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Haslam Lake Lang Creek Water Quality and Quantity Monitoring Program for 2012

Photo by Alex Dobler

Prepared for

Powell River Salmonid Enhancement Society

Funded by BC Timber Sales and the Powell River Community Forest

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Summary

British Columbia Timber Sales and and the Powell River Community Forest provide funds to the Powell River Salmonid Enhancement Society for monitoring water quality throughout the Haslam Lang Community Watershed. This report presents 2012 data (as well as selected 2010 and 2011 data to demonstrate trends) and discusses progress of the water quality monitoring program to date.

During 2012, the automated monitoring station located at the Salmon Enhancement Society Counting Station at the mouth of Lang Creek continued to record stage, rainfall, and water and air temperature on a continuous basis.

The stage discharge curve was recalibrated for the lower Lang Creek to account for changes in river channel morphology resulting from seasonal storms. John Termuende of Termuende Hydrological processed the stage data and compared it with the older curve. The results showed less than 5 % change from the original curve at low to moderate discharges. The 2012 hydrograph developed from lower Lang Creek data was very similar to that of 2011. In 2012 lower Lang Creek had a peak flow of 25 m^3/sec in a mid November storm. Summer low flow appeared to be similar with those in 2010 and 2011, albeit not such a long duration. Management of the Haslam weir outlet and sluice gates strongly influences both high and low flow on Lang Creek and is central to any investigation of flow on Lang Creek.

Bi-monthly, on-site sampling has been carried out by the Powell River Salmonid Enhancement Society at six strategic locations within the watershed throughout the 2012 season. This data has been collected from 1997 to present with a two year gap (2006, 2007) and provides an excellent historic record of variability of water quality parameters. As well as capturing water quality data at distinct points in time at a number of locations, the repeated visits of the observer to sites throughout the watershed enhanced the understanding of local watershed health.

Water temperature recorders have been employed in 2012 on Anderson Creek, Blackwater Creek and at the hatchery on upper Lang Creek. This continuous temperature data is of high quality and provides important insights into temperature fluctuations during the critical maximum high water temperatures of summer. Enough data is available on a range of streams that predictions of water temperatures on non-monitored streams should be quite reliable.

The pH meter electrode requires replacement or calibration fluid refurbished as the measurements over the past 3 years appear to be drifting downward.

With the newly recalibrated stage discharge curves, it would be useful to compare discharge being released at the Haslam Lake Weir with that at the mouth of Lang Creek.

Contractors working in the immeditate vicinity of the Powell river intake are reminded that this is the most sensitive location within the watershed. When disturbing surface soils, high levels of management should be employed to prevent fine sediment transport to the lake.

All digital data, well beyond what can be presented here, is archived at the office of the Powell River Salmonid Enhancement Society and can be made available to interested users.

I. INTRODUCTION

British Columbia Timber Sales (BCTS) and the Powell River Community Forest provided funding to the Powell River Salmon Enhancement Society in 2012 to monitor water quality within the Haslam Lang Watershed. The purpose of water quality monitoring is to

- provide information for resource management planning and decision making at the community and regional level;
- establish baseline levels in support of specific criteria/objectives development and attainment reporting;
- provide information on the status, health, trends and uses of water resources;
- employ and train persons from local communities to foster interest and involvement in community watersheds.

This report presents a range of data collected during the 2012 monitoring season, makes some comparisons with 2010 and 2011 data, comments on management significance of data and provides recommendations for ongoing monitoring.

II. BACKGROUND

The watershed being monitored lies immediately east of Powell River. It is confined to the drainages associated with Haslam Lake and Lang Creek, comprising a total area of around 12,800 ha. Elevations range from sea level at the mouth of Lang Creek to 1103 meters on Tin Hat Mountain. Most of the area falls within the Coastal Western Hemlock Biogeoclimatic zone. Douglas fir, red cedar, western hemlock and alder are the most common tree species found. Along the highest ridges on the north east portion of the watershed, one encounters the Mountain Hemlock Biogeoclimatic Zone. Most of the watershed has either been logged or burned in the last 80 years although small isolated patches of old growth remain. A network of forest roads is maintained within the watershed. An even more extensive network of old skid trails occurs at lower elevations throughout the watersheds and these are now used extensively for recreation activities.

Most of the watershed (excepting land immediately adjacent to lower Lang Creek) is comprised of crown land. Forestry for timber extraction is likely to be the major industrial use of the watersheds for the foreseeable future. Forest Development Plans have been drawn up, indicating future cutblocks and required access roads. The Ministry of Environment, Lands and Parks, (MoELP) completed the first Coastal Watershed Assessment Procedure (CWAP) in 1997. The results from this study indicated that the forest harvesting activities planned was conservative, and unlikely to influence hydrological characteristics of the watershed. Mining does not play much of a role on the area. Small rock quarries are used for the extraction of road ballast. Agriculture is restricted to a few small hobby farms along lower Lang Creek. Settlement (low density) is likewise confined to the southern strip adjacent to Lang Creek and even less so along the southern slopes of Haslam Lake. Being close to the population center of Powell River, the Haslam Lang area is popular with recreationists for riding ATVs, hiking, and non-motorized boating. Fisheries resources are substantial, particularly in the lower watershed. A large salmon population is supported along the course of Lang Creek within the lower 8 km of channel and adjacent tributaries. Major investment has been made in a fish hatchery, a counting station and an artificial spawning channel on Lang Creek. In 2000, Lang Creek was classified as a sensitive stream because of its high fisheries values. In the summer of 2000, a second Coastal Watershed

Assessment Procedure (CWAP) was carried out which supported the conclusions of the first CWAP. It also stressed that good management would be more important to the continued health of the watershed than the actual amount of watershed logged or roaded. The Community Forest, which is a major licensee, conducted an assessment of its roads positioned within the watershed area in 2009 which showed that the great majority of roads were being well managed. No substantial sediment sources from these roads or cutblocks had impacted water quality at the Powell River Water intake or on Lang Creek itself. Some of the more intractable management problems were often related to recreation uses. This had not changed in 2012.

