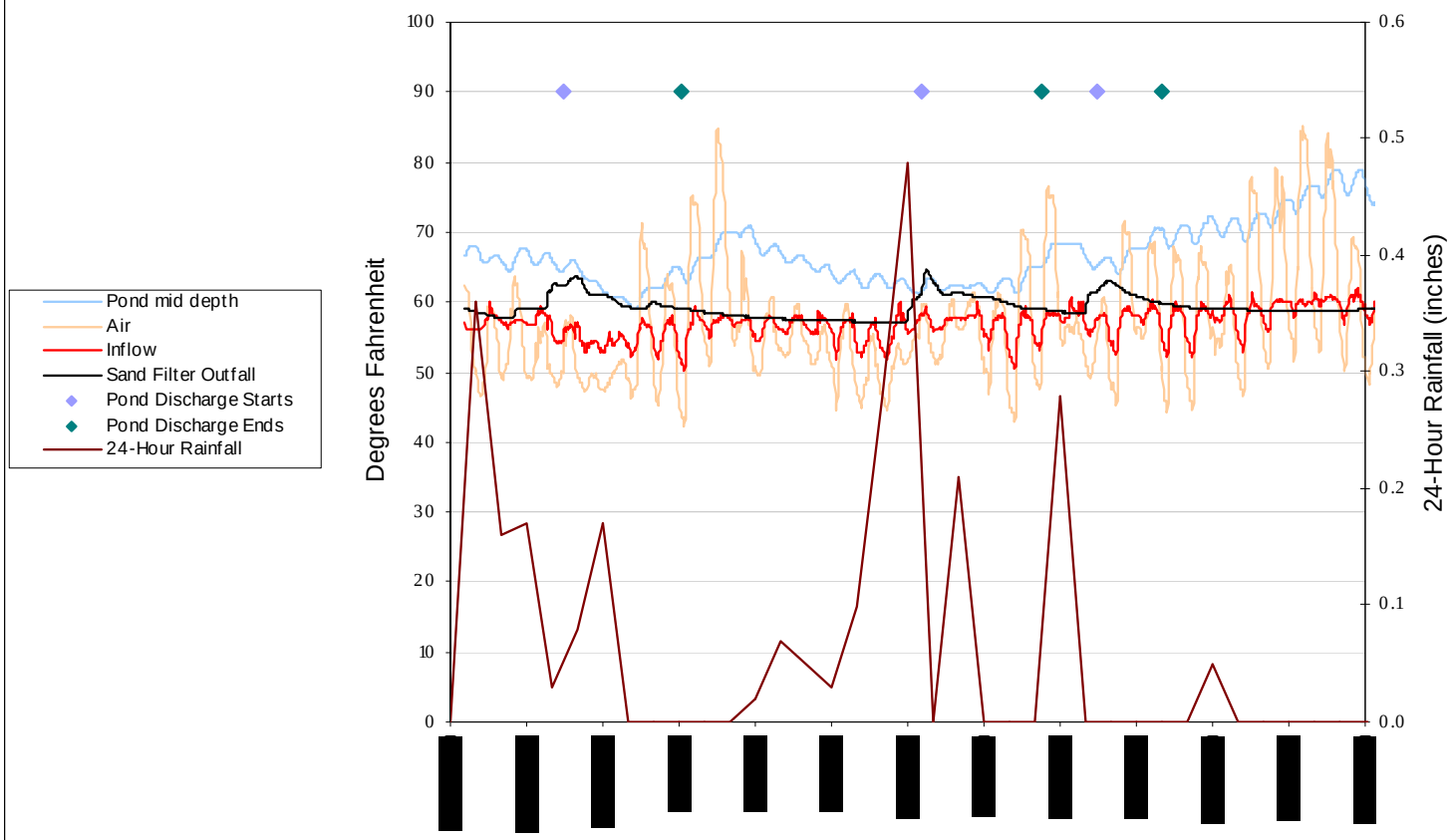

Figure 2 Trossachs Wet Pond and Sand Filter Continuous Temperature Record and Daily