With participation from: Mid Vancouver Island Habitat Enhancement Society, Qualicum Beach Streamkeepers, Parksville Fish & Game, Nile Creek Enhancement Society, Friends of French Creek, Nanaimo Area Land Trust, Harbour City River Stewards, Island Waters Fly Fishers and Vancouver Island University

Regional District of Nanaimo Community Watershed Monitoring Network 2012 Data Summary

Prepared by:
Rosie Barlak
Environmental Impact Assessment Biologist
Environmental Protection Division
Ministry of Environment
2080-A Labieux Rd
Nanaimo, BC V9T 6J9

January 2013

Program Outline

The purpose of this report is to present a summary of data collected as part of the Regional District of Nanaimo (RDN) Community Watershed Monitoring Network partnership. This partnership was initiated in 2011 by the RDN and the British Columbia (BC) Ministry of Environment (MOE) to collect data across the RDN. In its early stages (2011-2013) the program will be used for data gathering with the goals of obtaining enough data to see watershed trends and raise watershed health awareness in local communities. Long term goals are to use multiple years of data to determine in which watersheds more detailed monitoring and/or improved watershed management need occur, and to assist in land use planning.

Partnerships are core to the monitoring program. In 2012 the RDN and MOE organized the program and trained participants in monitoring protocols. Nine stewardship groups within the RDN participated in the monitoring program, with safety gear and land access provided by Island Timberlands LP. Stewardship groups participating in 2012 were: Nile Creek Enhancement Society, Friends of French Creek, Qualicum Beach Streamkeepers, Parksville Fish and Game, Mid Vancouver Island Habitat Enhancement Society, Nanaimo Area Land Trust, Harbour City River Stewards, Island Waters Fly Fishers and Vancouver Island University.

A total of 45 different sites in 14 different watersheds were monitored in 2012, the second year of the program. Samples were collected weekly between August 14 and September 11, 2012 (summer low flow) and between October 16 and November 13, 2012 (fall rains) by the stewardship groups according to BC MOE sampling procedures (BC MOE, 2003). Quality assurance/quality control samples were collected by three groups. In this document, data are presented and compared to existing BC Water Quality Guidelines (BC MOE, 1997) and/or Englishman River Water Quality Objectives (Barlak *et al*., 2010) (Table 1), applicable to other watersheds within the same ecoregion. Exceedences and similarity to 2011 data (Barlak, 2012) are noted. When any turbidity samples were less than 0 NTU, or not a true reading, calibration corrections were applied to all samples measured with the same instrument on that day and the corrected values presented here. When data collection was missed the missing data point is represented by a missing bar in the applicable figure in this report.

Table 1 - BC Water Quality Guidelines and/or Englishman River Water Quality Objectives

Parameter	Guideline or Objective Value	Importance
Turbidity (Englishman River Water Quality Objective)	October to December: 5 NTU maximum January to September: 2 NTU maximum	Measures clarity or cloudiness of water. High values are associated with higher levels of other contaminants (e.g. bacteria).
Temperature (Englishman River Water Quality Objective)	Short Term, at any location in the river - ≤17°C average weekly temperature Long Term ≤ 15 °C average weekly temperature. *Weekly averages could not be calculated with available data.	If too warm not aesthetically pleasing to drink and can affect health and survival of aquatic organisms.
Dissolved Oxygen (BC Water Quality Guideline for aquatic life)	30 day average 8 mg/L Instantaneous minimum 5 mg/L	If too low affects the health and survival of aquatic organisms.
Conductivity (no guideline)	No guidelines exist; coastal streams generally less than 80 μS/cm but can be more if significant ground water influences	The more dissolved ions in water, the greater the electrical conductivity. Dilution decreases conductivity but groundwater influences or sediment introduced in water can increase it.

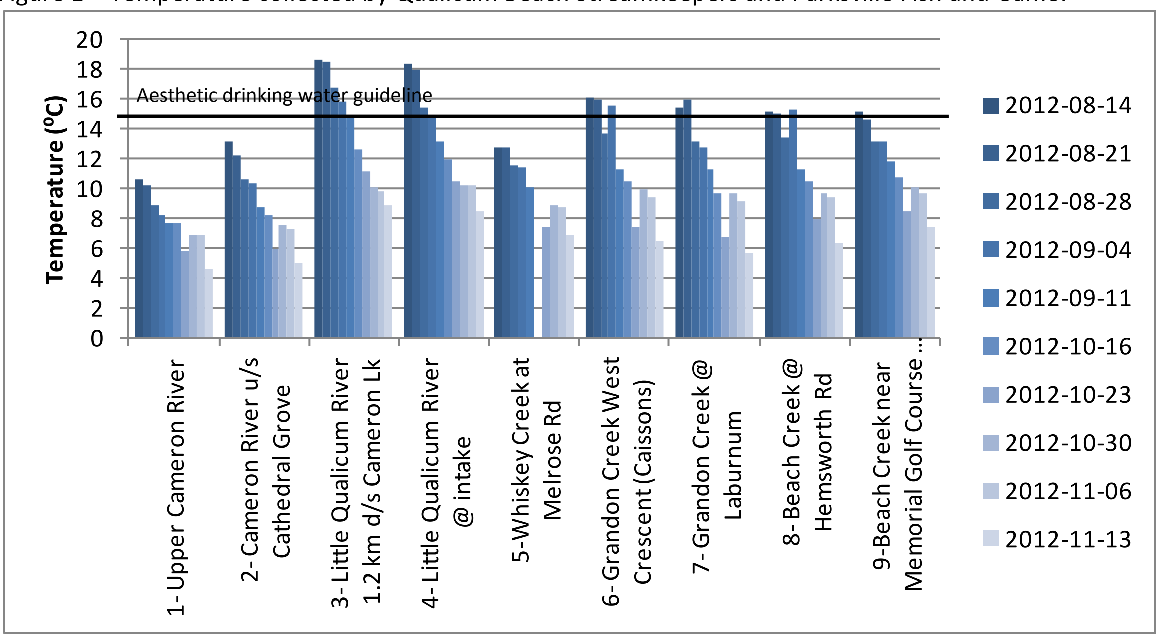
Data Summary

Summer and Fall 2012

Qualicum Beach Streamkeepers and Parksville Fish and Game

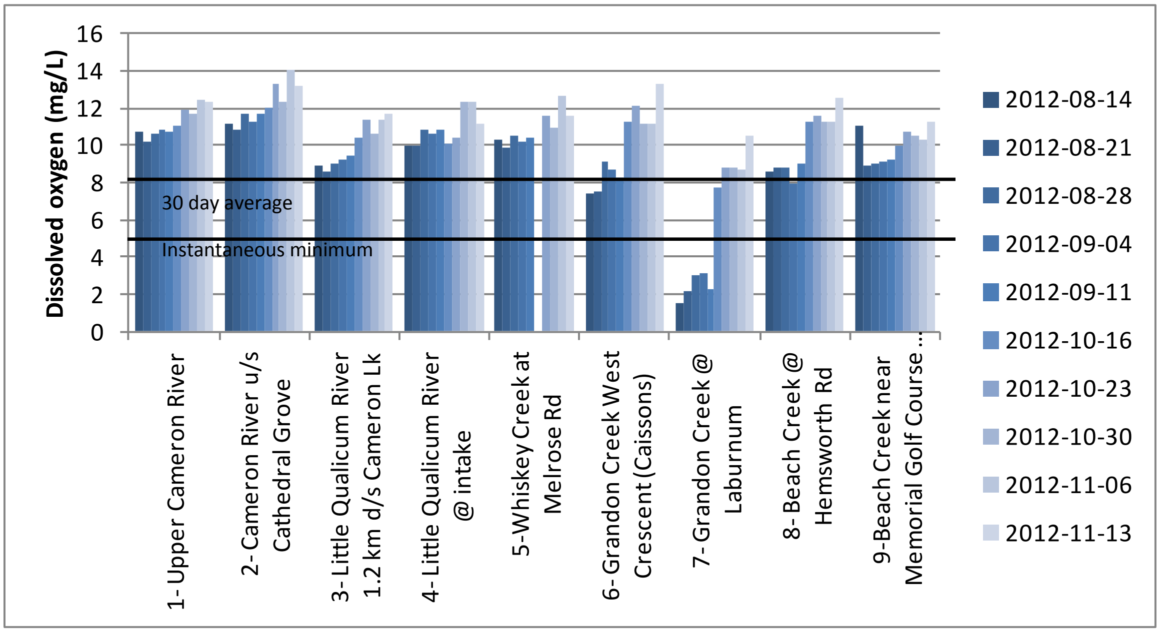
There was potential for exceedences of the aesthetic drinking water temperature guideline (weekly average 15ºC) in the lower Little Qualicum River throughout the summer sample period (Figure 1). Maximum summer water temperatures at times had potential to exceed the guideline for coho (17°C) rearing. This is typical of many east coast Vancouver Island streams where the lower portions are wide and shallow; as long as refuges remain with lower temperatures, juvenile fish should be able to retreat to these during periods of elevated temperatures. Data were very similar to those collected in 2011 as part of this program.

Figure 1 – Temperature collected by Qualicum Beach Streamkeepers and Parksville Fish and Game.



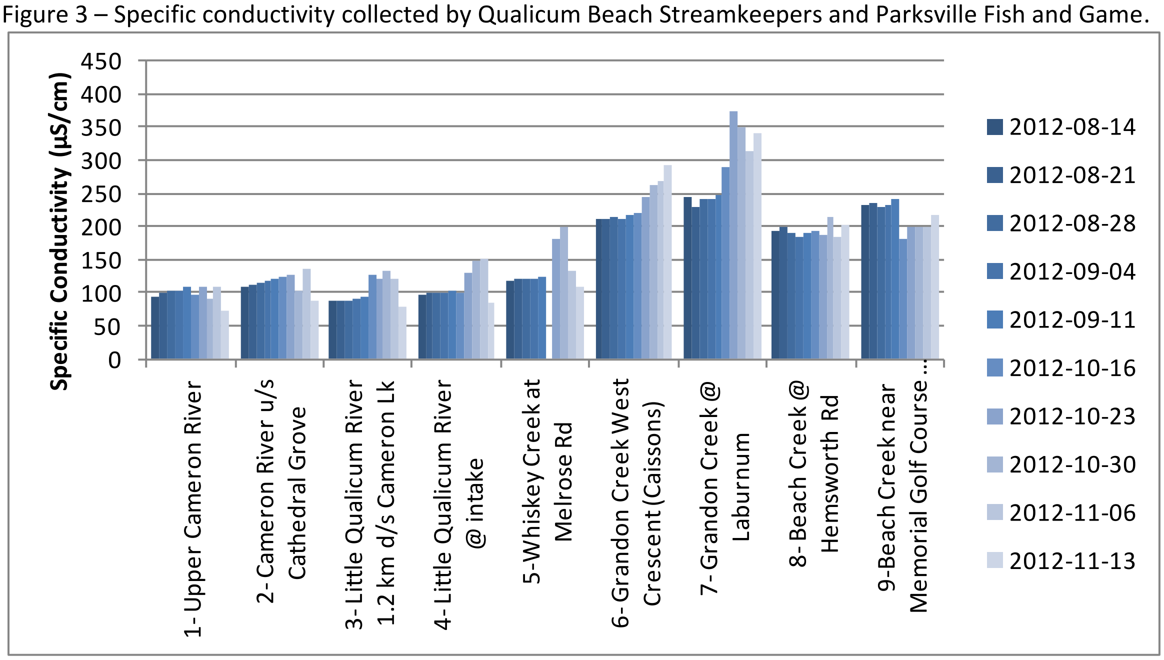
Dissolved oxygen (DO) at Grandon Creek at Laburnum was below the instantaneous minimum aquatic life guideline throughout the summer (Figure 2). An average (not shown in figure below) of these values was below the recommended 30 day average. Low DO values may be indicative of very low flow or still water, which matched field descriptions of flow at the Grandon Creek at Laburnum site. Data were very similar to those collected in 2011 as part of this program.

Figure 2 – Dissolved oxygen collected by Qualicum Beach Streamkeepers and Parksville Fish and Game.