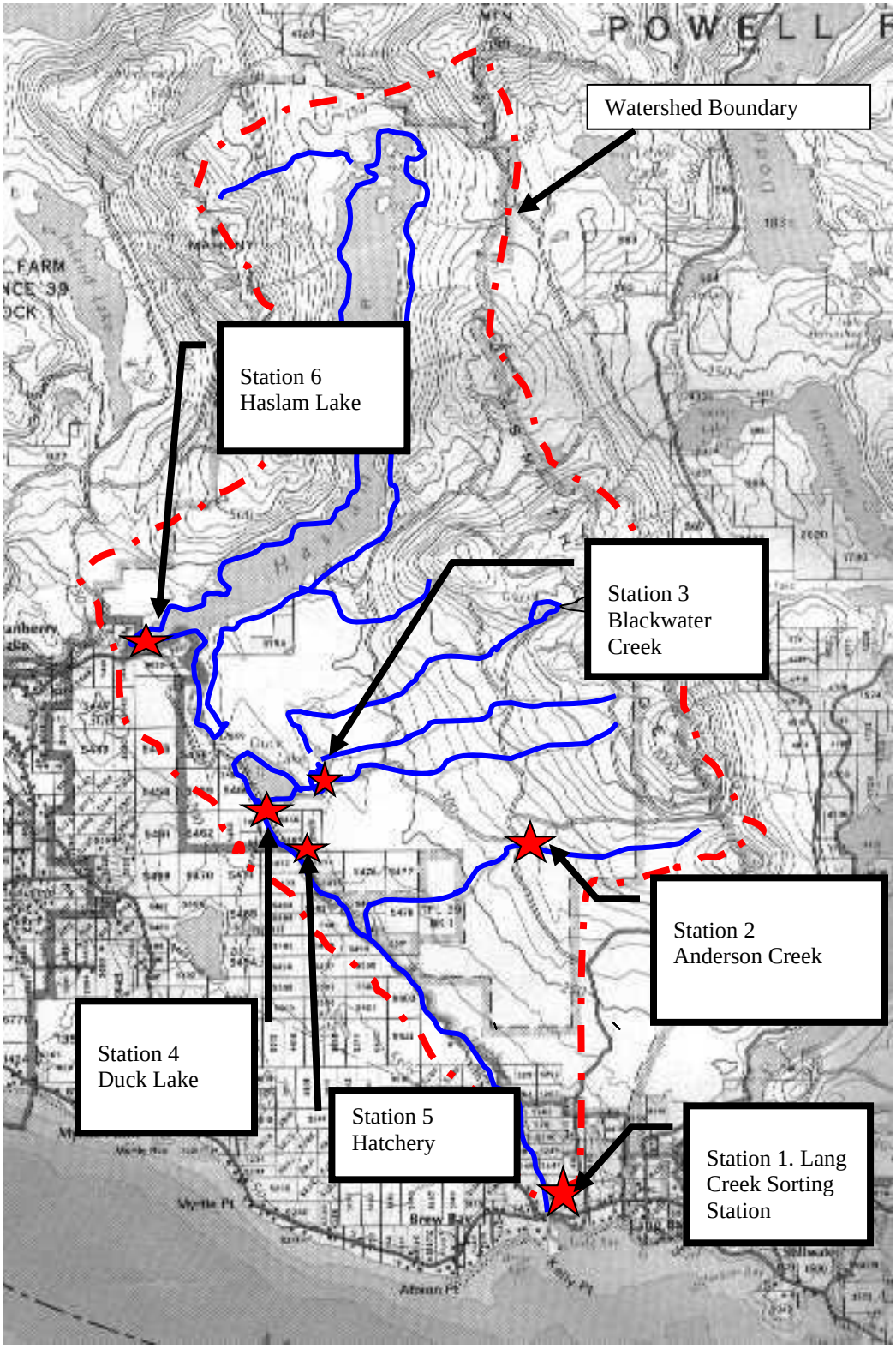
III. METHODOLOGY

This project was instigated to provide a continuation for a monitoring program than ran between 1997 and 2001 and restarted in 2008 within the Haslam Lang Community Watershed. Between 2001 and 2006, the Powell River Salmonid Enhancement Society maintained a small water quality data collection program. The water quality data that has been collected to date provides a reliable base line documenting water quality at strategic locations within the Haslam Lang Watershed. The sampling schedule is presented in Table 1. The sites chosen for water sampling were almost the same as those developed in the original program and are located on the map on Figure 1.

Table 1. Schedule for Monitoring Sites

Station	Sampling Interval	Sampling For
Station 1 Lang Creek Sorting Station Provincial Identification Number E220912	Continuous Bimonthly	Water temperature, stage, air temp, rainfall Portable meter to check on continuous recorders
Station 2 Anderson Creek Provincial Identification Number (4 km upstream of E220913)	Continuous Bimonthly	Temperature by Hobo Portable meter for turbidity, pH, specific conductivity, temp and discharge
Station 3 Black Water Creek Provincial Identification Number E220914	Continuous Bimonthly	Temperature by Hobo Portable meter for turbidity, pH, specific conductivity, temp and discharge
Station 4 Outlet of Duck Lake Provincial Identification Number E220915	Bimonthly	Portable meter for turbidity, pH, specific conductivity, temp, and discharge
Station 5 Upper Lang Creek Hatchery	Continuous	Temperature by Hobo
Station 6 Haslam Lake (near intake)	Bimonthly	Portable meter for turbidity, pH, specific conductivity ,temp

Figure 1. Location of Monitoring Stations within Haslam Lang Community Watershed



IV. SAMPLING PROCEDURES

A. Water sampling for laboratory analyses

No laboratory analyses were conducted in either 2011 or 2012 by the Ministry of Environment. This is a shortcoming of the monitoring program but was beyond the control of the Society.

B. Analysis using portable meters

Bi monthly analysis of water temperature, pH, turbidity and salinity were conducted using portable meters. Before sampling, the meters were calibrated with standard solutions following directions supplied by the meter manufacturers.

C. Automated samplers An automated stage, temperature and rainfall recorder is located at the mouth of Lang Creek. (Sorting Station) The processing and analysis of the continuous data from the sorting station was conducted by John Termuende of Termuende Hydrological Ltd. Data loggers (Hobos TM) were used to record hourly water temperature on Anderson, Blackwater and on Lang Creek at the Hatchery near Duck Lake.

V. RESULTS AND DISCUSSION

Results and discussion of data collected during the course of the monitoring program are presented below. Not all data is presented here because of the sheer volume. Some water temperature data was collected at a 15 minute interval, others hourly over the whole year. All of the original digital information used to develop these figures and tables is available on Excel spread sheets at the Powell River Salmon Enhancement Society office.