Rainfall July 1 through August 14, 2000

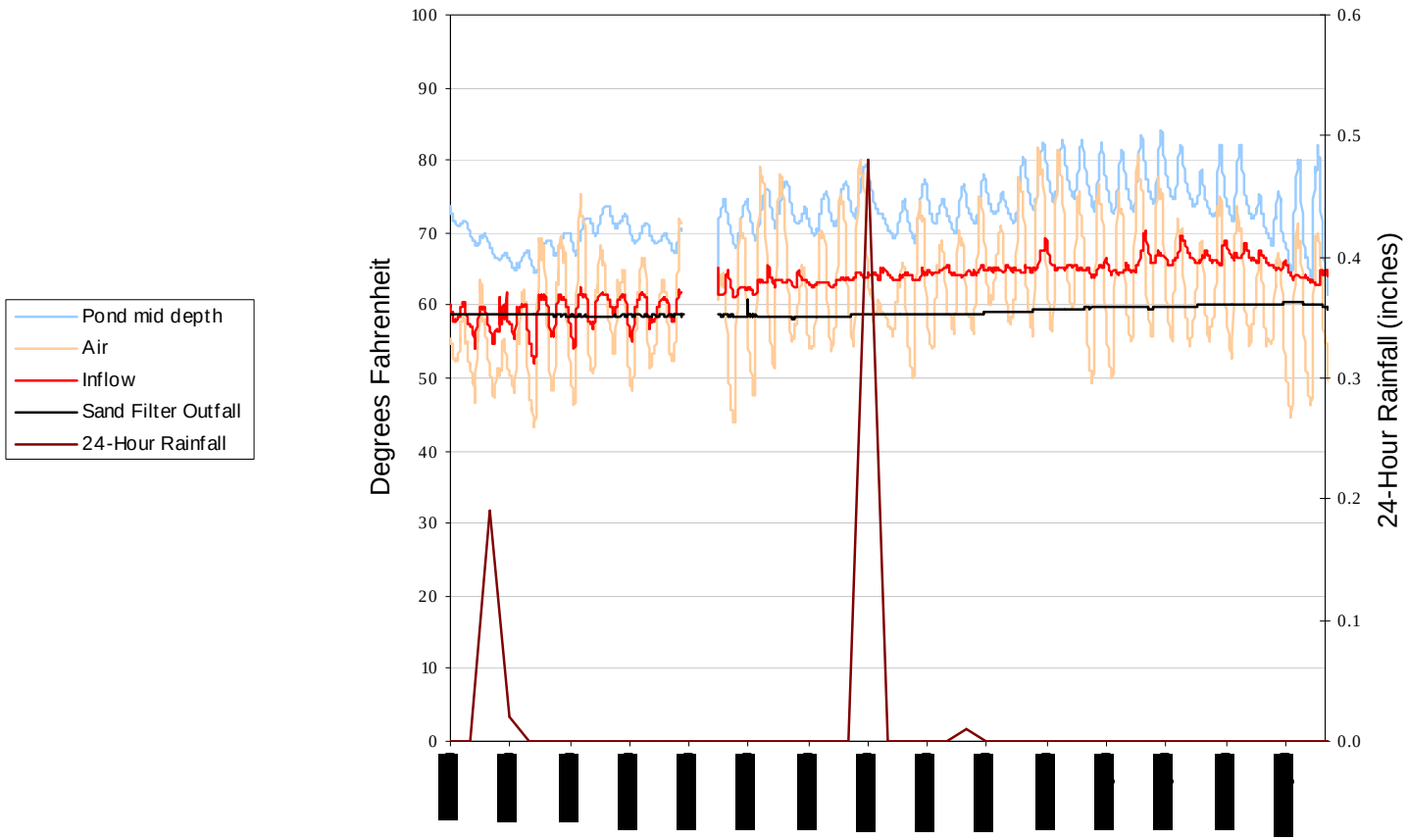
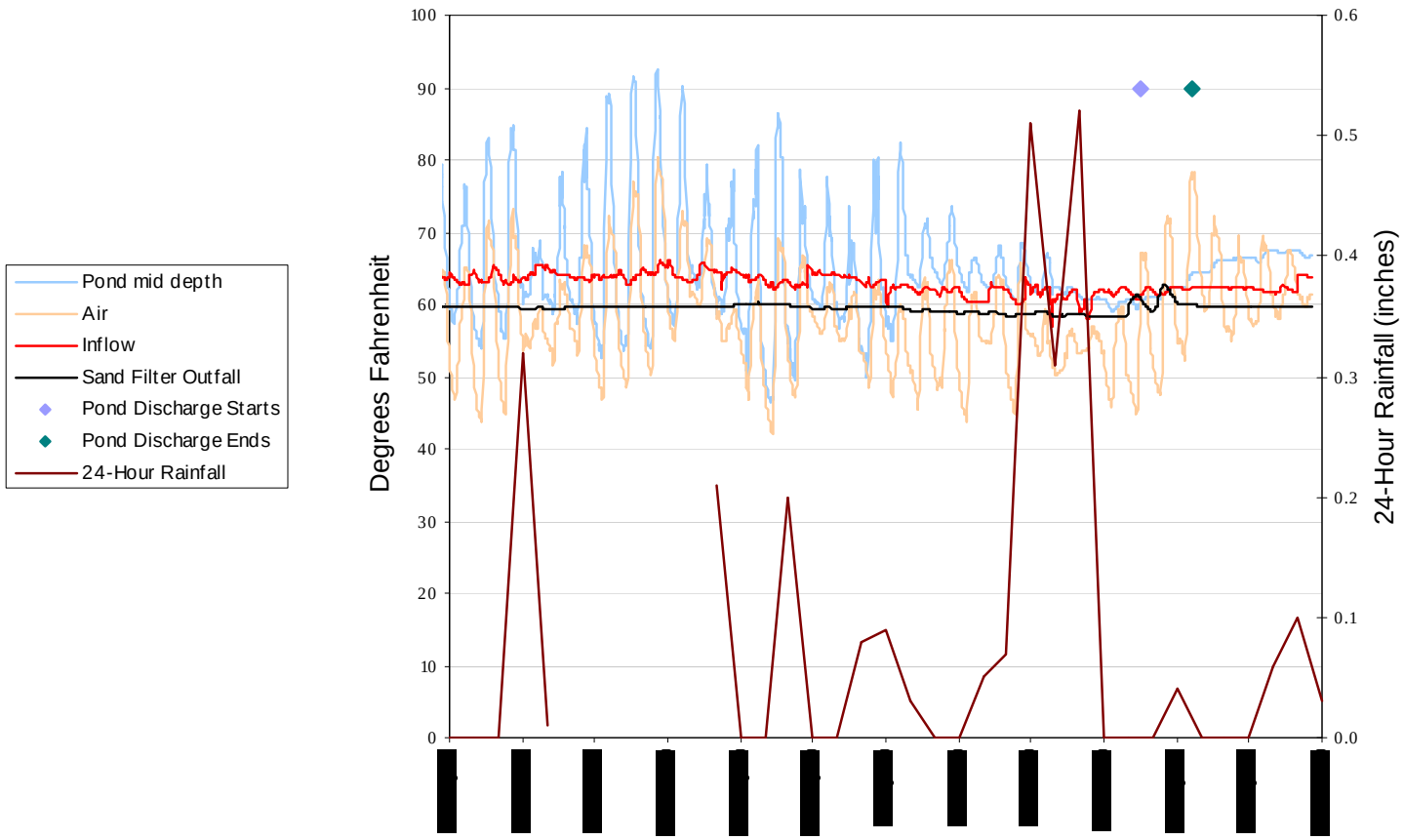
Figure 3 Trossachs Wet Pond and Sand Filter Continuous Temperature Record and Daily Rainfall August 15 through September 20, 2000