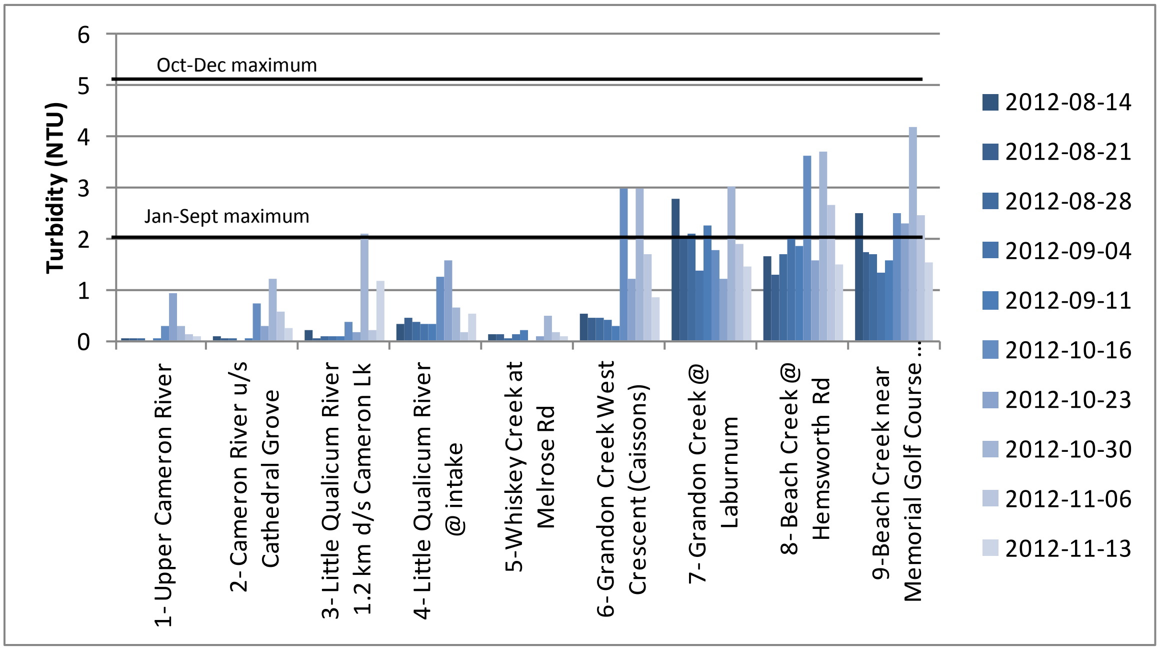
Conductivity was higher than levels typical of coastal streams in both Grandon and Beach Creeks during both sample periods and at Whiskey Creek in the fall (Figure 3). In Grandon and Beach Creeks increases appear to be associated primarily with increased turbidity in summer and possibly groundwater influences at all times. Fall increases at Whiskey Creek and slightly at the other sites appear to be associated with turbidity events. Data were similar to those collected in 2011 as part of this program.

Figure 3 – Specific conductivity collected by Qualicum Beach Streamkeepers and Parksville Fish and Game.



The January through September summer low flow maximum turbidity objective was at times exceeded in both Grandon Creek and Beach Creeks (Figure 4), similar to that observed in 2011. This and the proximity of these creeks to residential development areas suggest increased anthropogenic turbidity inputs to these creeks; further data collection will help determine trends. Increased fall values at all sites were associated with rainfall events and did not exceed October to December turbidity objectives in any samples collected.

Figure 4 – Turbidity collected by Qualicum Beach Streamkeepers and Parksville Fish and Game.



Nile Creek Enhancement Society

There was potential for exceedences of the aesthetic drinking water temperature guideline (weekly average 15^oC) at one site in Thames Creek and in Upper Nile Creek (Figure 5) in the summer. Dissolved oxygen and conductivity values are shown in Figures 6 and 7. Data were similar to those collected in 2011 as part of this program.

Figure 5 – Temperature collected by the Nile Creek Enhancement Society.

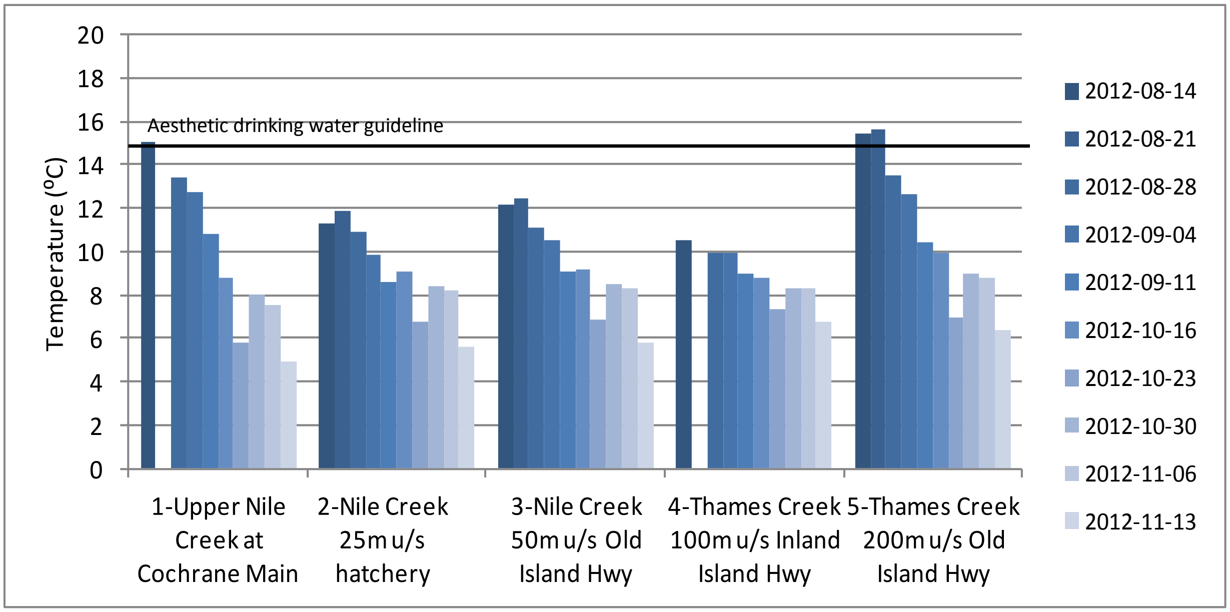


Figure 6 – Dissolved oxygen collected by the Nile Creek Enhancement Society.

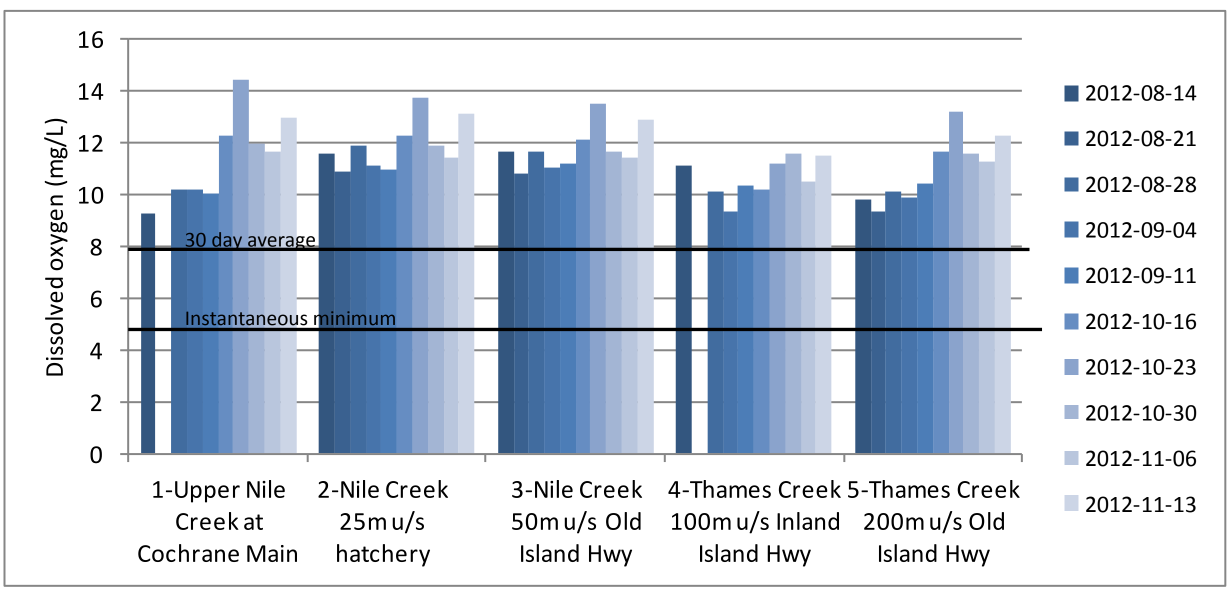
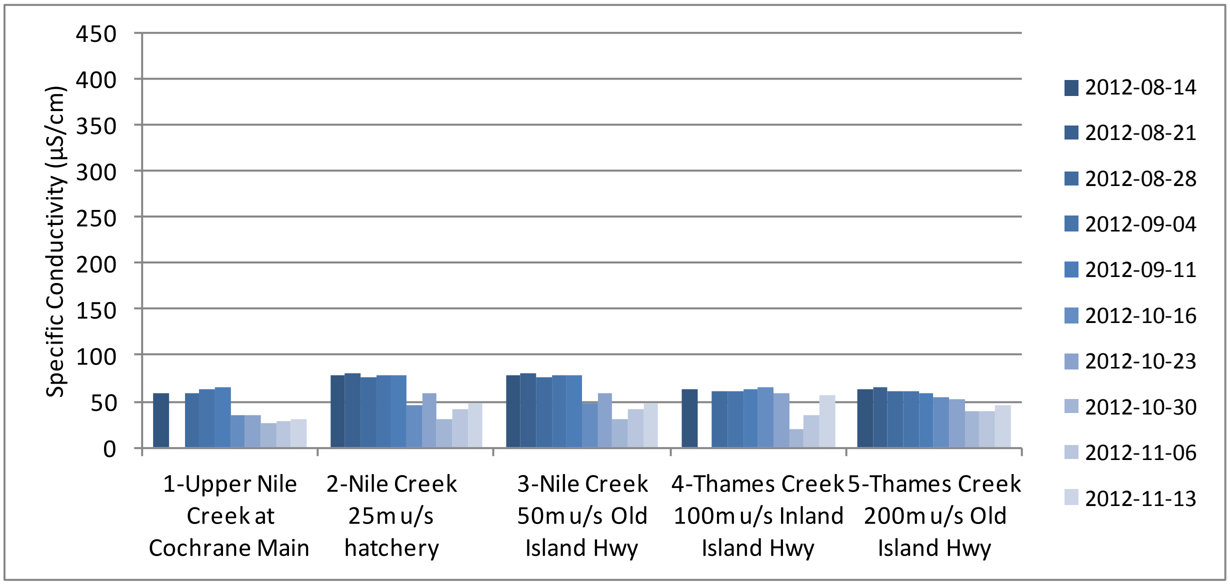
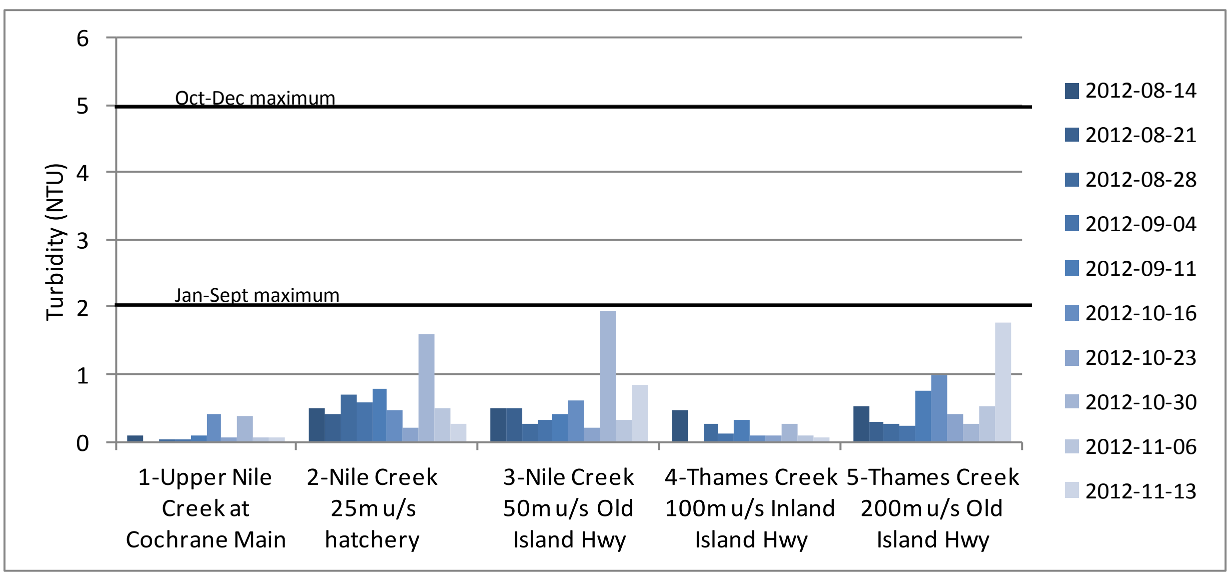


Figure 7 – Specific conductivity collected by the Nile Creek Enhancement Society.



Summer turbidity values at Thames Creek 200 m upstream Old Island Highway were slightly higher than those observed in 2011; as further data are collected trends may become apparent. Higher fall turbidity vales (Figure 8) were associated with rainfall events and tended to be highest in the lower watershed sites.