A. Water Quality

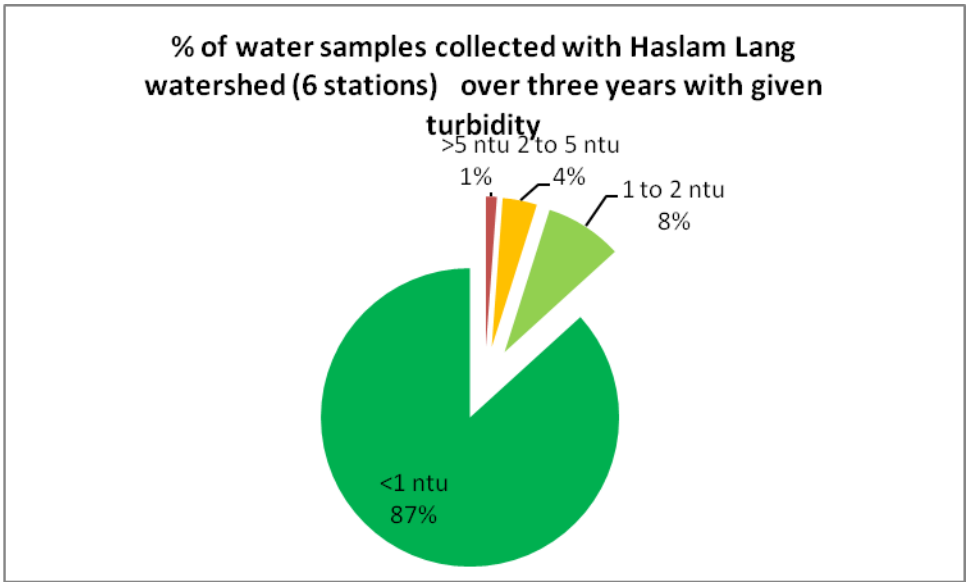
1. Laboratory Results: Water Chemistry and Biology

Last laboratory analyses were conducted by the Ministry of Environment (or their equivalent) in 2009. No new data was collected in 2010, 2011 or 2012.

2. Turbidity measurements with portable meter

On Figure 2 all bi monthly turbidity samples are compiled to show their range of magnitude between Jan 2010 and Dec 2012. Of the total of 432 samples taken at 6 sites over the previous 3 years, <1 % of the 5 samples exceeded 5 ntu, 4% fell between 2 and 5 ntu, 31 samples fell between 1 and 2 ntu, 8% of samples fell between 1 and 2 ntu and 87 % of the samples wer less than 1 ntu. The great majority of turbidity events were considered to be natural, ie not influenced by human activities. The few exceptions were noted below.

Figure 2



On Figure 3 spot turbidities are provided for 2010 through 2012. At all stations, turbidity events are most common between November and March and are usually associated with heavy precipitation, overland flow and greater discharge. Previously collected real time data showed peak turbidity flows during the rising limb of the hydrograph. Turbidities did not exceed 2 (and only rarely exceeded 1 ntu) between Spring and Autumn equinox for all sites.

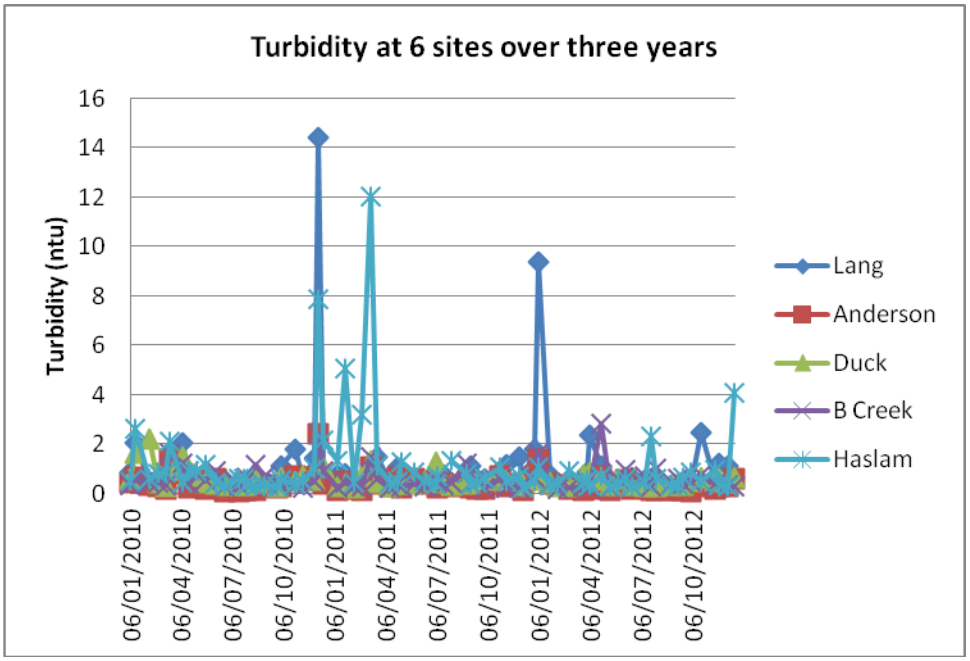
Three of the five turbidity events in excess of 5 NTU actually occurred along the shore of Haslam Lake immediately across from the intake. In most cases these higher turbidities were a result of wave action on unconsolidated materials that occur along the shore when lake levels were extremely high. However the ditching associated with construction of the fence around the chlorine plant in 2012 most certainly resulted in releases of fine sediment immediately adjacent to the intake but may not have actually been sampled.

A small sediment input immediately adjacent to the intake is orders of magnitude more significant as a drinking water quality threat than very large sediment inputs occurring at the head of the lake. Special care is required when disturbing land in proximity of intake

Occasional turbidity peaks in excess of 5 (which exceed Ministry of Health guidelines) occur on Lang Creek. In the 71 samples collected in 2010, 2011 and 2012 at the Lang Creek Sorting Station, 2 sample exceeded 5 ntu., 18 samples fell between 1 and 5 NTU, 51 samples fell between 0 and 1 ntu.

Turbidity events are episodic and easily missed with spot sampling. However, given the technical difficulties of acquiring good continuous turbidity data, spot recordings such as these provide an indication of the range of turbidity events that can be expected.

Figure 3. (2010, 2011 and 2012 Bimonthly turbidity data)



On Figure 4 turbidity data from the head waters and mouth of Lang Creek are presented. As in previous years, it is apparent that the turbidity events occuring at the mouth of Lang Creek were generated along the channel of the Lang Creek and its tibutaries and not upstream of Duck Lake which acts as an effective buffer.

Figure 4. 2010 2011 and 2012 Bimonthly Turbidity Data for Duck and Lang Creek Stations)

