Upper Millard Creek Headwaters

Springs and Seeps Report 2013

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TABLE OF CONTENTS

I INTRODUCTION

One of most serious problems associated with land development is the change in the rate and the amount of runoff reaching streams and rivers.

William M. Marsh (2010)

I-A Background

The Millard Creek Watershed is located at the south boundary of the City of Courtenay and the north portion of Area A of the Comox Valley Regional District (Map 1). Millard Creek drains an area of approximately five square kilometres before joining Piercy Creek and entering the marine waters of the Courtenay River Estuary. Land-use in the Millard Creek Watershed is primarily agricultural and rural residential with a trend of increasing residential density. The Minto Road Forest study site is situated in the south-west corner of the Millard Creek Watershed, right at a break point between subsurface and surface water flow. Monitoring the hydrology at the Minto Road Forest can provide important data with regards to environmental response to changes in land use.

The Youth and Environmental Restoration program (YER) provides work experience, training and support for youth under the age of nineteen (YER 2013). Through studying local watersheds with community members youth gain a sense of worth, belonging and place. The focus of YER, Phase I is to work one-on-one with youth conducting ecological restoration activities with a variety of environmental organizations; YER, Phase II has two youth and two adults concentrating on a specific project to further develop teamwork, research techniques and communication skills. The first three days of this YER Phase II program included habitat assessment and establishing six monitoring stations for water flow from springs and seeps within the Minto Road Forest study site. On days four and five the focus was on the preparation and presentation of a public tour by the youth.

The four YER team members were: YER coordinator, Wendy Kotilla; Registered Professional Biologist, Ian Moul; and two youth participants, Gordon Hardy and Darius Lymbery-Fox (Photograph 1). The five day program was from the 12th to the 16th of August 2013. This is a citizen science project with a goal of using scientific methods in ways that are interesting to the youth, helping them gain a more in-depth understanding of what makes up a functioning ecosystem, while at the same time collecting information useful in local land-use planning.

YER has conducted previous work within the Millard and Piercy watersheds and at the present study site. YER, Phase I work included: invasive species removal, planting native plant species, water quality monitoring, monitoring downstream fish migration, conducting adult spawning salmon counts and fish population estimates. YER, Phase II projects were carried out in 2008, 2011, and 2012 to monitor the productivity of fish habitat in the Millard Creek Rearing Channel, as well as ecological studies at this site in 2011 and 2012.

Photograph 1: The YER team, 12 to 16 of August 2013. From left to right: Gordon Hardy, Darius Lymbery-Fox, Wendy Kotilla, and Ian Moul

I-B Watersheds, Springs and Seeps

A watershed is an area of land in which all of the rainfall is captured and directed downstream to converge at a single point, a larger river, a lake, a wetland, or an estuary next to an ocean or a sea. Most rainfall initially soaks into the ground and flows unseen through the soil and the root zone of trees and plants. Water flows within the ground to breakpoints where the water surfaces as either springs or seeps. Springs are usually thought of as single source points of water flow, while seeps are less defined and appear first as wet areas. Downstream of springs and seeps, water may submerge once again or remain on the surface as the branching network of creeks and streams.

Areas of springs and seeps are often characterized by having wet or moist soils. Springs and seeps provide important habitat for both terrestrial and aquatic plants, and bird, fish and animal species.