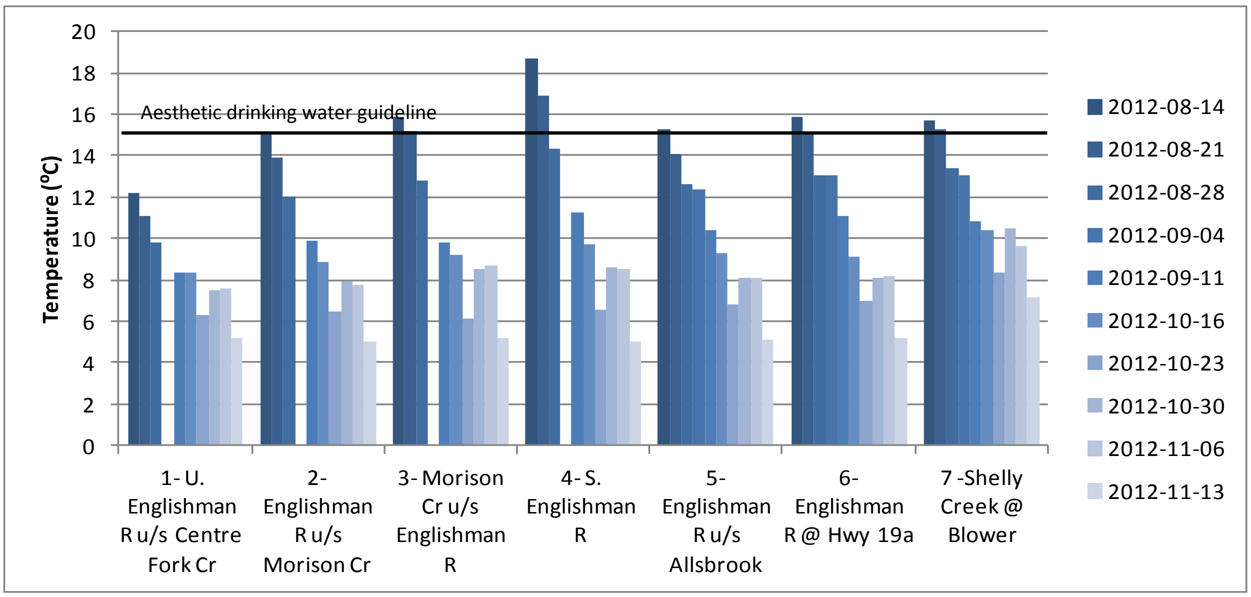
Figure 8 – Turbidity collected by the Nile Creek Enhancement Society.



Mid Vancouver Island Habitat Enhancement Society

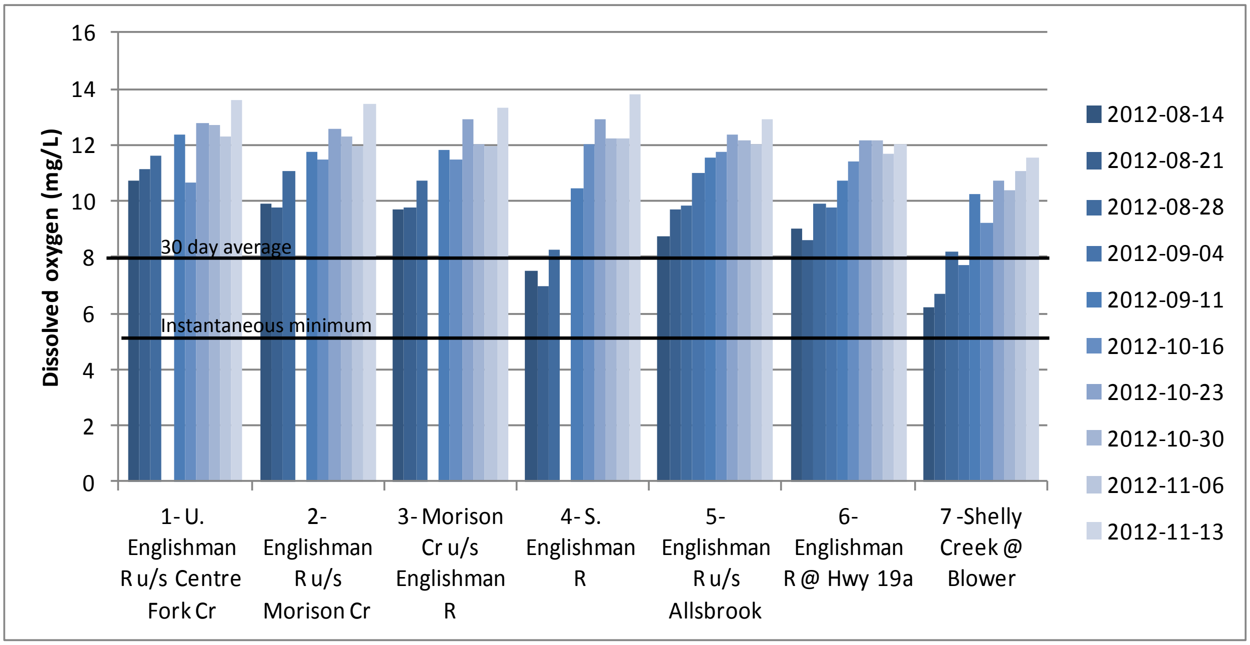
There was potential for exceedences of the aesthetic drinking water temperature guideline (weekly average 15^{o}C) in the summer at all sites except the Upper Englishman River (Figure 9). This is typical of many east coast Vancouver Island streams where the lower portions are wide and shallow. Maximum summer water temperatures had the potential to exceed the guideline for coho (17°C) rearing in the South Englishman River. More data are needed to determine if these observations could be related to the wide and shallow nature of this area of the South Englishman River, low flows, the hydrology of the upper watershed (low elevation, inputs from shallow lakes and a wetland) or other factors. As long as refuges remain with lower temperatures, juvenile fish should be able to retreat to these during periods of elevated temperatures. Values were slightly higher than those observed in 2011.

Figure 9 – Temperature collected by the Mid Vancouver Island Habitat Enhancement Society.



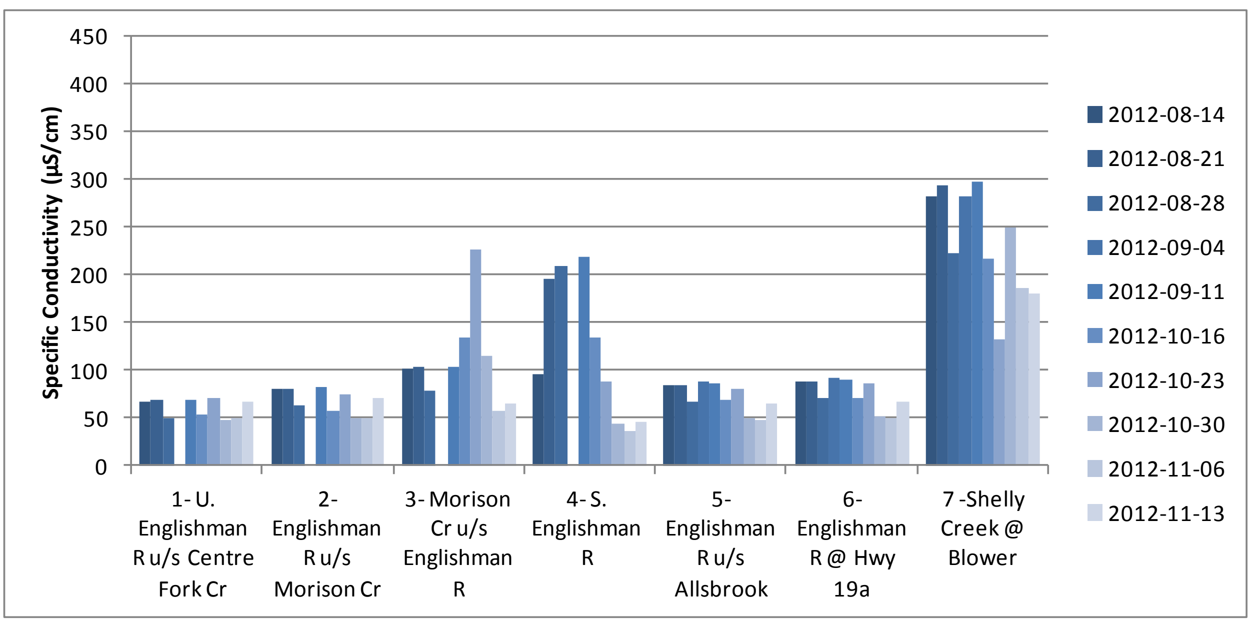
Dissolved oxygen in the summer at the South Englishman River site was slightly lower than that in 2011, possibly due to lower flows in 2012. The summer five weekly sample in 30 day average at this site could not be calculated as only four of the required five measurements were taken (Figure 10), but an average of the existing values was just above the 8 mg/L objective value. Summer dissolved oxygen at the Shelly Creek site (new site in 2012) did not meet the 30 day average objective of 8 mg/L.

Figure 10– Dissolved oxygen collected by the Mid Vancouver Island Habitat Enhancement Society.



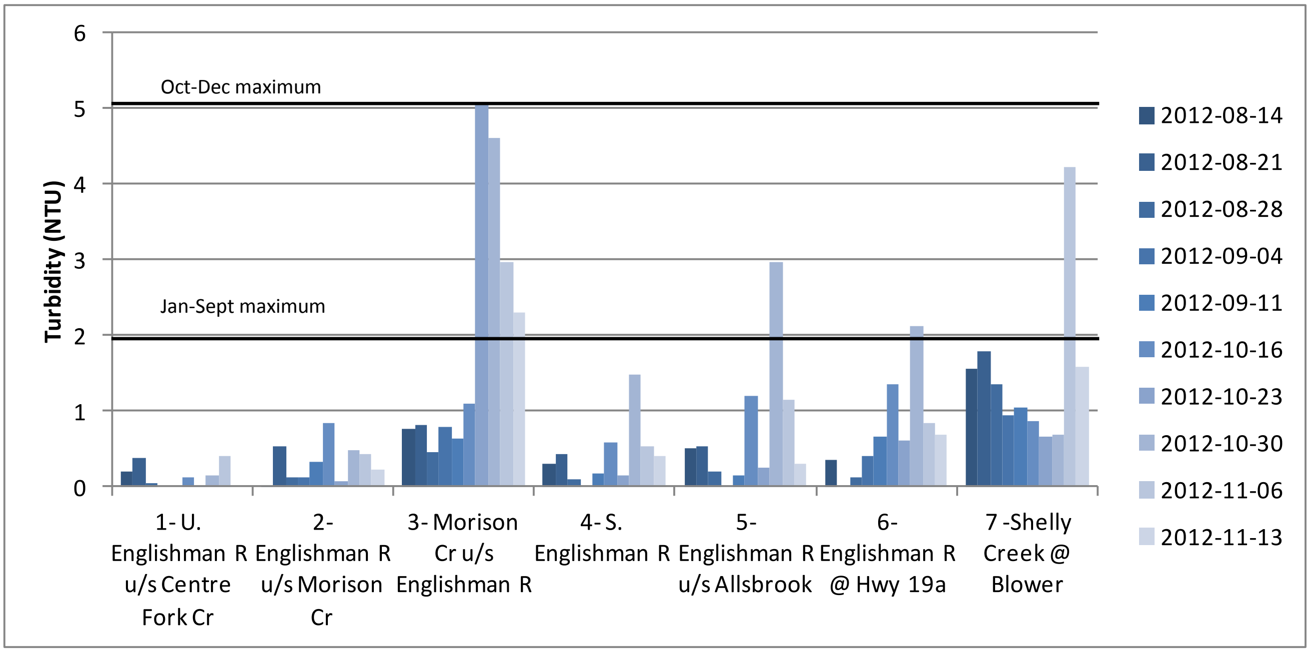
At the South Englishman River site, specific conductivity was higher than levels typical of coastal streams (Figure 11). These values were not typically associated with increased turbidity and were most likely influenced by higher groundwater inputs. With the exception of fall Morrison Creek values, data were similar to those observed in 2011. The Morrison Creek site in the fall and the Shelly Creek site in summer and fall showed conductivity higher than levels typical of coastal streams; these observations appeared to be associated with turbidity events. Further data collection will help determine trends.

Figure 11– Specific conductivity collected by the Mid Vancouver Island Habitat Enhancement Society.



Summer turbidity levels were similar to those observed in 2011. Increased fall turbidity observations at all sites were associated with rainfall events. Turbidity levels at Morison Creek exceeded the October to December maximum objective on one occasion and, similar to samples collected in Shelly Creek, were above background levels for most samples collected (Figure 12). Upstream activities are likely influencing these observations. As further data are collected trends may become apparent.

Figure 12– Turbidity collected by the Mid Vancouver Island Habitat Enhancement Society.



A monitoring instrument (sonde) installed at the Englishman River at Highway 19A site monitors temperature, conductivity and turbidity every 15 minutes; additional grab sampling (analyzed by a lab) by MVIHES as part of a Federal/Provincial monitoring program were also available for quality control comparison. All turbidity readings were within acceptable quality control criteria for all samples (Figure 13). Meter and lab readings for specific conductivity were plotted against conductivity measured by the sonde (Figure 14). The offset observed between the sonde and the other data points is due to the temperature conversation factor needed to show the sonde data as specific conductivity. This conversion was not done for this figure. The figure shows a similar pattern is observed between the two sets of values. Temperature readings were consistent with those observed in the sonde (Figure 15).

Figure 13 – Comparison of lab, field and continuous monitoring sonde turbidity measurements at the Englishman River at Highway 19A site.