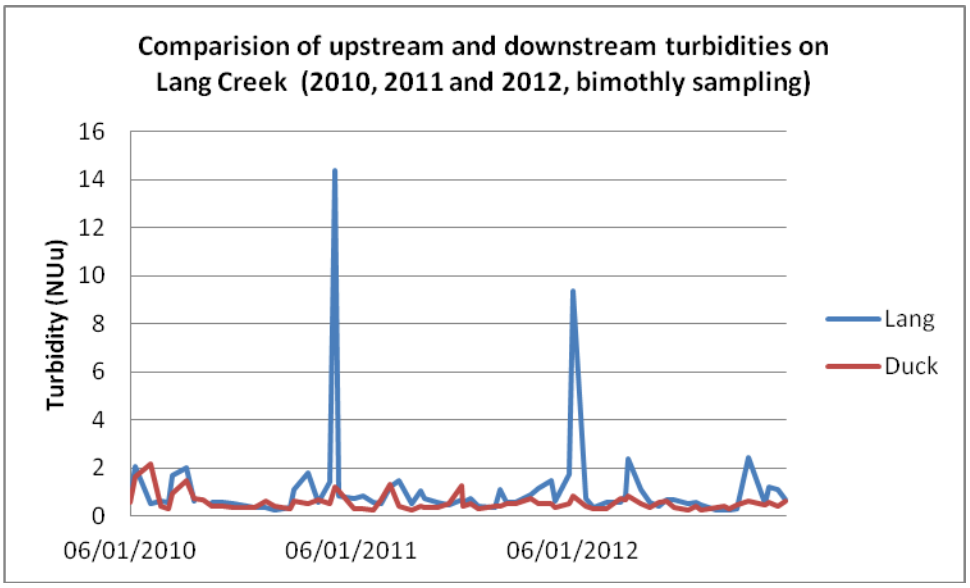
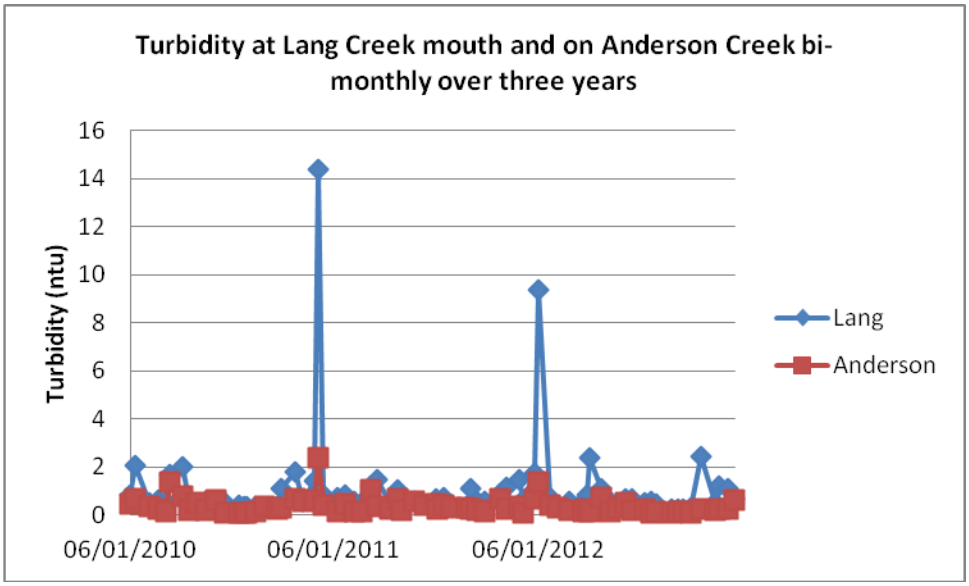


Figure 5 shows that for 2010, 2011 and 2012, Anderson Creek, the major tributary of Lang Creek, always had a lower turbidity value that the main stem of Lang Creek. Nornal "background " levels are generally less than 1 NTU. In the two instance with a slightly elevated turbidity on Anderson Creek, Lang Creek was also experiencing higher turbidities. While all streams in direct connection with Lang Creek will immediately contibute their full sediment load to the main stem of Lang Creek, as mentioned above, the more usual reason for turbity peaks on Lang Creek is sediment generated within the main channel, or along the banks of Lang Creek itself.

Figure 5 2010, 2011, 2012 Bimonthy Turbidity Data forLower Lang andAnderson Creek)



3. Continuous Turbidity Meter at Sorting Station on Lower Lang Creek

The continuous turbidity meter located on Lower Lang Creek was removed from service in 2012 because of inability to provide reasonable data.

4. pH with Portable Meter

Figure 6 shows the variability over 2010, 2011 and 2012 in pH for the 6 sampling sites within the watershed. The pH is near neutral to slightly acid. While there appears to be an overall trend towards slightly decreasing pH over the past three years, the drift is likely the result of the pH meter electrode is gradually failing over time or degrading of calibration fluid.

Figure 6. Bimonthly pH at various stations within Haslam Lang Watershed 2010, 2011, 2012

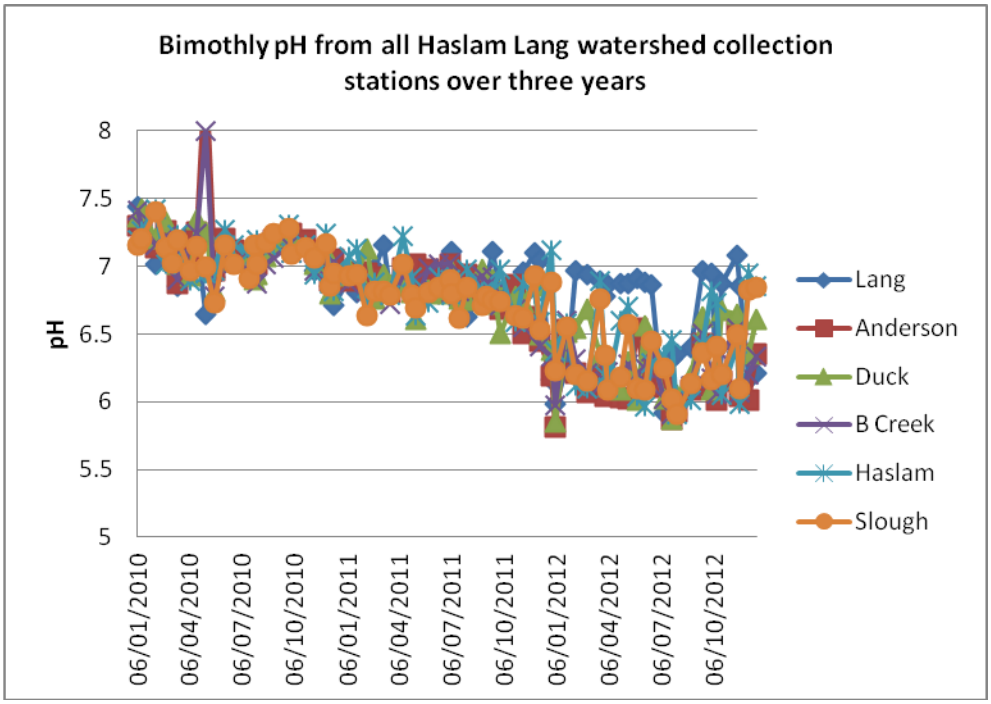
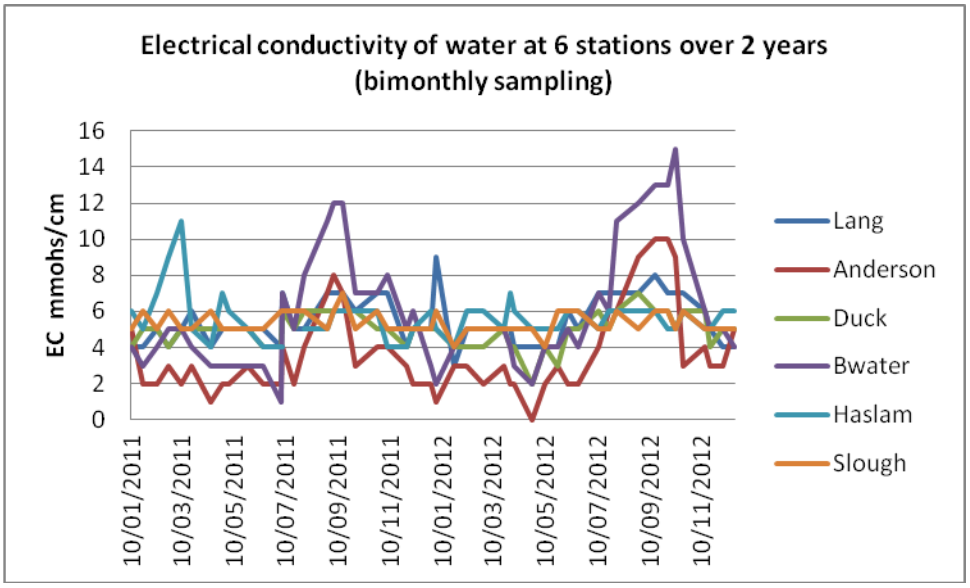