I-C Purpose of the Study

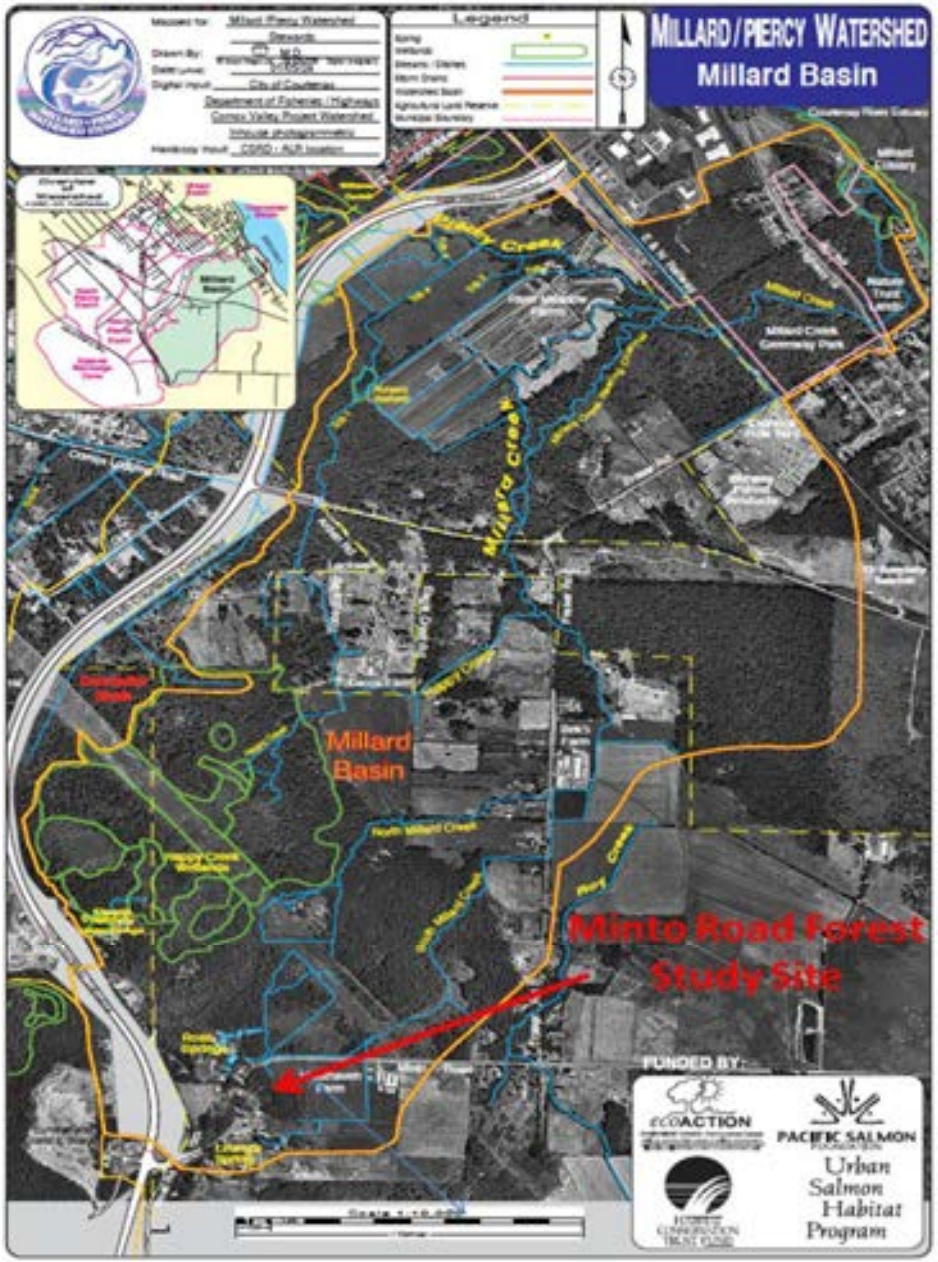
The purpose of this study is twofold:

1) To establish hydrological monitoring stations to measure water flow and water quality characteristics in the upper Millard Creek Watershed; and
2) To develop a methodology for an educational experience that is scientifically sound yet is interesting, hands on and understandable by youth that may or may not have experience working, or even spending time in the natural world.

I-D Location

Map 1: Overview map showing the location of the Minto Forest study site in relation to the Millard Creek Watershed.

Map1 was produced by the Project Watershed Mapping Centre



The study site is on private property and is not open to the public.

II METHODS

There does not appear to be a standardised British Columbia provincial government methodology for describing and inventorying springs and seeps. A field data form and survey protocol was developed using a combination of information from a US Department of Agriculture field guide for Groundwater Dependant Ecosystems (USDA 2011), some published notes from a meeting of Springs and Seeps Technical Work Group of the Northern Arizona University (SSTWG 2013), and discussions with Hydrologists Gilles Wendling P. Eng. and Arnd Burgert P. Geo. of GW Solutions Inc. in Nanaimo BC.

The survey protocol for springs and seeps documents:

1) The local landscape and landform type
2) The most common vegetation associated with the spring or seep location

Six staff gauges were made up of stainless steel metric rulers attached to sections of steel re-bar using hose clamps (Photographs 2 - 7). The staff gauges were hammered into the bed of either a pool or a glide section of a watercourse. The sediment level at the bottom of the ruler was recorded. Water level was the measure of the water read on the ruler, less the initial depth of the sediment.

The six staff gauges installed during this project were a continuation of previous monitoring of groundwater at a nearby surface well (shown on Map 2). Following the YER Phase II program, Staff Gauge # 1 was replaced with a V-notch weir, calibrated to measure water volume (Photograph 8). Starting on 17 September 2013, Wendy Kotilla began recording daily maximum and minimum air temperatures, rainfall amounts, and weather conditions at the Minto Road Forest.

Water quality indicators were measured using a HANNA Instruments HI98129 pH/EC/TDS/Temperature with Only One Tester, and an OxyGuard Handy Beta Portable DO Meter H01B. Air and water temperatures were measured with both an alcohol thermometer and the HANNA unit. The thermometers were preferred for this exercise as they are more “real” and understandable to the youth, compared to a digital electronic readout.