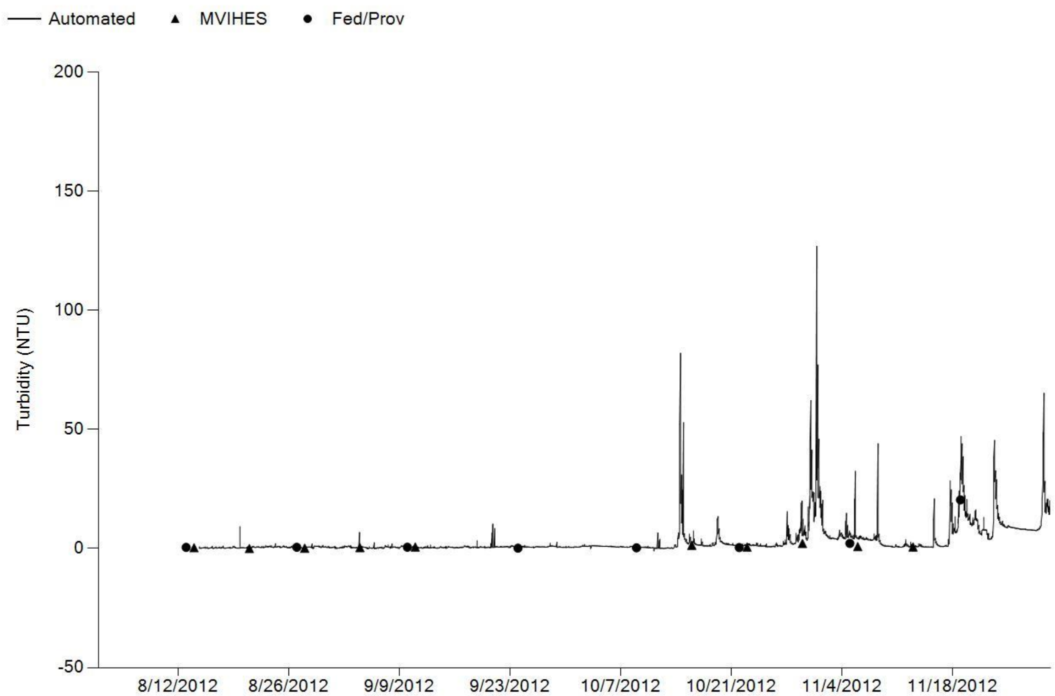


Figure 14– Comparison of lab, field <u>specific conductivity</u> and continuous monitoring sonde <u>conductivity</u> (i.e. not adjusted for temperature) measurements at the Englishman River at Highway 19A site.

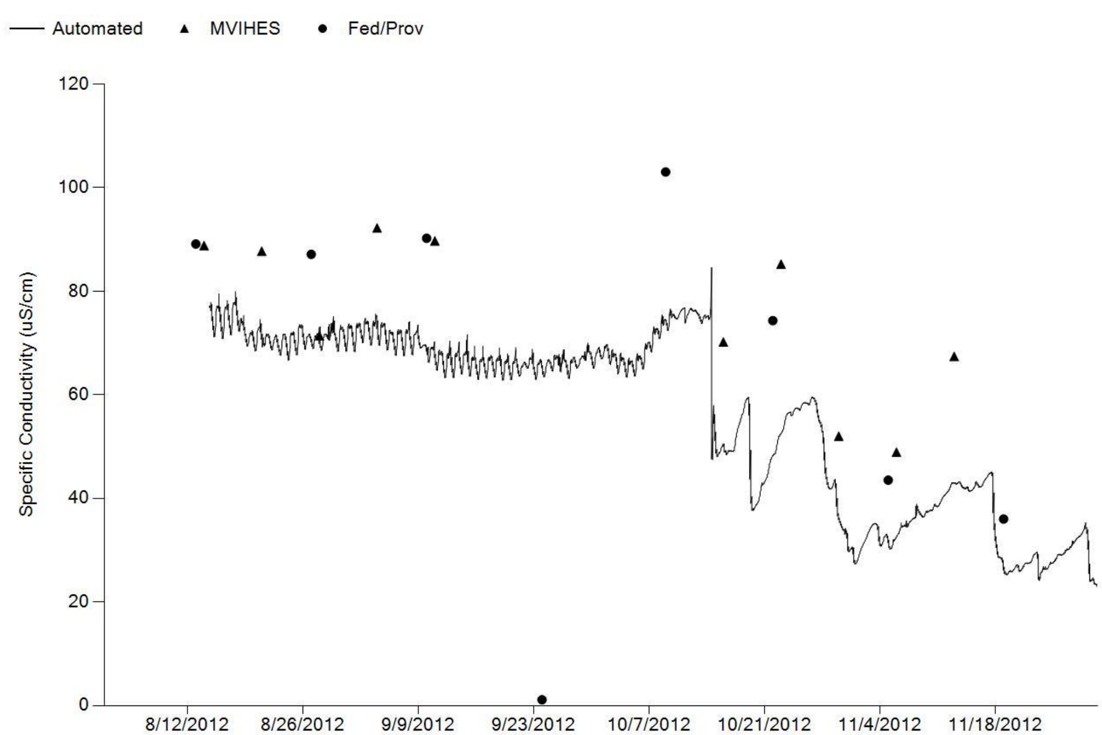
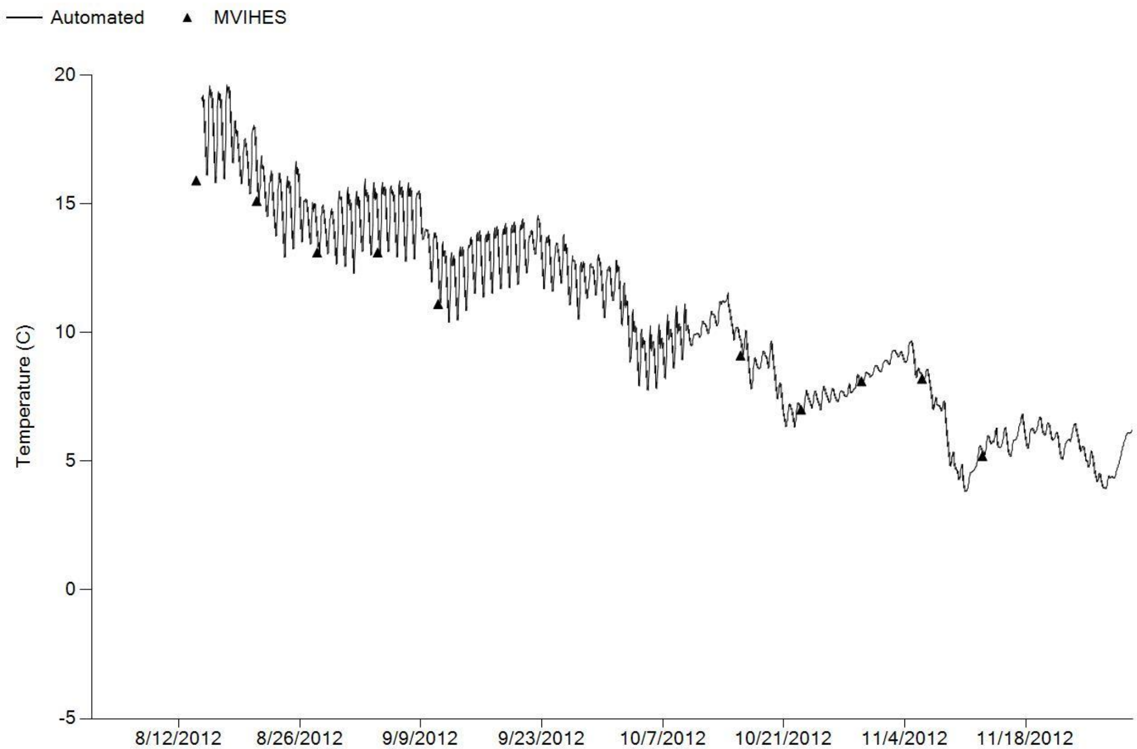


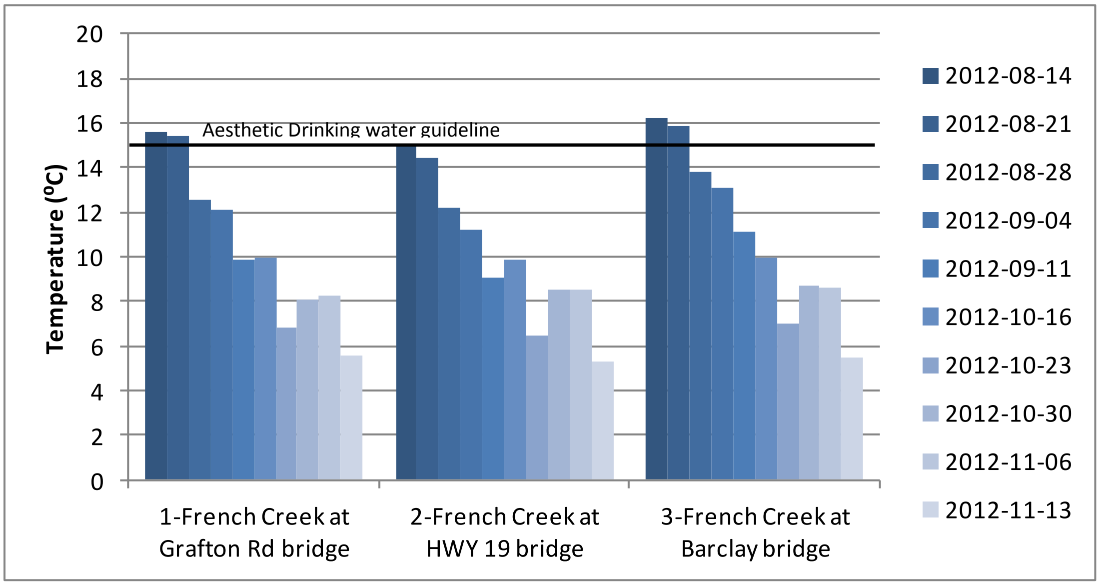
Figure 15 – Comparison of field and continuous monitoring sonde temperature measurements at the Englishman River at Highway 19A site.



Friends of French Creek

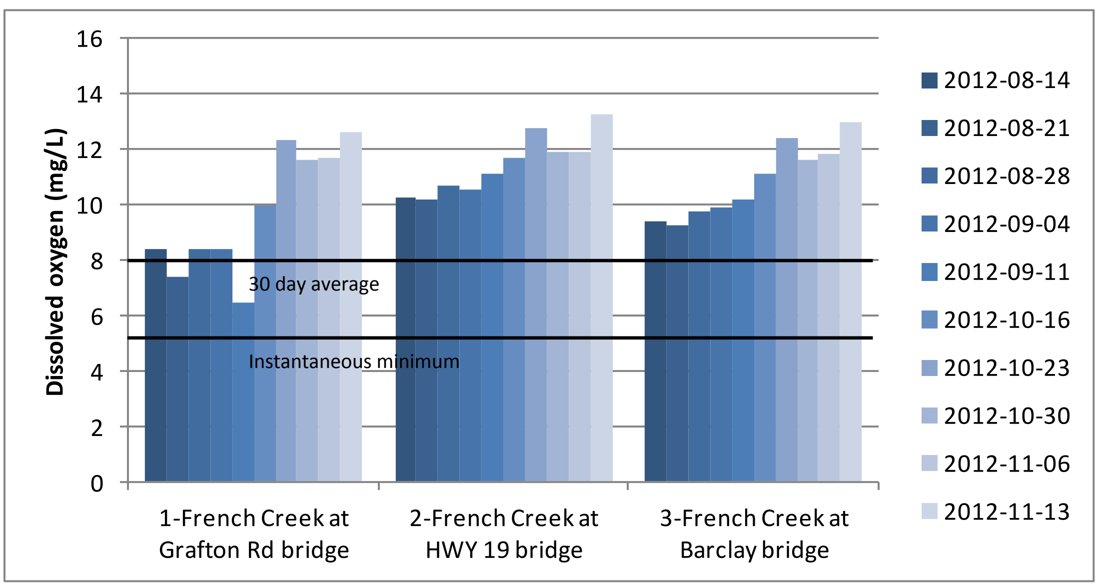
There was potential for exceedences of the aesthetic drinking water temperature guideline (weekly average 15^{o}C) at all three sites (Figure 16). Values were similar to those observed in 2011.

Figure 16– Temperature collected by the Friends of French Creek.