Figure 7 shows the levels of electrical conductivity of water measured over all the 6 sites over 2011 and 2012. These levels (between 2 and 14 mmoh/cm) indicate a very low level of dissolved salts as is expected in coastal watersheds dominated by granitic bedrock. There is a slight anomaly associated with Blackwater Creek where ECs are somewhat elevated in the summer. As with the increase in pH, these small increases are likely associated with the dust generation for the crushed limestone road bed used for the Forest Service Road adjacent to Blackwater creek.

Figure 7. 2011 and 2012 Bimonthly Electrical Conductivity Data

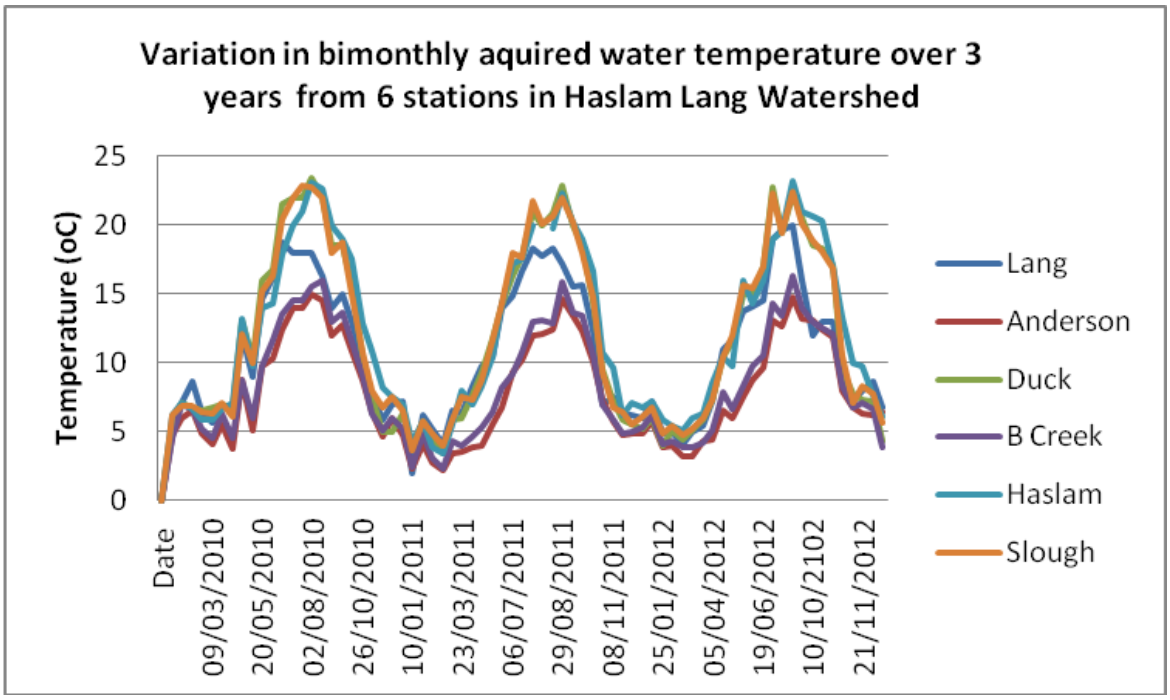


B. Water Temperature Monitoring Results

1. Bimonthly Manual collection from 6 sites within the watershed

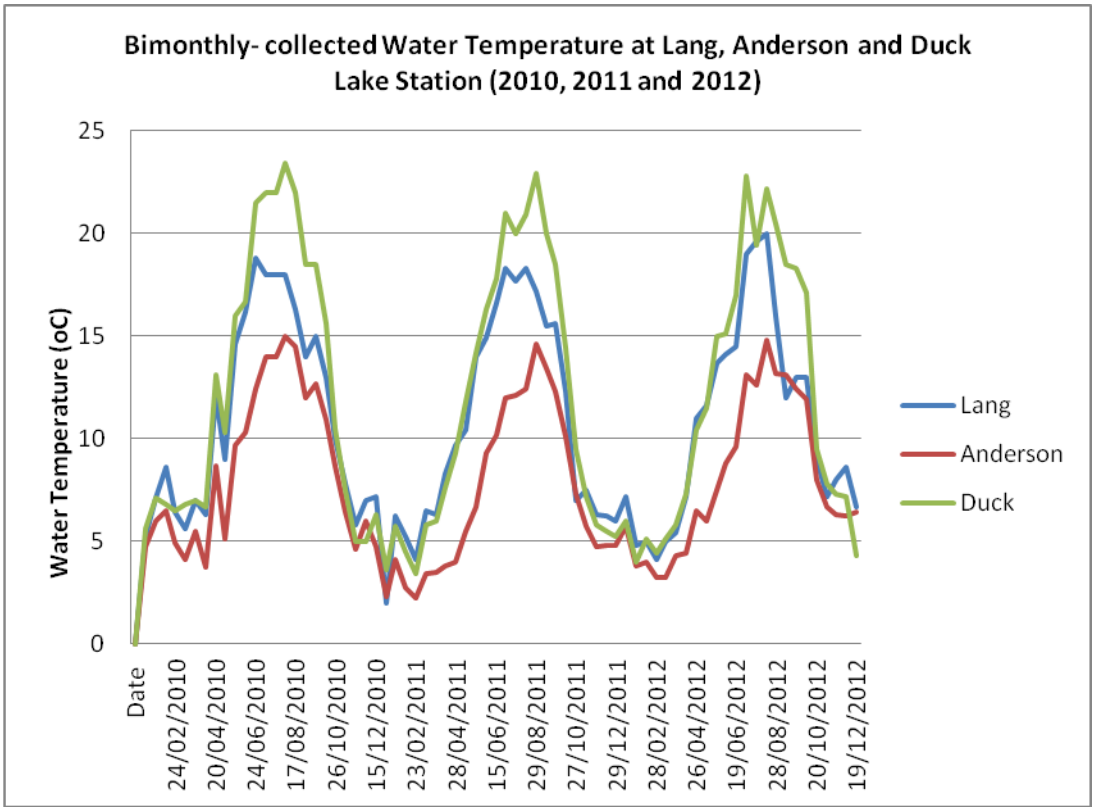
Figure 8 shows the range of, and variability between water temperatures of the major sampling sites over 2010, 2011, and 2012. The three years of data are consistent. Highest summer temperatures (>22 ° C) are recorded at the surface of lakes, (Haslam, Slough, Duck) lowest summer temperatures from small streams under forest cover (Anderson and Blackwater Creek) and intermediate summer temperatures on streams where warmer lake water is cooled as it flows through forested riparian zone (Lang).