III RESULTS AND DISCUSSION

III-A Monitoring Groundwater at a Domestic Water Surface Well

Ground water levels immediately uphill of the Minto Road Forest have been monitored by measuring water levels in a domestic drinking water shallow well for the past six years (Figure 1). With the exception of 2009, where water levels were lower when compared to other years, water levels have followed a similar pattern. Ground water levels are highest in the early spring, March and April, following the seasonal fall and winter rains and then gradually lower thought the summer and early fall. At this time there does not appear to be any trend for changes in the water table across the six year of monitoring.

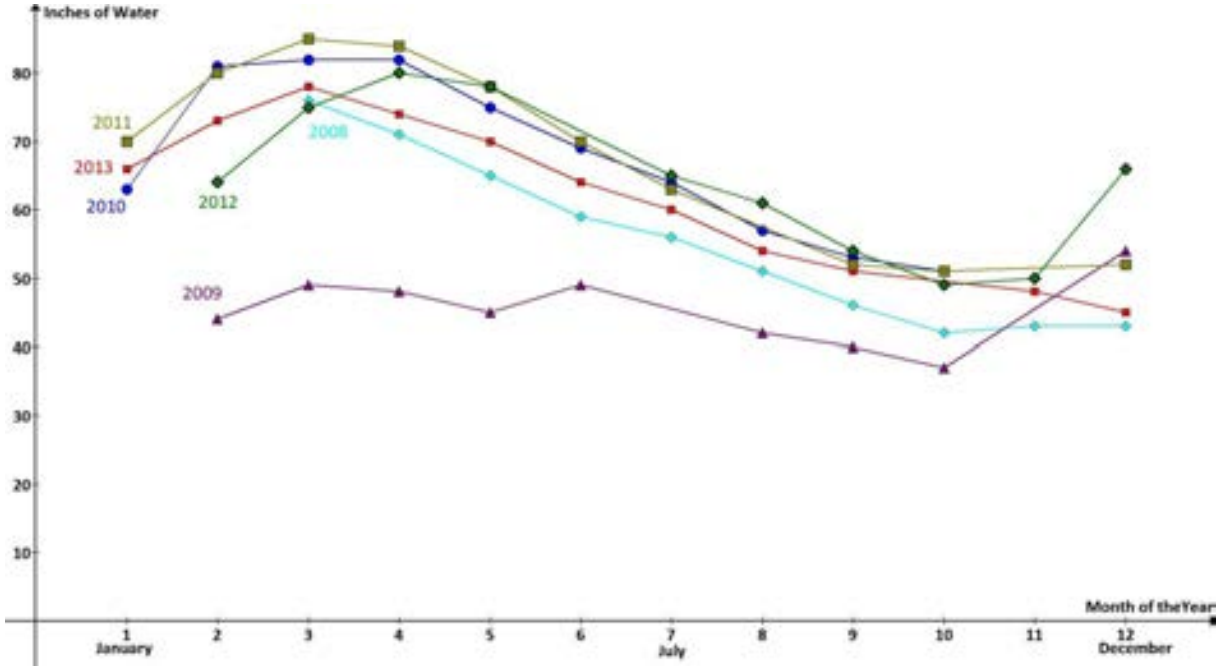


Figure 1: Well water levels near the Minto Road Forest Study Site from 2008 to the present

The lower water level in 2009 is of particular interest in that two domestic water wells in the neighbourhood ran dry that year. The Environment Canada weather station on the Puntledge River in Courtenay recorded a total precipitation of 243.8mm in November

2008 through January 2009, 55% lower than the average for the same three months over the past five year (Environment Canada 2013). This shows how important the late fall and early winter rains are in replenishing the shallow groundwater layer of the watershed. Evidence suggests the low water levels in 2009 represent a natural climatic dry period. That two neighbouring wells ran dry demonstrates how changes in the water table can adversely affect local residents and the plants, animals and fish that depend on a constant supply of water. A future comparison of the well water levels with the water flows recorded at the staff gauges installed during this project should give a better understanding of how subtle changes in the groundwater levels can affect the local ecosystem.