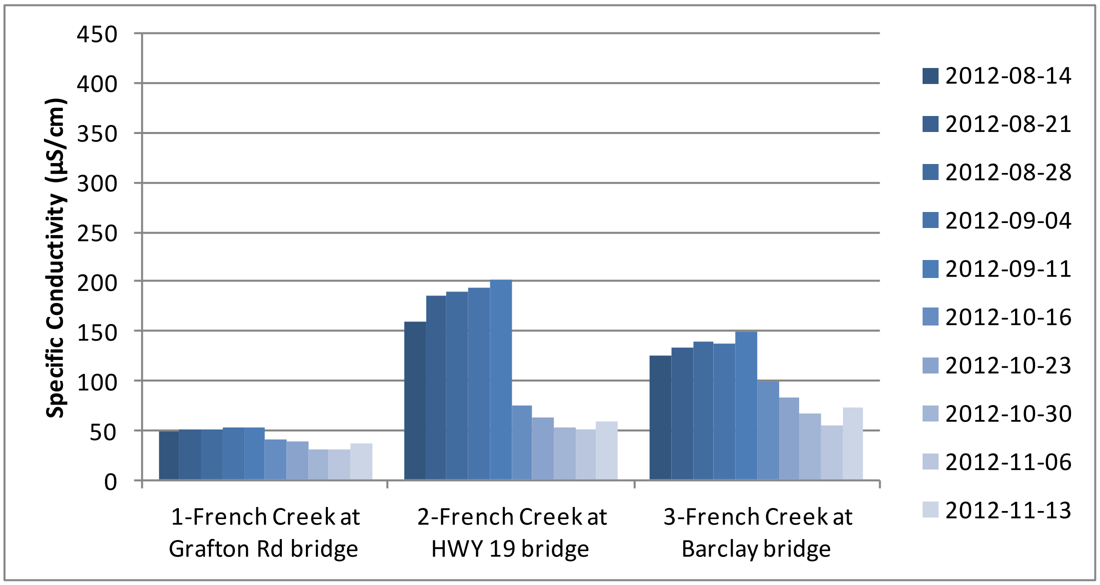
Dissolved oxygen (DO) at the Grafton Road site was below the recommended 30 day average (average of 7.81 mg/L not shown) (Figure 17). Low DO values were associated with very low flow or still water at this site. Values were similar to those observed in 2011.

Figure 17– Dissolved oxygen collected by the Friends of French Creek.



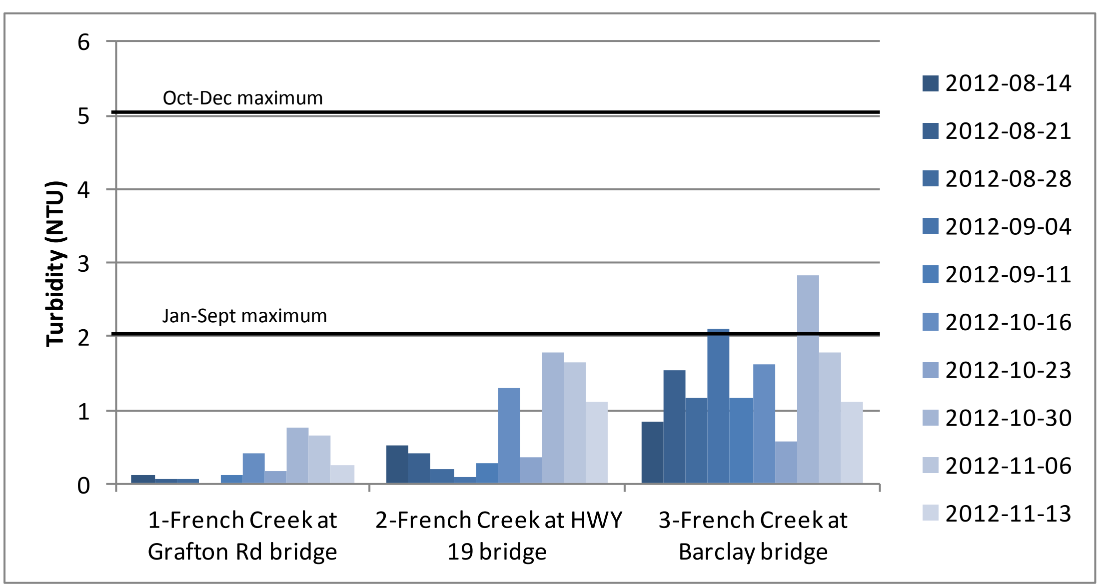
At the Highway 19 and Barclay Bridge sites, conductivity was higher than levels typical of coastal streams in the summer (Figure 18). These values appeared to be associated with increased turbidity at the Barclay Bridge site, while at the Highway 19 site they may have been influenced by higher groundwater inputs. Values were similar to those observed in 2011.

Figure 18– Specific conductivity collected by the Friends of French Creek.



Summer turbidity at the Barclay Bridge site occasionally exceeded the maximum turbidity objective (Figure 19) and data were slightly higher than those observed in 2011. On Aug 28, 2012 when turbidity exceeded the objective of 2 NTU it was noted that there was an excavator working upstream. Throughout the summer large groups of ducks were also observed upstream and likely also contributed to higher turbidity values. Higher fall values were associated with rainfall events.

Figure 19– Turbidity collected by the Friends of French Creek.

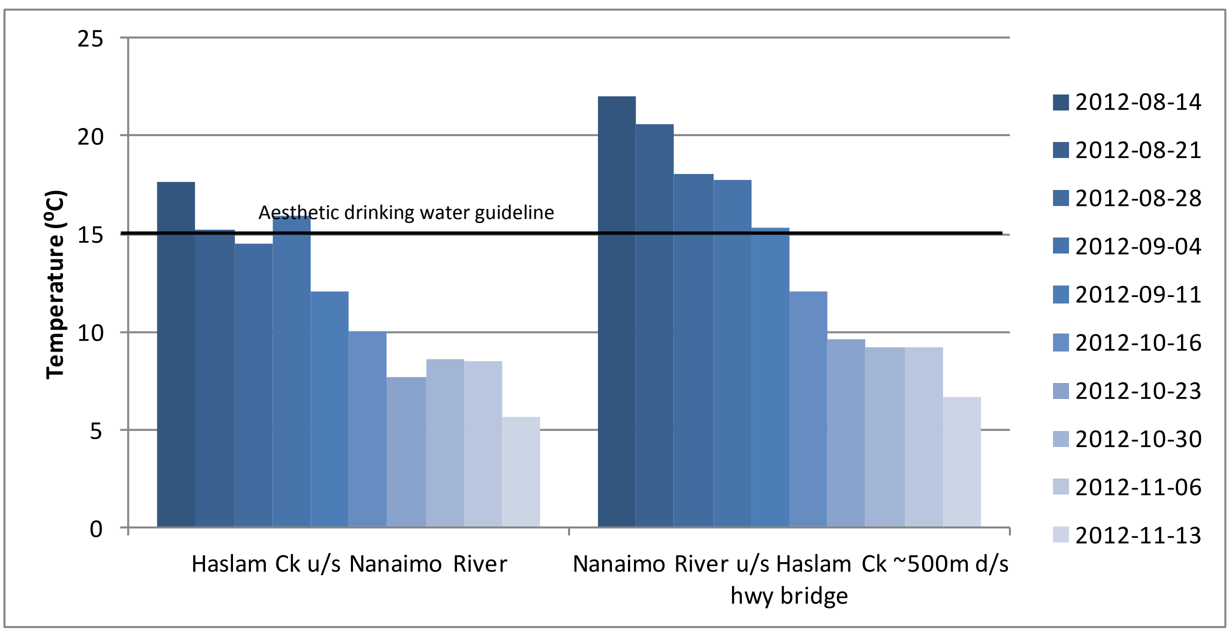


Duplicate turbidity readings for quality assurance purposes were taken at the French Creek sites, re-zeroing the meter before each new reading. Four of the 30 duplicate samples taken had duplicate readings that were both within the accuracy of the meter (i.e. higher than 0.04 NTU) and more than 25% different from the first readings. These four sets of values were on the low range of the meter (i.e. less than 1 NTU) and most were less than 0.40 NTU, thus none would have the potential to artificially show a turbidity objective exceedence. In addition, three more readings were taken at each site, not zeroing the meter after each reading. With the exception of one site on Sept 11, 2012, where the triplicate values were within 25% of the first reading but not the duplicate reading, all were within 25% of the duplicate reading.

Nanaimo Area Land Trust

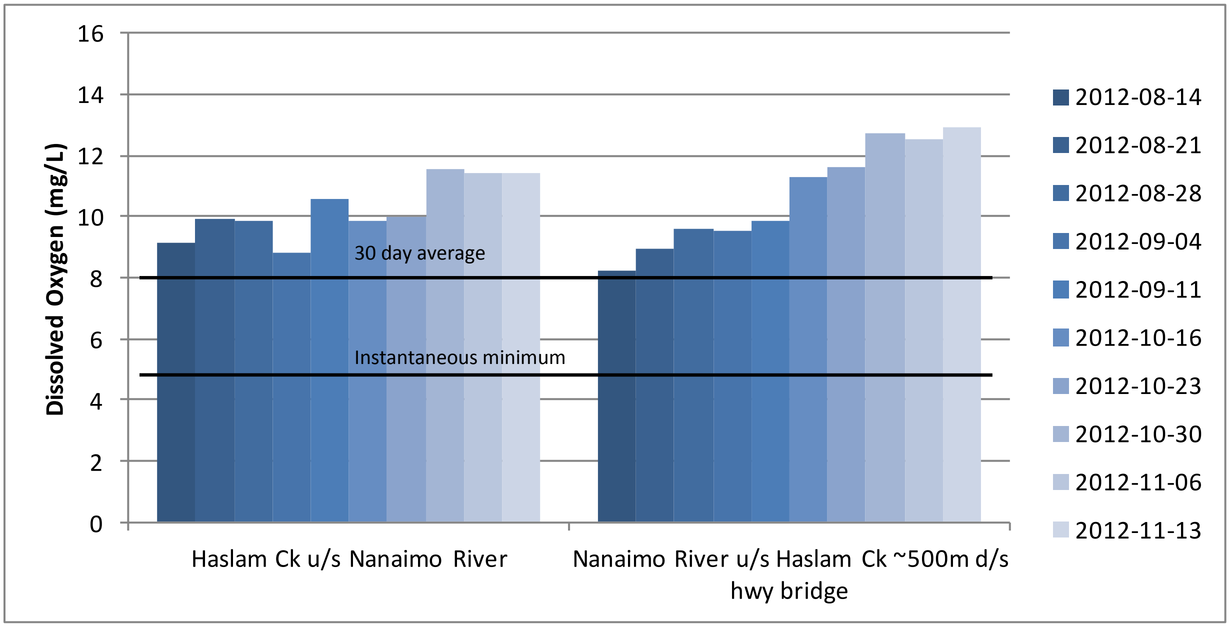
There was potential for exceedences of the aesthetic drinking water temperature guideline (weekly average 15°C) occasionally in Haslam Creek and throughout the summer sample period in the Nanaimo River upstream Haslam Creek (Figure 20). Summer temperatures occasionally had the potential to exceed the guideline for coho rearing (17°C) at the Nanaimo River site. This is typical of many east coast Vancouver Island streams where the lower portions are wide and shallow; as long as refuges remain with lower temperatures, juvenile fish should be able to retreat to these during periods of elevated temperatures.

Figure 20– Temperature collected by the Nanaimo Area Land Trust.



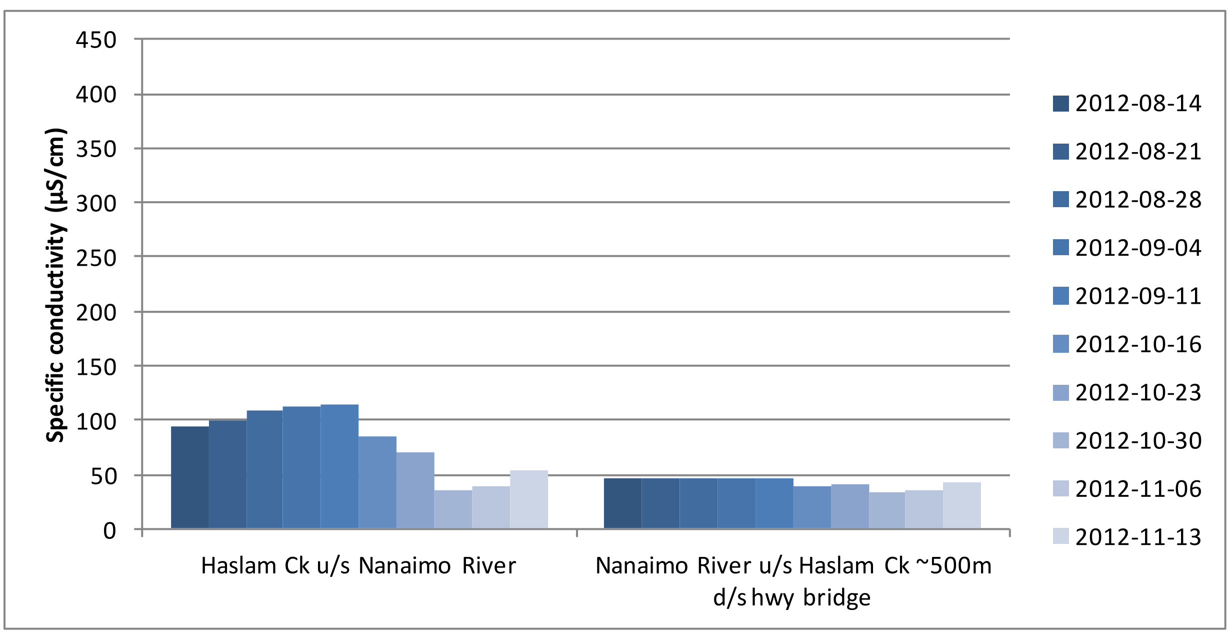
Dissolved oxygen values are shown in Figure 21.

Figure 21– Dissolved oxygen collected by the Nanaimo Area Land Trust.