Figure 8. (2010, 2011, 2012 Bimonthly Water Temperature at 6 Sampled Stations)



On Figure 9 the cooling effect of Lang Creek water passing from its outlet on Duck Lake to the mouth at the sorting station is portrayed. During the hottest period in the summer, Lang Creek can be cooled as much as 4 degrees centigrade along its passage between Duck Lake and the mouth. Evapotranspiration and direct shading from riparian vegetation likely influence this cooling effect as well as additions of cooler water from Anderson Creek and two other unnamed creeks east of Anderson Creek and ground water seeping directly into the channel. Previous reports have stressed the importance of these small streams as cool water havens for salmonids while the main channel of Lang Creek is much warmer.

Figure 9. (2010, 2011 and 2012 biimonthly Water Temperature for Upper and Lower Lang Creek and major tributary)



2. Continuous water temperature records

On Figure 10 and 11, continuous water temperature data for Anderson Creek is provided. Note that for the warmest period of the summer, at 15 degrees centigrade, the water of Anderson Creek is an important sanctuary for heat stressed fish from the main stem of Lang Creek where water temperatures can be well over 20 ºC.

Figure 10. Continuous water temperature data on Anderson Creek over 2012

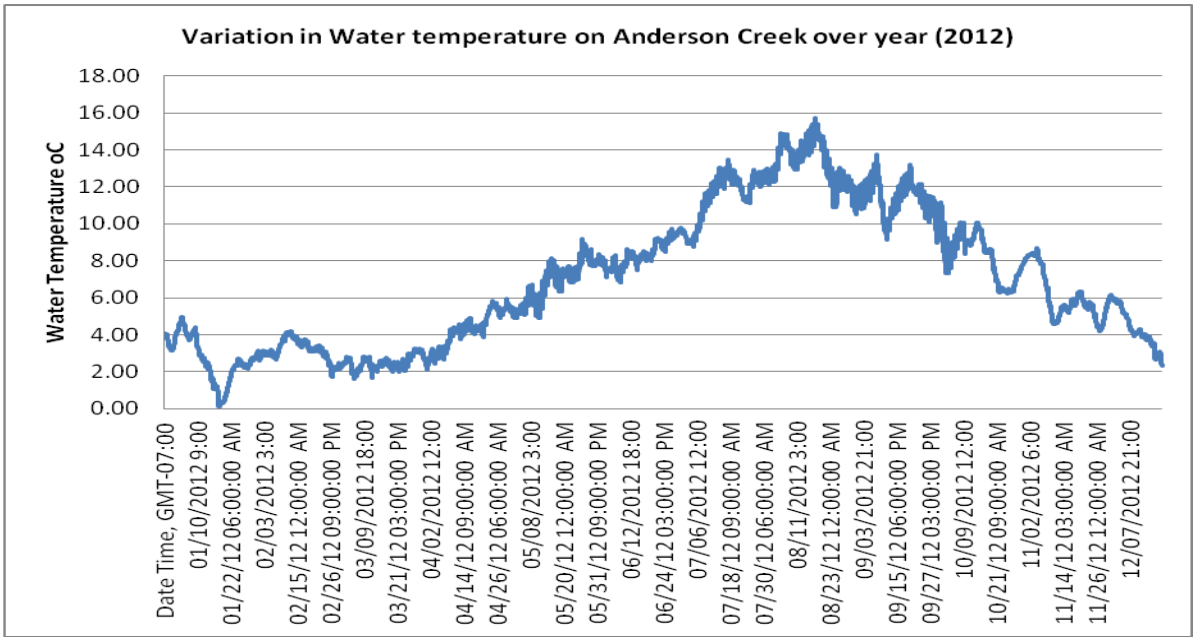
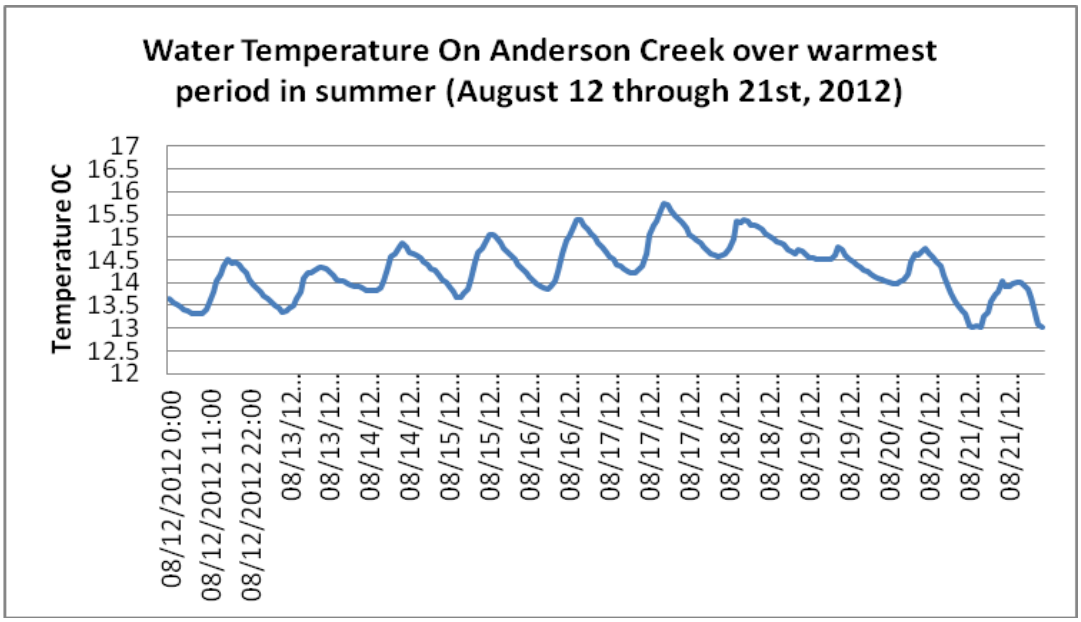