III-B Measuring Water Flow Using Staff Gauges

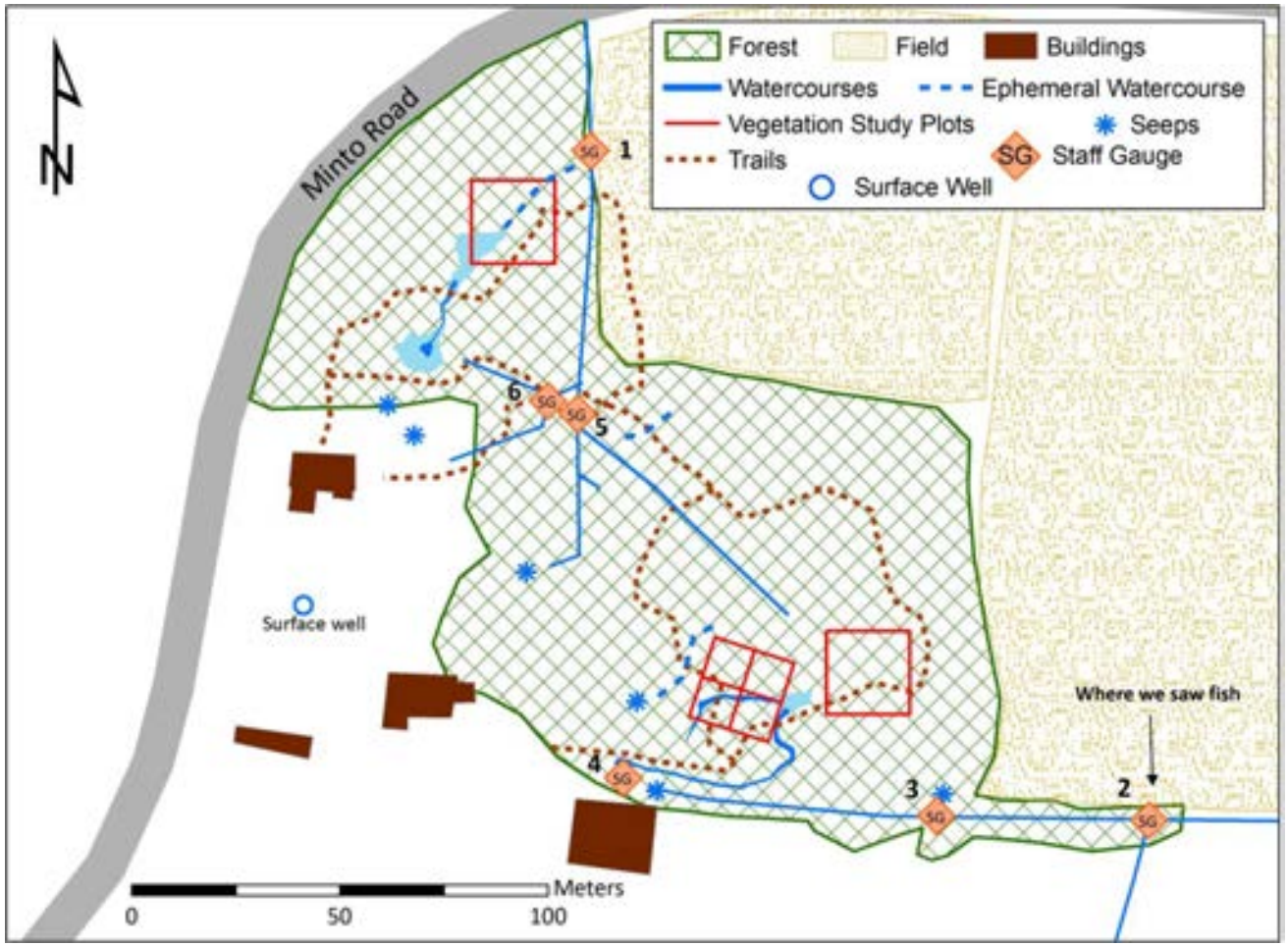
Stainless steel rulers were placed as permanent staff gauges for monitoring water flow at six locations (Map 2 and Photographs 2 - 7). The locations of the staff gauges were picked by consensus of the group based on observation of the entire forest and then choosing locations that best captured the flow of water where it could be measured. Staff Gauge 1 captured water flow from much of the forest area, including the more upstream locations of Staff Gauges 5 and 6. Staff Gauge 2 captured flow from southern portion of the forest as well as waters flowing from neighbouring properties to the south. Staff Gauge 3 was upstream of Staff Gauge 2 and caught water flow from the west.

Staff Gauge 4, at the forest pool was different in that it was measuring water in a larger fully saturated area. It appears that underground flow from the area of the pool resurfaces downstream both to the north-east (and on towards Staff Gauges 1 and 5) and also as the source of a small watercourse that flows in a shallow ditch along the south margin of the forest towards Staff Gauges 2 and 3.

Using stainless steel rulers for staff gauges was problematic in that they were very difficult to read. We attempted to correct this by switching to sections of yellow metal tape from a construction type tape measure - though these were also difficult to read. By trial and error it was discovered that the easiest way to read the stainless steel rulers was to photograph them with a digital camera and then zoom in to read the ruler. Beyond the scope of the single week of the YER program, the staff gauges and water quality will be read twice each month. The surface well will continue to be monitored monthly and the weather conditions will be monitored daily.