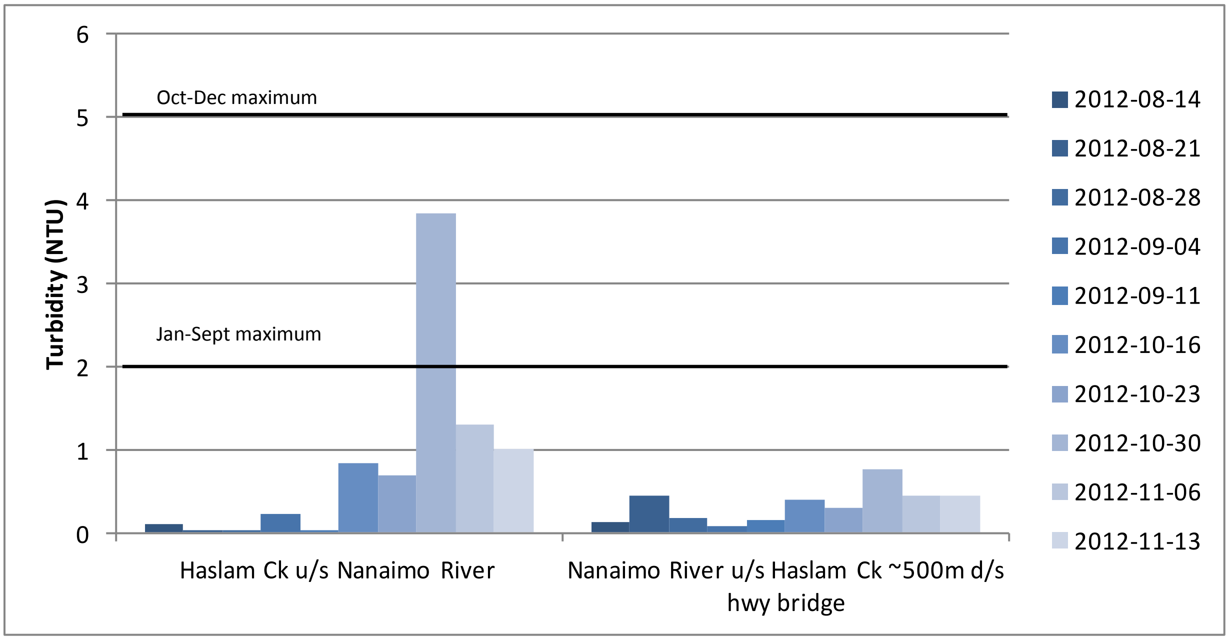
Slightly higher summer specific conductivity values at the Haslam Creek (Figure 22) site may indicate some groundwater influence.

Figure 22– Specific conductivity collected by the Nanaimo Area Land Trust.



Fall turbidity events were associated with rainfall events. Though turbidity objectives were not exceeded at any time, the high turbidity spike on Oct 30, 2012 was noteworthy (Figure 23) and may have been associated with high numbers of dead spawned fish observed and very high water levels on that day.

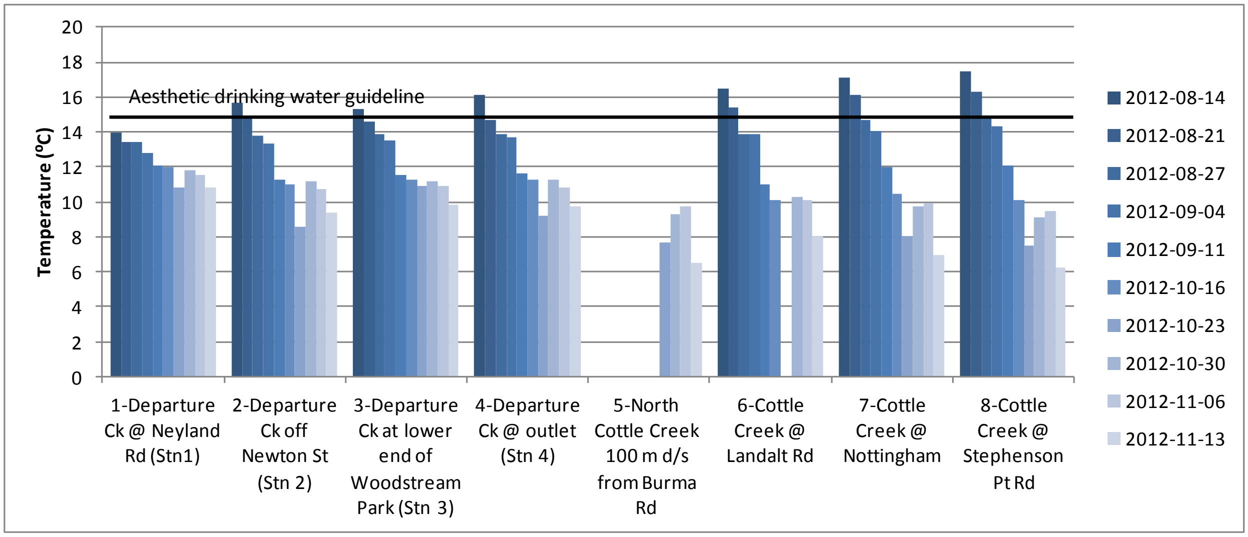
Figure 23– Turbidity collected by the Nanaimo Area Land Trust.



Harbour City River Stewards (in affiliation with Nanaimo Area Land Trust)

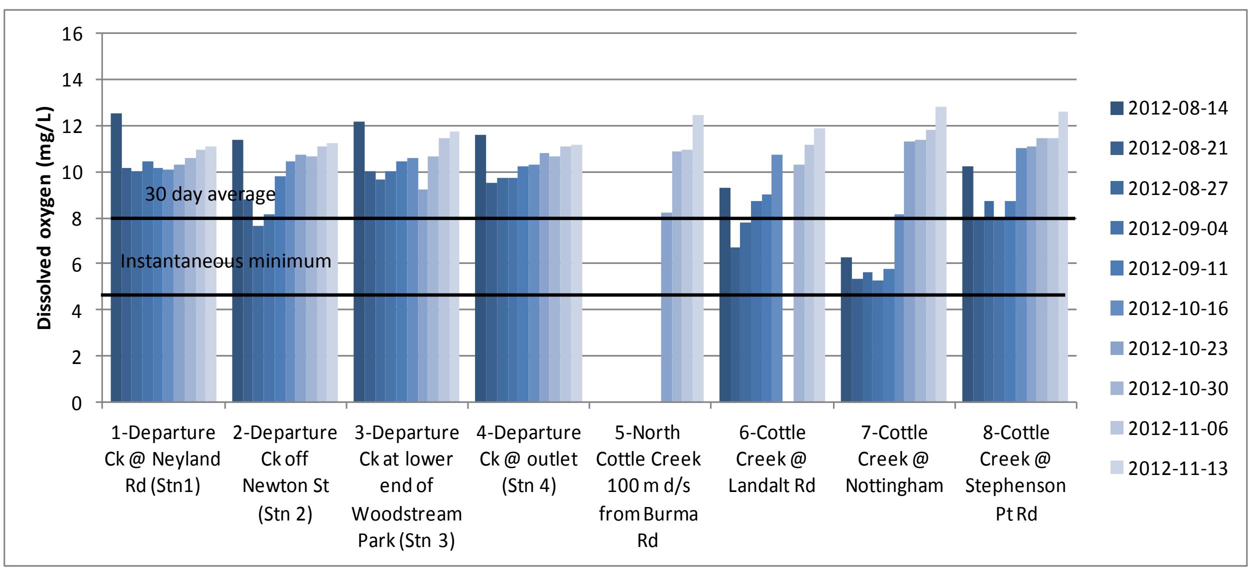
There was potential for summer exceedences of the aesthetic drinking water temperature guideline (weekly average 15^{o}C) occasionally in both Departure and Cottle Creeks (Figure 24) and potential for summer exceedence of the guideline for coho rearing (17°C) in the lower portions of creek. Though fisheries information (Habitat Wizard, 2012) indicates only that cutthroat trout are present in Cottle Creek, not coho, cutthroat trout have the same maximum guideline for rearing. High summer temperatures are typical of many east coast Vancouver Island streams where the lower portions are wide and shallow or in smaller creeks; as long as refuges remain with lower temperatures, juvenile fish should be able to retreat to these during periods of elevated temperatures.

Figure 24– Temperature collected by the Harbour City River Stewards.



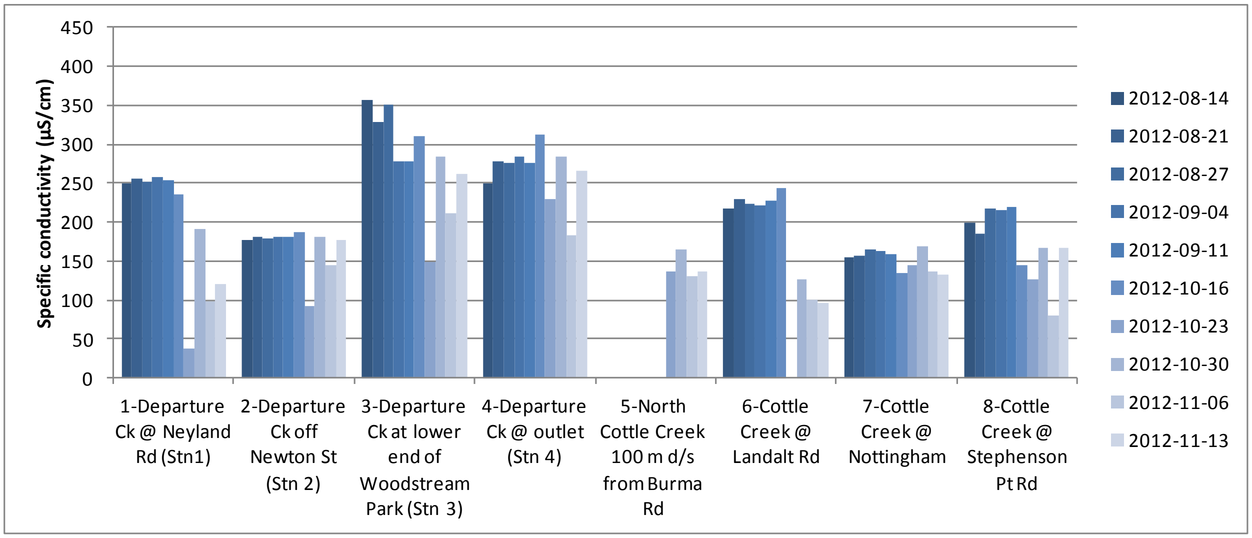
Dissolved oxygen (DO) at the Cottle Creek at Nottingham site was below the recommended 30 day average (average of 5.67 mg/L not shown) (Figure 25). Low DO values were associated with very low flow or still water at this site.

Figure 25– Dissolved oxygen collected by the Harbour City River Stewards.



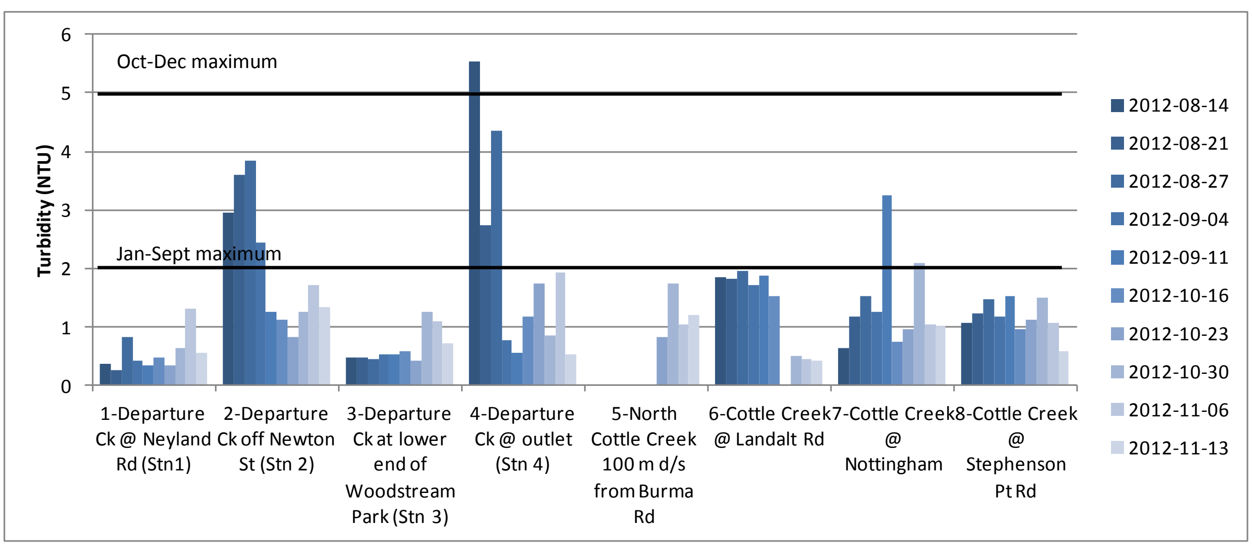
Specific conductivity was higher than levels typical of coastal streams in the summer at all sites (Figure 26). These values appear to be associated with increased turbidity (Figure 27) in Cottle Creek, while in Departure Creek higher conductivity may indicate some groundwater influence in combination with turbidity influences. Further data collection will help determine trends.