Figure 11 Continuous water temperaturedata for warmest period on Anderson Creek (2012)


Water Temperature On Anderson Creek over warmest period in summer (August 12 through 21st, 2012)
Temperature 0C
17
16.5
16
15.5
15
14.5
14
13.5
13
12.5
12
08/12/2012 0:00
08/12/2012 11:00
08/12/2012 22:00
08/13/12...
08/13/12...
08/14/12...
08/14/12...
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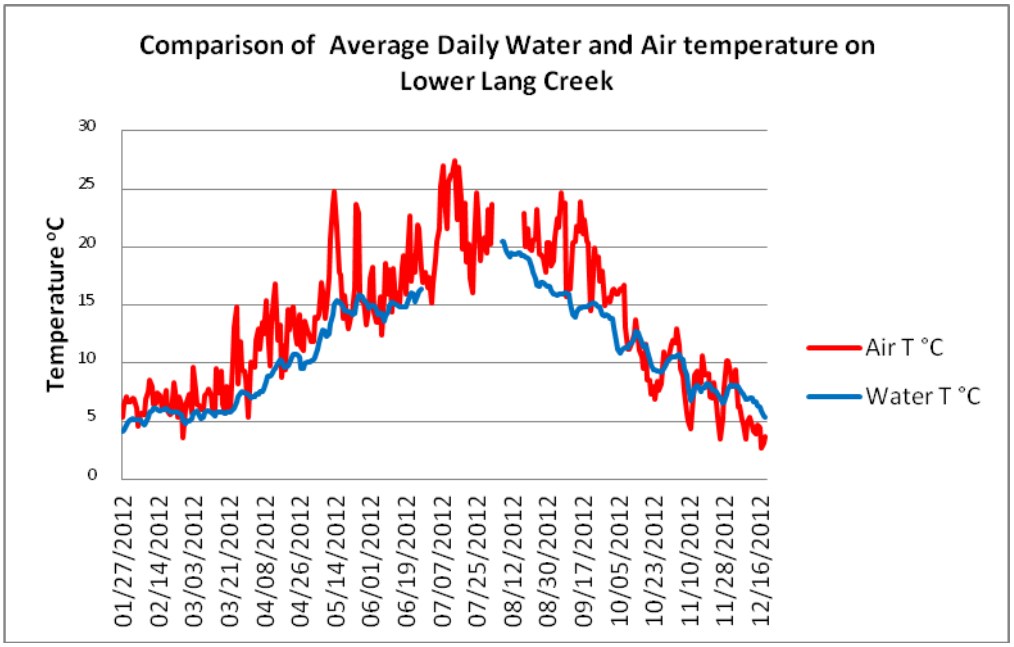
08/20/12...
08/21/12...
08/21/12...

Figure 12 provides daily average air and water temperatures collected from the Sorting Station on lower Lang Creek over 2012. Air temperatures peaked at over 27 º C in midsummer whereas summer water temperatures did not exceed 20 º C. Diurnal variation in air temperature occasionally exceeds 20º C whereas the diurnal fluctuation in water temperature rarely exceeds 2 º C. Some data gaps occur in this graph as a result of construction work interrupting data downloading.

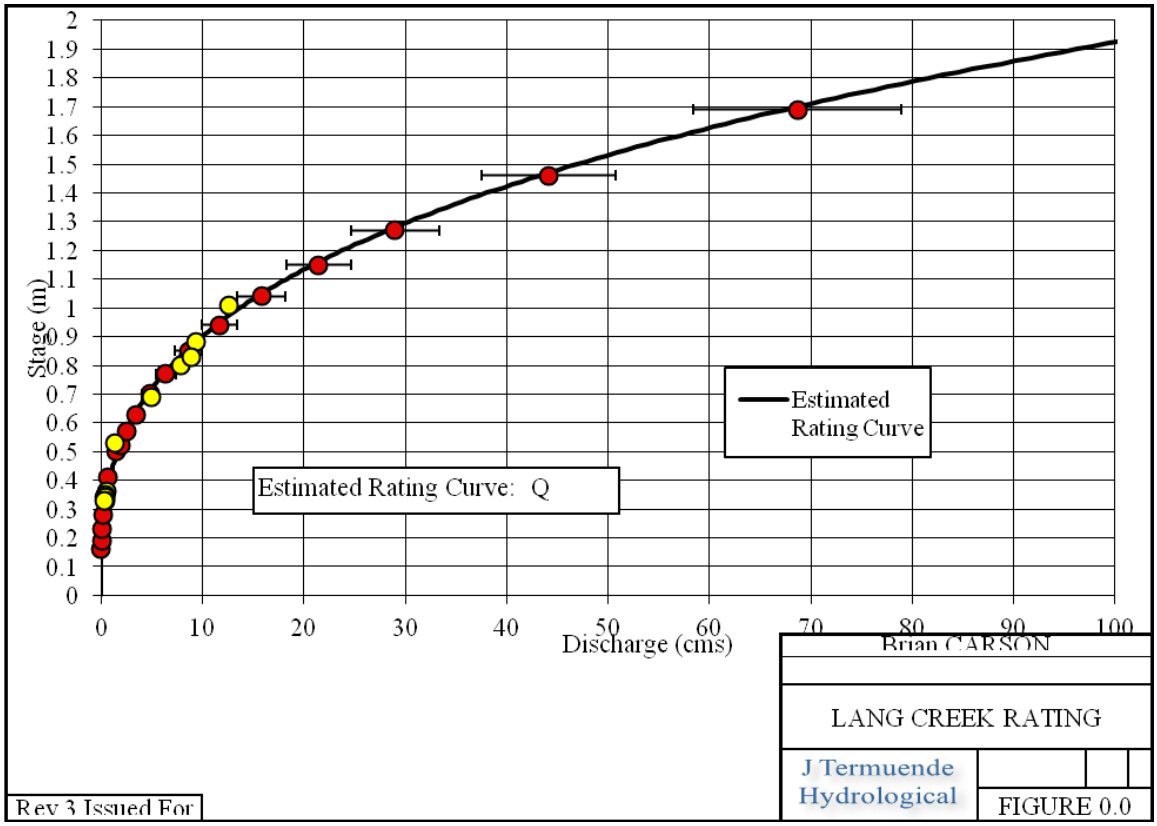
Figure 12. 2012 Average Air and Water Temperatures for Lower Lang Creek



C. **Discharge of Lang Creek over 2012 Season**

Over the 2012 season the Salmon Enhancement Society undertook to reconstruct the stage- discharge curve based on 11 discharge measurements collected between 0.5 and 12 m^3/sec. John Termuende of Termuende Hydrological processed the continuous data from the stage recorder and compared the old and new rating curve. These re-measured points are shown as yellow on the figure below. As will be noted, they are in very close concordance with the original stage discharge curve developed a number of years previously. The close concordance provides assurance that in spite of any changes to the stream channel morphology that may have occurred with winter flood events, the data for stage discharge curve is still accurate and the data collected over the past few years represents actual discharges.

Figure 13. Stage Discharge Curve for Lower Lang Creek



On Figure 14 and 15, hydrographs for 2011 and 2012 are presented with daily rainfall. The two years experienced very similar flows. The highest recorded flow in 2011 was around 35 m^3/sec whereas in 2012 it was 25 m^3/sec. Total rainfall at the sorting station was 1012 mm in 2012.

Figure1 14

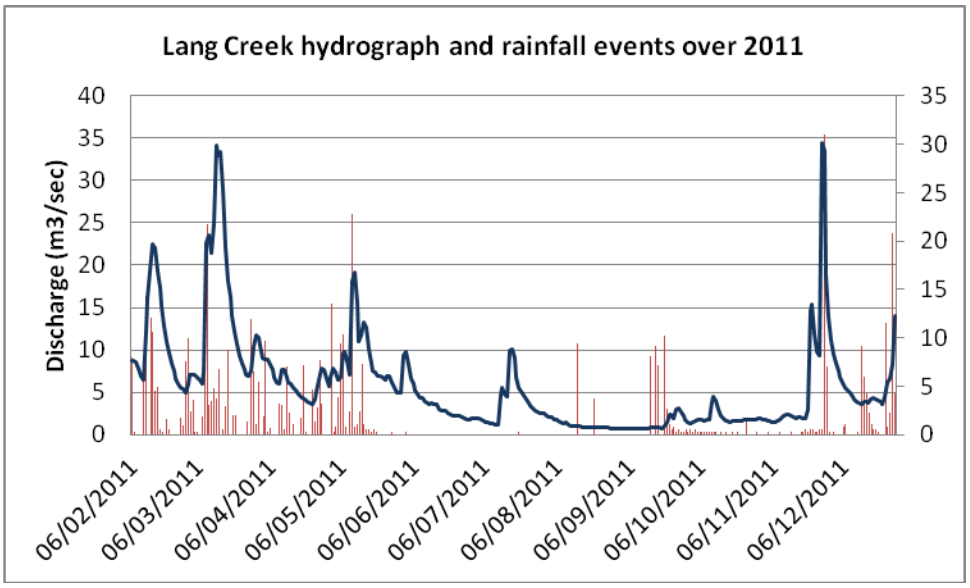
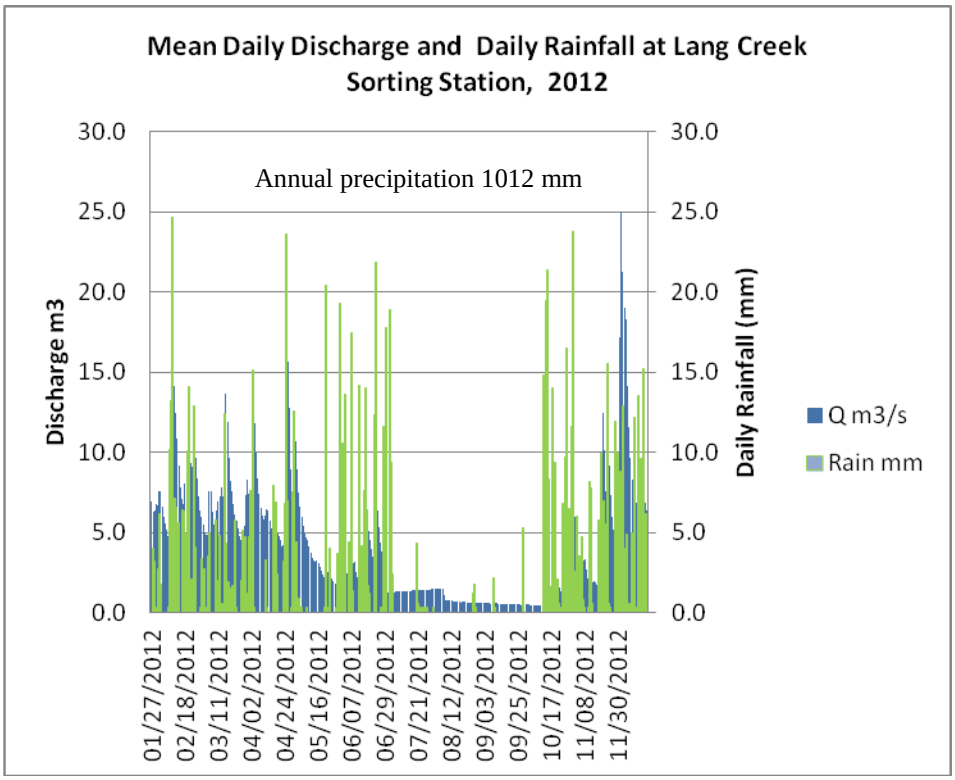


Figure 15



VI. CONCLUSIONS AND RCOMMENDATIONS

The 2012 season was successful at collecting high quality data and the Powell River Salmon Enhancement Society should be again commended for a job well done as a volunteer organization. The data collected in 2012 supports a general conclusion that water quality is not significantly impacted by its various users at this time. Some opportunities to upgrade management of the monitoring network are considerd.

1. The rain gauge at the Sorting Facility is now functioning properly, recording an annual rainfall of 1012 mm over 2012.

2. The Society has done an excellent job at recalibrating the stage discharge curve in order to assure confindence with the discharge data at low flows. In the coming summer, a close comparison of flows leaving the Haslam Lake weir and those measured at the sorting station would be useful to determine tributary and ground water inputs into Lang Creek during critical low flow periods.

3. Laboratory analysis of water samples should be redone to capture at least 2 characteristic hydrological events at the 6 sampling sites. Most important events to be targeted for sampling include summer low flow and winter peak flow at the selected stations.

4. The drift on the pH meter indicates either that it is time to replace the electrode and/ or the calibration fluid.

5. Based on photographs and verbal communications with SES staff, the fencing and ditching of the chlorination tanks at the head of Haslam Lake potentially impacted raw water quality of Powell River District. Immediately after construction, the newly cleared ditches carried heavy fine sediment loads directly into the lake near the intake. Any contractor working in the immediate vicinity of the Haslam Lake intake should employ “best management practices” when there is a possibility that surface drainage from soil disturbance will reach the lake.

6. As discussed in last year’s report, the weir’s primary role is to hold back water to maintain summer and fall discharge on Lang Creek. Two concurrent impacts of lake level management include its effect on peak flow on Lang Creek and excess exposure of soil- covered lake shore at very high lake levels. Both influence sediment generation and overall health of the watershed

7. Some gravel protection on beaches that would be exposed to wave action immediately adjacent to the Haslam Intake might be considered if they continue to produce fine sediment during heavy wave action in the winter.