As the groundwater monitoring data set develops over the years it will be used as an ongoing part of YER programs and provide important trend information about the local environment.

Following the completion of the YER program Staff Gauge 1 was replaced with a V-Notch Weir (Photograph 2). Water flow at the weir is determined by a table that converts water levels read on the staff gauge to water volume.



Map 2: The Minto Road Forest study site, showing the location of the staff gauges set up during this project and also the vegetation study plots from previous projects.

Photograph 2: Staff Gauge #1 (called Wendy's Bridge) along a drainage ditch at the north east edge of the Forest.

Photograph 3: Staff Gauge #2 – At the convergence of two creeks (called the Fish Pool) at the south-east edge of the forest.

Photograph 4: Staff Gauge #3 (called the Bird House Trickle) at a spring along the south edge of the forest – near a tree with a birdhouse.

Photograph 5: Staff Gauge #4 (called The Forest Pool) in a pool along the south edge of the forest.

Photograph 6: Staff Gauge #5 (called Linda's Bridge) near some major seeps along a ditch that drain much of the central area of the forest.

Photograph 7: Staff Gauge #6 (called the Car Park Spring) at a point of consistent water flow by three cars abandoned in the 1950s.

Photograph 8: V-Notch Weir for monitoring water flow at the site of Staff Gauge #1.

III-C Water Quality

Water quality measurements were taken at each of the staff gauge locations (Table 1). All water temperatures recorded fall within a range that is considered as "cool" (13 - 20°C), which is warmer than desired and places the fish at a moderate risk of disease (Taccogna and Munro 1995). Warm water contains less oxygen than cold water. When the water temperature increases, the concentration of dissolved oxygen decreases. As the temperature rises, animals use oxygen at a faster rate (Taccogna and Munro 1995). It is interesting that the only location where we observed fish was where the water was the warmest.

Table 1: Water quality measurements at six staff gauge location in the Minto Forest Study Site – August 2013

	SG 1	SG 2	SG 3	SG 4	SG 5	SG 6
Date	14 Aug 2013	12 Aug 2013	14 Aug 2013	12 Aug 2013	13 Aug 2013	13 Aug 2013
Time of day						
Weather		Overcast and rain		Overcast and rain		
Rain in past 24 hours?		Yes		Yes		
Air Temperature	19°C	19°C	18°C	20°C	19°C	18°C
Water Temperature	13°C	17.4°C	14°C	15°C	13°C	13°C
Dissolved Oxygen	88%	91%	68%	40%	Not collected	53%
pH	6.24	5.86	5.56	5.93	5.66	5.53
Total Dissolved Solids	73 mg/l	87 mg/l	85 mg/l	125 mg/l	75 mg/l	76 mg/l

The level of Dissolved Oxygen was variable at the five sites sampled. The low dissolved oxygen levels at Staff Gauges 3, 4 and 6 are not unexpected as these locations are very near where the water was coming directly from underground. The lowest Dissolved Oxygen level recorded was at Staff Gauge 4, the forest pool, was also expected and is likely linked with the decomposition of leaves accumulating in the pool. As the water begins to flow it quickly gains oxygen and levels measured at Staff Gauges 1 and 2 are at a low but acceptable level for fish health. Healthy streams are saturated with oxygen (90 to 110% saturation) during most of the year (Taccogna and Munro 1995). Dissolved oxygen is linked to both water temperature and conditions in which the water is flowing. Cold, deep and turbulent water tends to have more dissolved oxygen.

The pH scale measures the relative acidity or alkalinity of any substance. The scale ranges from very strong acid, at pH 0, to very strong base, at pH 14 (Taccogna and Munro 1995). Pure water has a neutral pH of 7. Most aquatic organisms are sensitive to small pH changes and prefer a pH of 6.0 to 8.5. Streams that drain soils with high mineral content are usually alkaline, whereas streams that drain coniferous forests are usually acidic. The pH measured at the Minto Road Forest study site, with its abundance of coniferous trees is expected to be slightly acidic and our measurements fall within the acceptable range for non fish bearing waters. The pH reading of 5.86 recorded at Staff Gauge 2, the same site where trout were observed is of some concern as it is approaching the acidity limit for the wellbeing of Cutthroat Trout.