Figure 26– Specific conductivity collected by the Harbour City River Stewards.



Summer turbidity events were in exceedence of turbidity objectives in Departure Creek off Newton Street and at outlet, as well as at Cottle Creek at Nottingham (Figure 27). The Departure Creek exceedences were associated with temporary in-stream works (Newton Street site) and the fact that the sample location was in a pool below a small cascade that may have disturbed sediment (outlet site). Fall turbidity events were associated with rainfall events. Elevated summer turbidity in the Cottle Creek sites may indicate anthropogenic influences; further data collection will help determine trends.

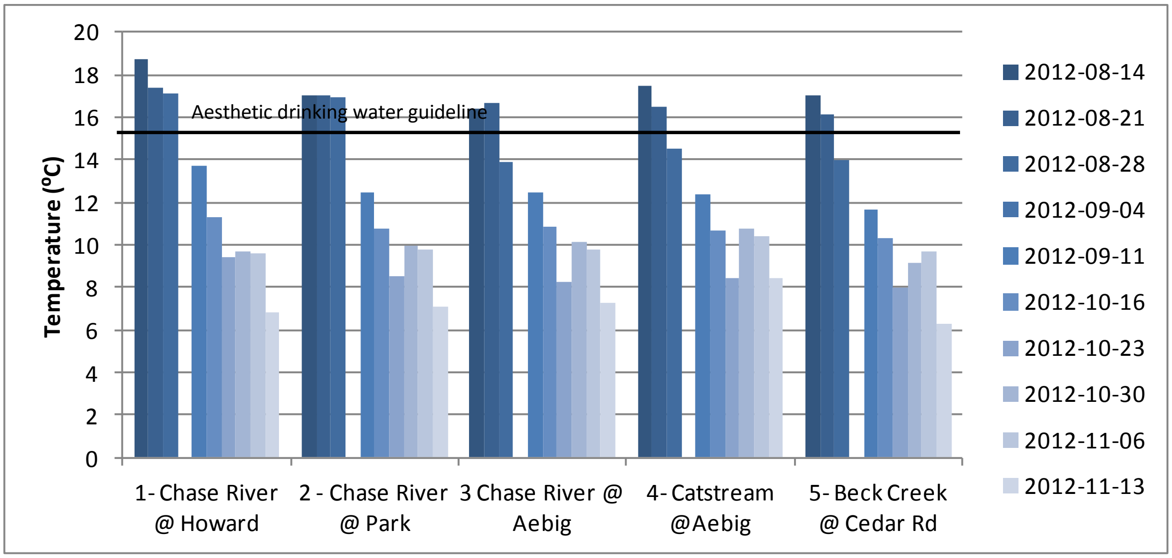
Figure 27– Turbidity collected by the Harbour City River Stewards.



Vancouver Island University

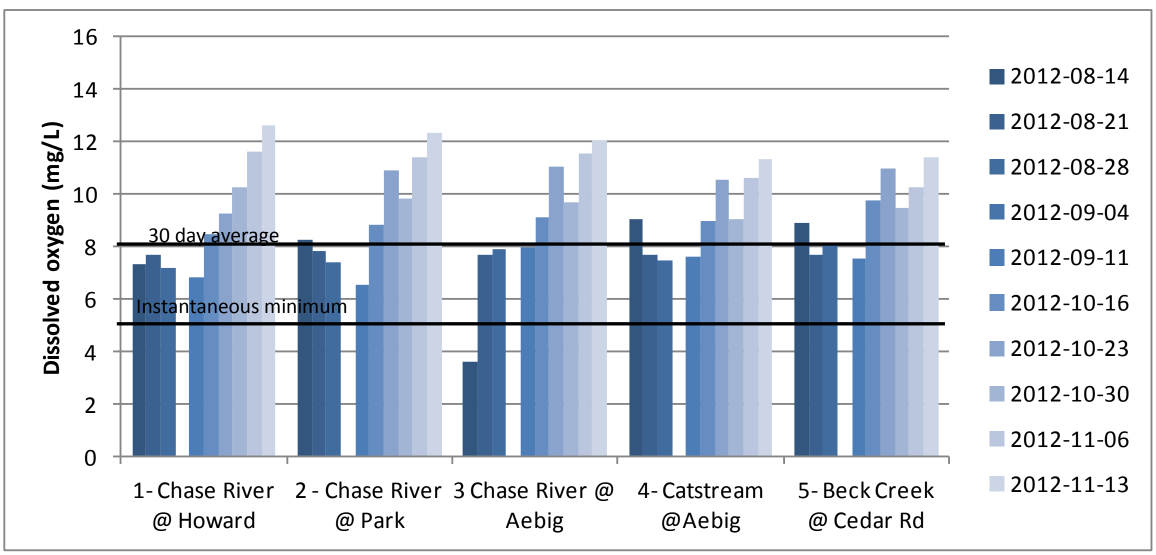
There was potential for exceedences of the aesthetic drinking water temperature guideline (weekly average 15°C) at all sites and the guideline for coho rearing (17°C) at nearly all sites in the summer (Figure 28). This is typical of many east coast Vancouver Island streams where the lower portions are wide and shallow or in smaller creeks; as long as refuges remain with lower temperatures, juvenile fish should be able to retreat to these during periods of elevated temperatures.

Figure 28– Temperature collected by the Vancouver Island University.



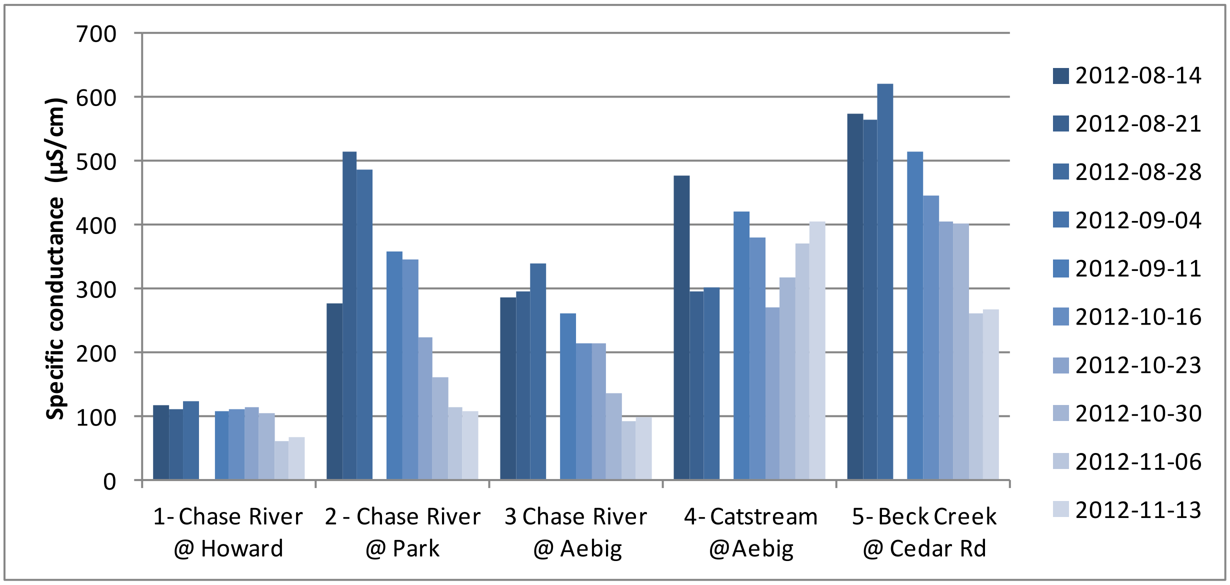
Most summer dissolved oxygen observations were below 8 mg/L. Without a fifth sample date in a 30 day period a direct comparison to objectives cannot be made; however the sites had the potential to be below the recommended 30 day average (Figure 29). Chase River at Aebig Rd had one observation below the instantaneous minimum dissolved oxygen objective (5 mg/). Low DO values were associated with very low flow or still water at these sites in the summer.

Figure 29– Dissolved oxygen collected by the Vancouver Island University.



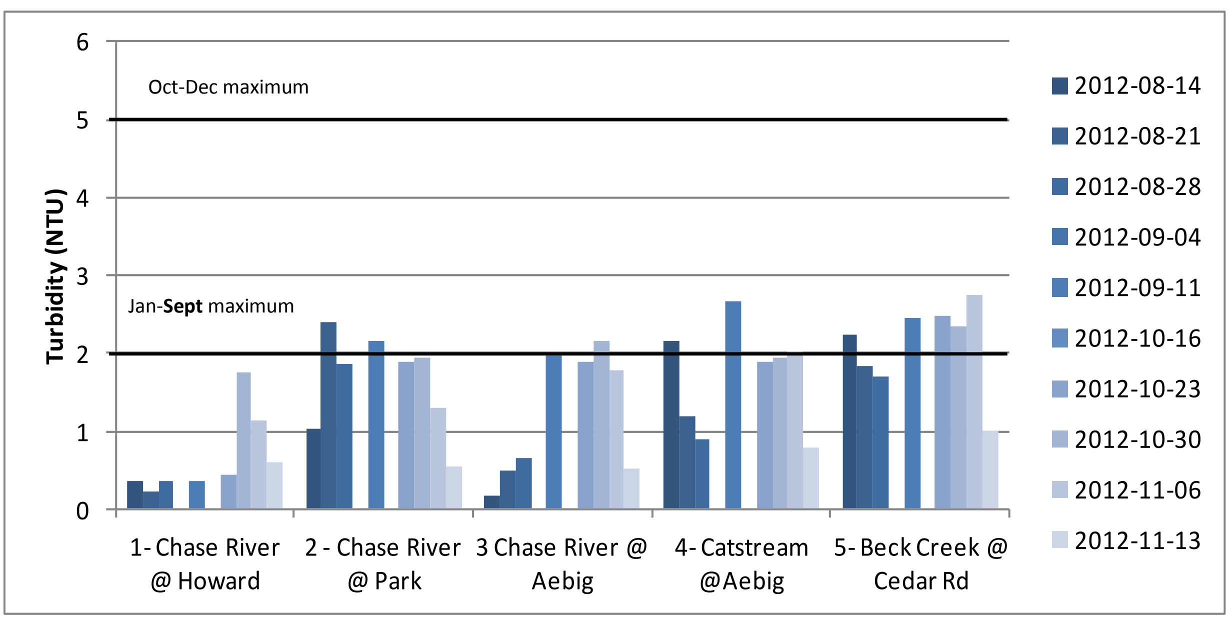
Specific conductivity was higher than levels typical of coastal streams in the summer at all sites except Chase River at Howard (Figure 30). These values appear to be associated with increased turbidity (Figure 30) but may also indicate some groundwater influence. Further data collection will help determine trends.

Figure 30– Specific conductance collected by Vancouver Island University.



Summer turbidity events were occasionally in exceedence of turbidity objectives in Chase River, Catstream and Beck Creek (Figure 31), and may indicate athropogenic turbidity influences. Field observations indicated work on a logjam upstream of the Chase River at Aebig site on Sept 11, 2012 which likely affected turbidity readings. Fall turbidity events were associated with rainfall events. Further data collection will help determine trends.

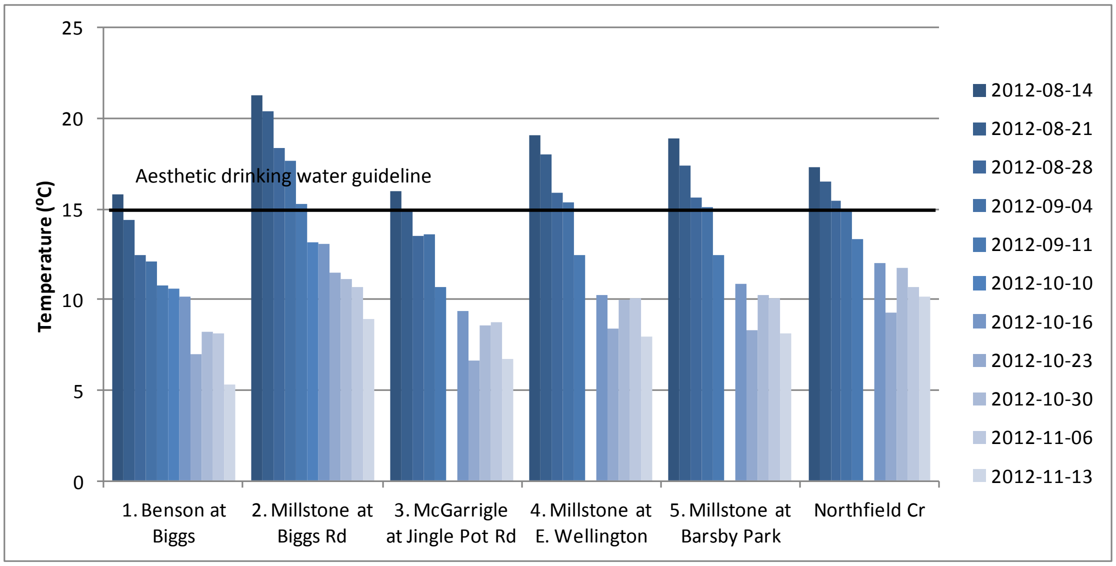
Figure 31– Turbidity collected by Vancouver Island University.



Island Waters Fly Fishers

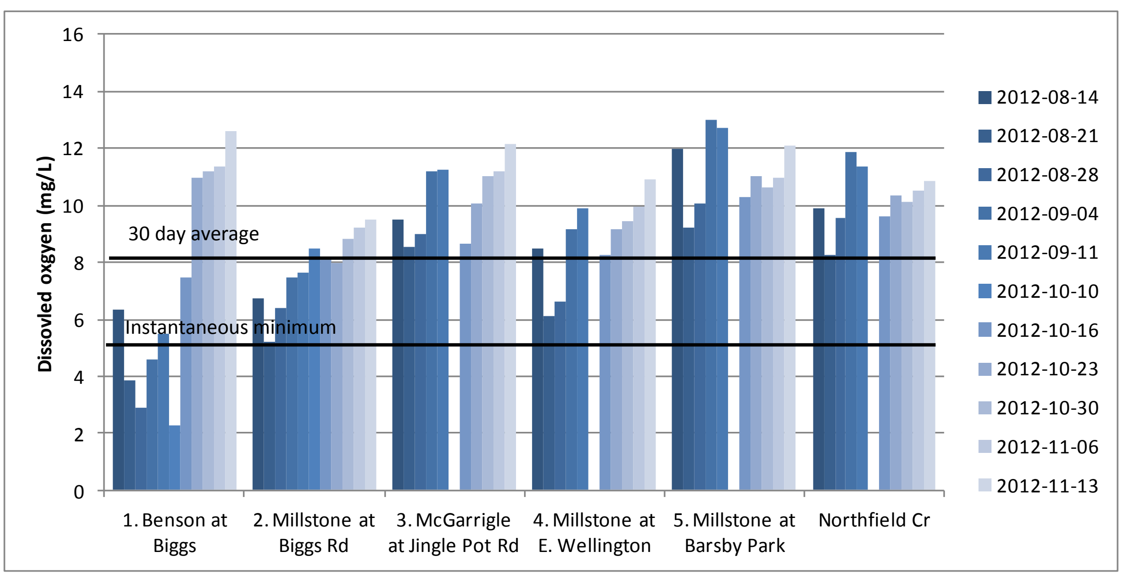
There was potential for summer exceedences of the aesthetic drinking water temperature guideline (weekly average 15°C) at all sites and the guideline for coho rearing (17°C) at nearly all sites (Figure 32). This is typical of many east coast Vancouver Island streams where the lower portions are wide and shallow or in smaller creeks; as long as refuges remain with lower temperatures, juvenile fish should be able to retreat to these during periods of elevated temperatures.

Figure 32– Temperature collected by the Island Waters Fly Fishers.



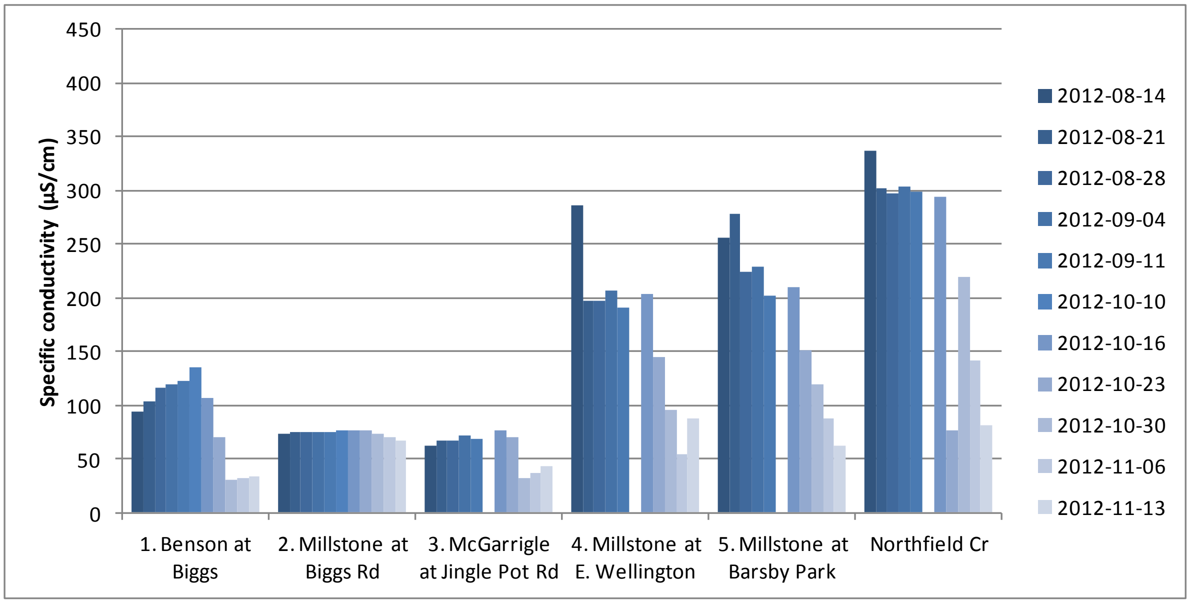
Summer dissolved oxygen was below the recommended 30 day average (Figure 33) of 8 mg/L at the Benson Creek (4.64 mg/L) and Millstone at Biggs (6.69 mg/L) sites. The Benson Creek site had several summer observations below the instantaneous minimum dissolved oxygen objective (5 mg/L). Low DO values were associated with very low flow or still water at these sites in the summer.

Figure 33– Dissolved oxygen collected by the Island Waters Fly Fishers.



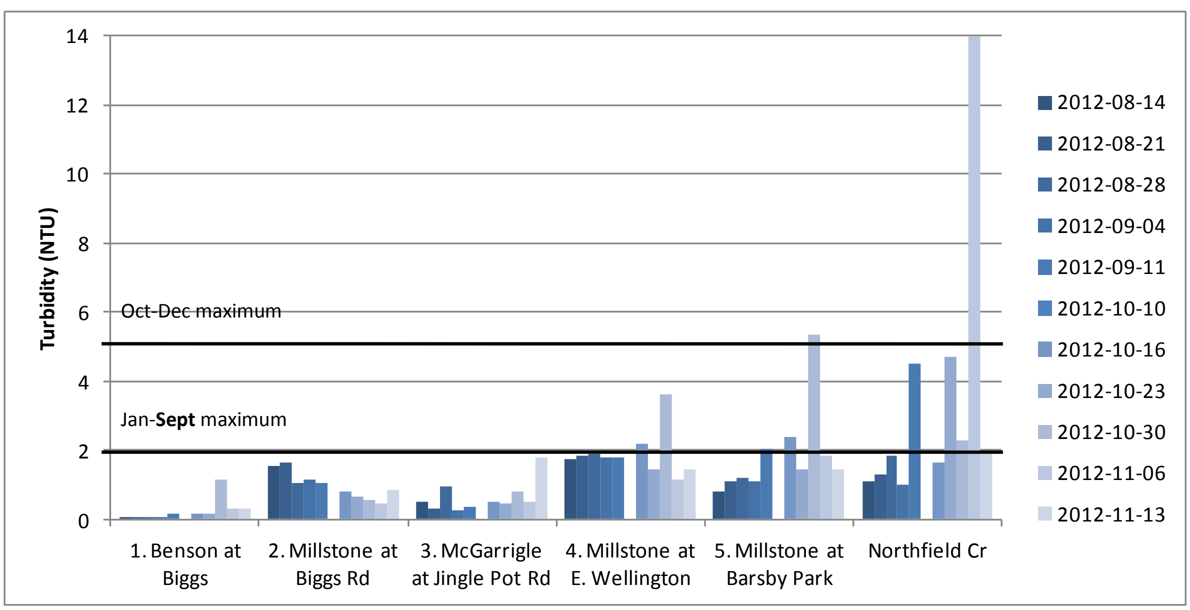
Specific conductivity was higher than levels typical of coastal streams in the summer at the Benson Creek, Millstone at East Wellington, Millstone at Barsby Park and Northfield Creek sites (Figure 34). These values appear to be associated with increased turbidity for all but the Benson site (Figure 35) but may also indicate some groundwater influence. Further data collection will help determine trends.

Figure 34– Specific conductivity collected by the Island Waters Fly Fishers.



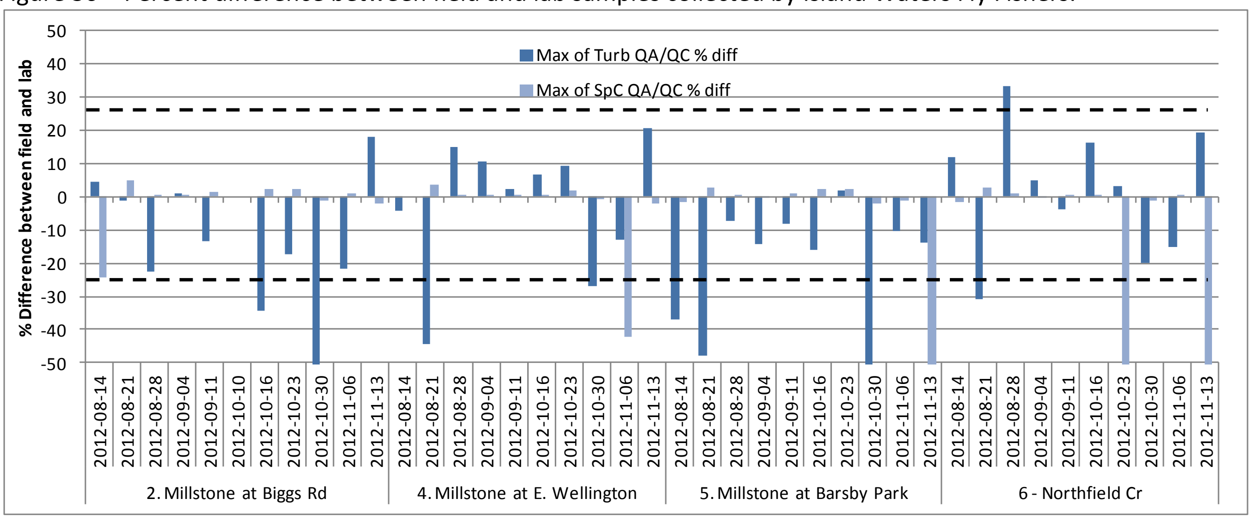
The January to September turbidity maximum was exceeded at the Northfield Creek site, while October to December objective was exceeded both at the Millstone at Barsby Park and Northfield Creek sites (Figure 35). These exceedences and other high turbidity values observed may indicate athropogenic turbidity influences. Fall turbidity events were associated with rainfall events. Further data collection will help determine trends.

Figure 35– Turbidity collected by the Island Waters Fly Fishers.



At four of the sampling sites (Millstone at Biggs, Millstone at East Wellington, Millstone at Barsby and Northfield Creek) grab samples were taken for lab analysis as part of quality assurance/quality control procedures (Figure 36). Nine of the forty turbidity samples (five in summer and four in fall) analyzed were greater than 25% different than the associated meter reading taken in the field that day, and eight of these results showed a higher lab value than field value. Using the lab results objective comparison, Millstone at East Wellington also exceeds January to September turbidity objectives. Four of forty grab sample specific conductivity readings were greater than 25% different than the field readings, all were in the fall samples and all were higher than field readings. This may be due to sample technique where filling a large bottle had the potential to disturb bottom sediment and result in a higher reading. During higher flows and rain events these differences may also be due to that there can be more variation between readings taken in the same stream.

Figure 36 – Percent difference between field and lab samples collected by Island Waters Fly Fishers.



Recommendations

The following recommendations are made for future monitoring years:

- Sampling should continue at all sites.
- Re-training of calibration and sampling procedures should occur at least once each year of the program.
- Quality control samples (e.g. duplicates sent for lab analysis and duplicate meter readings) should occur in each watershed.
- The importance of getting five samples in 30 days for comparison to objectives should be emphasized.

References

Barlak, R. 2012. Regional District of Nanaimo Community Watershed Monitoring Network 2011 Data Summary. British Columbia Ministry of Environment. Nanaimo, B.C. Available online at: http://www.env.gov.bc.ca/wat/wq/pdf/community_montoring_program_data_summary2011.pdf

Barlak, R., Epps, D. and Phippen, B. 2010. Water quality assessment and objectives for the Englishman River Community Watershed: technical report. British Columbia Ministry of Environment. Victoria, B.C. Available online at: http://www.env.gov.bc.ca/wat/wq/wq_objectives.html

BC MOE (British Columbia Ministry of Environment). 1997. Ambient water quality criteria for dissolved oxygen. Available online at: http://www.env.gov.bc.ca/wat/wq/BCguidelines/do/index.html

BC MOE (British Columbia Ministry of Environment). 2003. British Columbia field sampling manual for continuous monitoring and the collection of air, air-emission, water, wastewater, soil, sediment, and biological samples. Available online at: http://www.env.gov.bc.ca/epd/wamr/labsys/field_man_03.html.

Habitat Wizard. 2012. Online mapping system of habitat and fisheries information. Ministry of Environment. Available online at: http://www.env.gov.bc.ca/habwiz/