Total Dissolved Solid (TDS) is a measurement of inorganic salts, organic matter and other dissolved materials in water (Wikipedia 2013). The concentration and composition of TDS in natural waters is determined by the geology of the drainage, atmospheric precipitation, and the water balance (evaporation-precipitation). The most common chemical constituents are calcium, phosphates, nitrates, sodium, potassium and chloride associated with runoff of agricultural fertilizers. Total dissolved solids can cause toxicity through increases in salinity, changes in the ionic composition of the water and toxicity of individual ions (Weber-Scannell and Duffy 2007). Changes in the ionic composition of water can exclude some species while promoting population growth of others (Weber-Scannell and Duffy 2007). TDS is usually a measure of salts; the TDS of rainwater is <10ppm, and for freshwater rivers TDS ranges from 100 to 1,000ppm (Waterwatch 2012). The TDS reading of <100ppm measured at five of the six staff gauges would be considered as “soft” water and does not suggest a concern over runoffs from agricultural lands upstream of the site. The more outlying TDS measure at Staff Gauge 4, the forest pool, may be higher due to the still water of the pool and organic sediments stirred up from the pool bottom when we sampled.

III-C Inventory and Habitat Descriptions of Springs and Seeps

All of the locations in the Minto Road Forest where water was emerging from the subsurface had the appearance of seeps, where water was not bubbling up or flowing from a crack in a rock, as might better describe a spring (Photograph 9). The Forest Pool (Staff Gauge 4, Photograph 5) appeared to be the result of several seeps from where soil and fill had been piled up on the neighbouring property to the south-west of the edge of the forest. All of the seep areas had vegetation typically found in moist or wet soils (See Appendix for data sheets for each site).

We were surprised and pleased to find fish at the site of Staff Gauge #2 (Photograph 3). This was unexpected as this area is above a natural fish barrier. Dave Davies of the Department of Fisheries and Oceans (Personal Communication) was less surprised and noted that in many watersheds fish may be found above what are thought to be impassible barriers, these fish populations are often very old and date back to higher water levels following the past ice age. While it is possible that the fish may have been moved into the upper watershed by human activity, Dave Davies suggests it is more likely this is a natural population. We attempted to catch fish using a minnow trap but were not successful. On 16 September Wendy Kotilla was able to catch two fish and identified them as Cutthroat Trout (55 and 80mm in length).

Much of the success of this project was in the youth's ability to understand the importance of groundwater and its relationship with both vegetation and with the water quality delivered to fish bearing waters downstream of the seeps. We noted that while we had rain the night before and during the first day of the project, we were in the driest time of the year following a very dry summer. We discussed how the vegetation observed was very dependent on wet or moist soils and can be used as an indicator of subsurface moisture. Future changes in vegetation could be a signal of changes in the water table up-stream of the seep areas.

The success of the inventory and descriptions of springs and seeps was measured in terms of both the data collected and in the youth's ability read the landscape and to share their new found understanding of the local environment during a public tour of the area on the fifth day of the project (Photographs 10, 11 and 12).

Photograph 9: A location where water from saturated soil is seeping into a channel of water where there is just enough flow to move organic material and expose some mineral substrate on the bed of the channel. Water in this location would typically be cooler than the surrounding air in the summer, and have a dissolved oxygen level lower than needed to support a healthy fish population (See section III-C). The dissolved oxygen levels will quickly increase as the water is exposed to the air and gets stirred up as it trickles over small riffles and flows downstream.

Photographs 10, 11 and 12: On day five of the project, Gordon Hardy and Darius Lymbery-Fox hosted a public tour of the study site for 15 participants and explained the data collection methods, the importance of groundwater, and the value of a monitoring program.

IV SUMMARY

The Youth and Environmental Restoration Program has involved Phase II youth participants at the Minto Road Forest study site for three years. In 2011 and 2012 we conducted ecological inventories and mapped watercourses; in 2013 we established six sites to monitor water levels and water quality at springs and seeps within this forest. Through applying scientific methods to the local landscape, the youth increased their knowledge of regional ecology and then successfully shared their acquired wisdom on the public tour.

Ongoing environmental monitoring at the Minto Road Forest will include: monthly water level measurement at the surface well; twice monthly recording of the water levels at the six staff gauges; and daily weather monitoring (temperature, rainfall and conditions). Environmental monitoring of the Minto Road Forest will be included as part of future YER programs.

V RECOMMENDATIONS

We believe it very important to monitor groundwater in the upper Millard Creek Watershed. With proposed real-estate development in the area it is essential to establish a base-line of water level and water quality data for tracking changes in the future. An inventory of all springs and seeps in the area using a common data collection protocol would be most useful when documenting and understanding future changes in both groundwater and surface flow. Inclusion of youth with these projects is a good way for educating and connecting them with scientific research and landscape ecology as work experience, as well as just getting them outside in and learning about the natural world.

VI ACKNOWLEDGMENTS

Permission to work in this area of the Millard Creek headwaters was provided by land-owners: Sue Minchin and Wendy Kotilla.

Funding for Wendy Kotilla and the youth was provided by Ministry of Children and Family Development. Funding for Ian Moul was provided by a Grant in Aid from the Comox Valley Regional District.

Many thanks to Gilles Wendling P. Eng. and Arnd Burgert P. Geo. for advice on sampling design, and to Jim Palmer for calibrating the Hanna unit.

Richard Hart built the V-Notch Weir and worked with Wendy and two YER participants to measure and install it.

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APPENDIX – data sheets from each staff gauge study site

SPRING AND SEEP DATA	Day: 14	Month: August	Year: 2013	Staff Gauge # 1
Site Name: Wendy's bridge				
Surveyor(s): Ian, Wendy, Gordon and Darius				

SITE DESCRIPTION			
General Location: Along the east edge of the forest where it meets the field.			
Coordinates:	UTM Zone: 10	Easting: 355781	Northing: 5500775
Slope: < 5%	Aspect: There is a gentle slope to the north with an open aspect to the east.		
Description of the site: This is a ditch that was most likely dug out to lower the water table in the field to the east. The size of the red alder trees along the edge of the ditch suggest it has been around for about 30 – 40 years.			
GlideLength:	Wetted Width: 155cm	Bankfull Width: 200cm	Staff Gauge Water Level: 37mm
Substrate (%)	Organic Soil: 70%	Mineral Soil: 30%	Rocks: 0	Bedrock: 0

WATER CHEMISTRY	Time of Day: 11:43	Air Temperature: 19°C	Water Temperature: 13°C
Total Dissolved Solids (TDS): 73	Dissolved Oxygen (DO): 88%	pH: 6.24	

SITE VEGETATION: (within 5m of the spring or seep)		
Trees:	Shrubs:	Herbs:
Red alder	Salmonberry	Lady fern
		Horse tail
		Sword fern
		Grasses and aquatic plants

Notes: The bed of the ditch is made up of pale sand, covered by a thin layer of dark organic material. In places with slightly more current the sand has been washed clean.

SPRING AND SEEP DATA	Day: 13	Month: August	Year: 2013	Staff Gauge # 2
Site Name: Fish Pool				
Surveyor(s): Ian, Wendy, Gordon and Darius				

SITE DESCRIPTION

General Location: At the easternmost point of hedgerow extending from the forest. At a junction from a watercourse from the forest and from neighbouring lands to the south. 80% of the flowing waters is from the south.

Coordinates:	UTM Zone: 10	Easting: 355912	Northing: 5500630

Slope: < 5% - appearance of level ground	Aspect: There is a gentle slope to the east. Open to the east

Description of the site: At some point in the past rip-rap has been dumped to line the edges of the ditch. The bed of the watercourse is a mix of fine and course sands.

Glide Length:	Wetted Width:	Bankfull Width:	Staff Gauge Water Level: 8cm

Substrate (%)	Organic Soil: 0%	Mineral Soil: 100%	Rocks: 0	Bedrock: 0

WATER CHEMISTRY	Time of Day: 12:41	Air Temperature: 19°C	Water Temperature: 12°C

Total Dissolved Solids (TDS): 87	Dissolved Oxygen (DO): 91%	pH: 5.86

SITE VEGETATION: (within 5m of the spring or seep)

Trees:	Shrubs:	Herbs:	
Red alder	Blackberry	Grasses	Vetch
Willow species	Salmonberry	Horse tail	
		Lady fern	
		Cleavers	

Notes: We could see several fish, a salmon species presumably cut-throats trout with a length of between 10 and 14cm. The fish darted under exposed roots of bank-side trees. We set a trap for 24 hours but did not catch any fish.

SPRING AND SEEP DATA	Day: 14	Month: August	Year: 2013	Staff Gauge # 3
Site Name: Bird House Trickle				
Surveyor(s): Ian, Wendy, Gordon and Darius				

SITE DESCRIPTION

General Location: At the southern edge of the forest with a neighbouring horse paddock to the south. The Staff Gauge is in a shallow ditch like glide immediately south of a trickle of flow from a seep.

Coordinates:	UTM Zone: 10	Easting: 355858	Northing: 5500630

Slope: < 5% - appearance of level ground	Aspect: There is a gentle slope to the east. Open to the south

Description of the site: In a loose tangle of vegetation that if left alone will develop into a hedgerow.

Glide Length: 5m	Wetted Width: 55cm	Bankfull Width:	Staff Gauge Water Level: 2.6cm

Substrate (%)	Organic Soil: 100%	Mineral Soil: 0%	Rocks: 0	Bedrock: 0

WATER CHEMISTRY	Time of Day: 10:11	Air Temperature: 18°C	Water Temperature: 14°C

Total Dissolved Solids (TDS): 85	Dissolved Oxygen (DO): 68%	pH: 5.56

SITE VEGETATION: (within 5m of the spring or seep)

Trees:	Shrubs:	Herbs:	
Western red cedar	Salmonberry	Trailing Blackberry	Bracken
Red alder	Himalayan Blackberry	Horse tail	False Lilly of the Valley
Mountain ash (Rowen)	Huckleberry	Skunk Cabbage	
One tree we could not identify		Lady fern	

Notes: The base of the staff gauge ruler is 5mm into the stream bed sediments

SPRING AND SEEP DATA	Day: 12	Month: August	Year: 2013	Staff Gauge # 4
Site Name: The Pool				
Surveyor(s): Ian, Wendy, Gordon and Darius				

SITE DESCRIPTION

General Location: Along the south edge of the forest up on a gentle rise to the west.

Coordinates:	UTM Zone: 10	Easting: 355775	Northing: 5500611

Slope:	Aspect: The slope of the land is to the east.

Description of the site: A shallow pool at the southern edge of the forest and just north of the boundary with a neighbouring property. The pool appears to have been created when land was excavated and piled up on the neighbouring property. The size of the red alder trees that surround the pool suggest it had been around for about 30 years.

Pool Length:	Pool Width:	Pool Depth:	Staff Gauge Water Level:

Substrate (%)	Organic Soil: 100%	Mineral Soil: 0	Rocks: 0	Bedrock: 0

WATER CHEMISTRY	Time of Day:	Air Temperature: 20.0 °C	Water Temperature: 17.4 °C

Total Dissolved Solids (TDS): 125	Dissolved Oxygen (DO): 40%	pH: 5.93

SITE VEGETATION: (within 5m of the spring or seep)

Trees:	Shrubs:	Herbs:
Red alder	Salmonberry	Skunk cabbage
	Devil's club	Horse tail
		Bracken fern
		Sedges

Notes: Overcast after a heavy rain

SPRING AND SEEP DATA	Day: 13	Month: August	Year: 2013	Staff Gauge # 5
Site Name: Linda's Bridge				
Surveyor(s): Ian, Wendy, Gordon and Darius				

SITE DESCRIPTION

General Location: Near the east edge of the central part of the forest, just inside the forest from the trail over the field.

Coordinates:	UTM Zone: 10	Easting: 355779	Northing: 5500722

Slope: < 5% - appearance of level ground	Aspect: There is a gentle slope to the north. The site is enclosed in the forest

Description of the site: A ditch that was dug 30 tp 40 years ago that has naturalised. The base of the watercourse is fine sand with about 50% covered with organic sediments.

Glide Length: 5m	Wetted Width: 55cm	Bankfull Width:	Staff Gauge Water Level: 2.6cm

Substrate (%)	Organic Soil: 50%	Mineral Soil: 50%	Rocks: 0	Bedrock: 0

WATER CHEMISTRY	Time of Day: 11:15	Air Temperature: 19°C	Water Temperature: 13°C

Total Dissolved Solids (TDS): 75	Dissolved Oxygen (DO):	pH: 5.66

SITE VEGETATION: (within 5m of the spring or seep)

Trees:	Shrubs:	Herbs:	
Red alder	Salmonberry	Lady fern	
		Horse tail	

Notes: The base of the staff gauge ruler is 5mm into the stream bed sediments

SPRING AND SEEP DATA	Day: 13	Month: August	Year: 2013	Staff Gauge # 6
Site Name: The Car-park Spring				
Surveyor(s): Ian, Wendy, Gordon and Darius				

SITE DESCRIPTION

General Location: Within 10m to the south of the abandoned cars, at a plank bridge over a trickle of water.

Coordinates:	UTM Zone: 10	Easting: 355775	Northing: 5500611
Slope: <5%	Aspect: The slope of the land is gentle and to the north-east.		

Description of the site: A narrow trickle of water (less than 1 metre wide) with some flow from the south-west to the north-east.

Pool Length:	Pool Width: 32"	Pool Depth:	Staff Gauge Water Level:

Substrate (%)	Organic Soil: 100%	Mineral Soil: 0	Rocks: 0	Bedrock: 0

WATER CHEMISTRY	Time of Day: 09:51	Air Temperature: 18.0 °C	Water Temperature: 13.0 °C
Total Dissolved Solids (TDS): 76	Dissolved Oxygen (DO): 53%	pH: 5.53	

SITE VEGETATION: (within 5m of the spring or seep)

Trees:	Shrubs:	Herbs:	
Red alder	Salmonberry	Horse tail	Sword fern
Big-leaf maple		Bracken fern	Cleavers
		Stinging nettle	Sedges
		Skunk cabbage	

Notes: