Shelly Creek Stream Assessment

And Fish Habitat Survey

(2014 and 2015)

Report

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MVIHES
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DISCLAIMER

The Mid Vancouver Island Enhancement Society and the report's authors should not be held responsible for errors of omission or interpretation, given best efforts were made to verify the accuracy and completeness of field data collected and presented in this technical document.

1.0   Introduction

The Shelly Creek watershed is the most developed sub basin in the Englishman River watershed (Clough, 2013). A high proportion of the watershed is privately owned (84.5%) and is dominated by residential and farm activities that have impacted the creek through ditching, stormwater, loss of riparian cover, low flows, barriers to fish migration and poor water quality (Bocking &Gaboury 2001, Walshe 1999). Despite these impacts to fish and fish habitat, the creek continues to be a major contributor to Coho smolt production for the Englishman River watershed (Clough 2013, Riordan 2016).

The Mid Vancouver Habitat Enhancement Stewards (MVIHES) have been active in the Shelly Creek watershed for over 16 years. The following is a list of projects which have been undertaken to improve the understanding of the stream's health:

- In 1999, a stream assessment was completed using the Urban Salmon Habitat Program methodology, from the creek's confluence with the Englishman River to the E & N railway (Walshe,1999).
- In 2009, the municipal and MOTI road ditch lines, that discharge into Shelly Creek were identified and assessed for the presence/absence of fish (MVIHES 2009).
- From 2011 to present, working with the Regional District of Nanaimo in an annual water Community Watershed Monitoring Network (CWMN) Trend sampling program (Barlak, 2013).
- From 2011 to present, operating a downstream fish counting fence to enumerate Coho smolts migrating into the Englishman River (Clough 2011, 2012, 2013; Riordan 2015, 2016).

In summary, the stewards have determined that Shelly Creek is a significant contributor to Coho salmon smolt production for the Englishman River; however it appears to have poor water quality, with higher than normal turbity, especially during storm (peak flow) events.

In the summer of 2014, the stewards began a stream channel assessment project for Shelly Creek with the following objectives:

1. To determine the possible reason(s) for high sediment values for Shelly Creek, identified in the CWMN water sampling (2011 to 2013).
2. To identify the changes to the biophysical conditions of Shelly Creek (fish habitat) since the original assessment 15 years ago.

2.0   Methods

To assess both the stream channel condition and the possible changes to fish habitat over time, the project used the Urban Salmon Habitat Program (USHP) survey methodology (Michalski et al. 2001). The methodology was developed for completing fish and fish habitat assessments on urban streams by stewardship groups, with the goal of identifying fish habitat restoration projects. The USHP survey methodology contains four modules:

- Instream habitat assessment
- Riparian assessment
- Fish assessment
- Mapping project

The first step in any stream assessment is the overview stage, where we attempted to find available information on Shelly Creek's biophysical condition along with mapping to determine access and reach breaks. Much of the stream crosses private property, so permission from landowners was sought.

In June 2014, a training day was organized and delivered by DR Clough Consulting for members of the MVIHES. The training included a review of the instream and riparian assessment procedures. To ensure capture of a complete dataset of habitat conditions, the entire stream channel length was surveyed.

Upon completion of the USHP assessment, a Professional Geomorphologist reviewed the habitat data collected, and completed a field assessment to provide a summary of possible fish habitat enhancement project concepts (Hilsen, 2014).

In 2015, the stewards decided to continue the stream assessment into the upper reaches, to seek information about physical channel conditions, which may be contributing to high turbity values in the CWM water sampling program. To undertake a field survey on the creek channel conditions required some modifications to the USHP methods for the following reasons:

- The stream channel is no longer considered to be "directly" contributing to fish, and therefore cannot be considered as fish habitat (for USHP purposes).
- The channel is dry for approximately 6 months of the year.

The first modification to the method was to eliminate measurements of fish habitat, including:

1) habitat type; 2) wetted width; 3) average depth; 4) instream cover.

The second modification was to measure the channel based on it's "condition". To accomplish this a stream channel "condition" assessment was used (Hogan, 1996). The channel was classified as follows:

- **Natural Channel** – measurements of channel length, typology and gradients that are not disturbed with severe bank erosion.
- **Obstructed Channel** – measurement of channel length, typology and gradient associated with a channel plugged with large woody debris.
- **Altered Channel** – measurement of channel length, typology and gradient of a channel modified by man (ditched, rip rapped, culverted).

3.0   Results and Discussion

3.1   Overview of Shelly Creek Assessment in 2014 and 2015

The Shelly Creek watershed has a total channel length of almost 6.5 km from the headwaters in Errington to the confluence with the Englishman River (Hilsen, 2014). This watershed can be described as a 1st order stream (Michalski 2001). The assessment took place over a two year time frame during low flow, summer/fall months. The channel assessment took several forms, and can best be described by the reaches used to describe homogenous sections of the channel (Fig. 1).
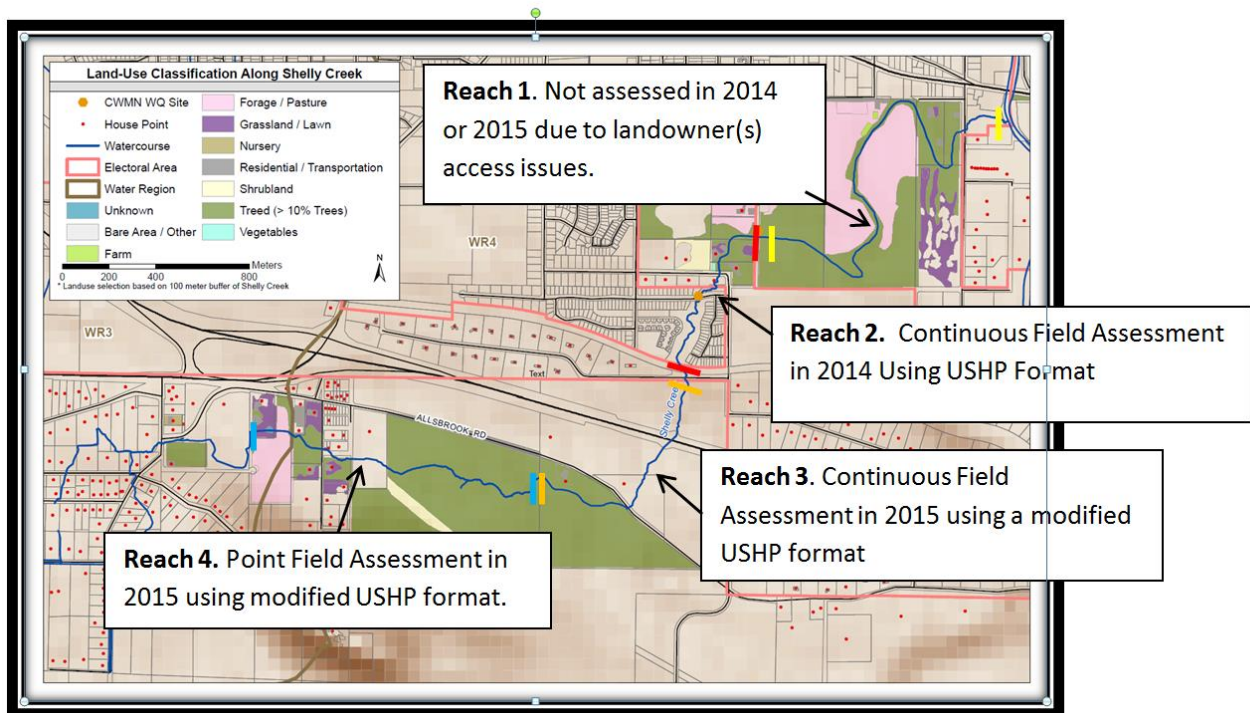

Figure 1. Reaches of Shelly Creek

The following is a summary of the how each reach was/was not assessed:

Reach 1. Creek confluence with the Englishman River - upstream to Blower Road

This lower reach of the creek is 1670m in length and is dominated by the Shelly Farm. Access was not permitted by MVIHES surveyors, however access was permitted for the Geomorphologist review in 2014 (Hilsen 2014). This is a very important reach, as it has anadromous fish rearing in the lower 620m of wetland which crosses Martindale Road. The remaining 60 % of the stream within the reach has been modified for farming. Other significant features include a (man made) barrier to fish passage and a discharge of stormwater from Stanford Ave.

Reach 2. Blower Road - upstream to the E&N Railway Crossing

This reach is 900m in length, and is accessible to resident cutthroat trout. It has a stream gradient of 2% to 3%. The USHP survey was used to assess the channel "continuously" (meter x meter) through the entire reach. The landuse is characterized as small rural properties and urban interface, with three road crossings. The creek's riparian vegetation has been protected in a park above Hamilton Road.

Reach 3. E&N Railway Crossing - upstream to Island Timberlands (east) Property Boundary

This reach is 1133m in length with an average stream gradient of 5% to 7%. The stream is located in a forested gully for much of this reach. The channel is characterized by cascade pools with significant large woody debris jams causing channel erosion during winter storm events. The channel is dry from approximately 6 months of the year. Channel assessment took place using a modified USHP format. The assessment was "continuous" (meter x meter) through the entire reach.

Reach 4. Island Timberlands Property (east) Property Boundary to Feneral Home (east) Property Boundary.

This upper reach is 1300m in length, and is 0.5% gradient. The landuse includes the large forestry parcel owned by Island Timberlands, and several hobby farm residential properties. Due to limited access to the stream due to private property, we accessed the creek in three locations (where permission was granted), and measured channel conditions over a 100m length.

According to the Fish in The Ditch Atlas, the stream originates from ditches in the Ruffels Road and Bellevue Road area, which extends the stream channel approximately 1000m (MVIHES, 2009).

3.2   Survey Findings for Reach 2:

The raw data showing habitat measurements for Reach # 2,3 and 4 are found in Appendix 1 of the digital version of this report. Photos of each reach are found in Appendix 2 of the digital version of this report.

To results of the reach # 2 survey, using the USHP "rating of habitat values", we can conclude that the reach can be rated as in "poor condition" (Table 1).

Table 1. Results of USHP Biophysical Habitat Conditions for Reach #2

Habitat Parameters	Value	Ratings
% Pool Area	60.69	Good
Mean Stream Depth (m)	0.15	Poor
LWD/Bank Full Channel Width	0.5	Poor
% Cover in Pools	< 5	Poor
Average % Boulder	5	Poor
Average % Fines	45	Poor
Average % Gravel	35	Fair
% of Reach Eroded	34	Poor
Obstructions	27	Poor
% of Reach Altered	10	Poor
% Wetted Area	50	Poor
DO	6.4	Fair
Ph	7.5	Fair
H20 Temp	15 - 23	Poor

The survey was conducted in July 2014, during low flows, in a record dry and warm summer. There was very little riffle habitat available for fish, which at this time, are confined to pools that are very shallow. Flows were not measured during this survey, but estimated at 0.5 liters/minute. All of the flows emerged from a spring located in the channel about 80 meters below the E&N railway. Some other notable findings in the survey include the following:

- The large number of obstructions in the channel. There are 4 culverts in the reach which are significant barriers to fish movement, but by far the number (n =22) of large woody debris jams that have blocked the entire channel and built up a sediment plug has reduced fish movement to only high flow time periods.

- Over one third of the reach has actively eroding channel features like exposed soil streambanks and exposed tree roots.
- Nearly 50 percent of the entire reach has channel substrates dominated by fines (sands and mud).

When comparing the 2014 USHP data with the 1999 survey on the same reach, we can see some significant changes to habitat values due to changes in the stream channel (Table 2). Repeat habitat surveys provide a means to compare reaches against measureable channel attributes. Thomas (2012) identified factors that can cause survey data results to vary that should be considered when evaluating the surveys below:

- Different surveyors may interpret features differently
- Measuring equipment may not be calibrated
- Habitat features change depending on the time of the year.

Now, it should be recognized that the USHP methodology was designed to be simple (to the public), without need of sophisticated measuring tools, for exactly the purpose of comparing data between years.

Table 2. Comparison of 1999 and 2014 USHP Surveys for Reach #2*

Stream Reach	Blower Rd. -Butler Rd.		Butler Rd. - Corfield Glades storm		Corfield Glades storm - Hamilton Rd.		Hamilton Rd. to E and N Culvert	
Reach Length	280 m		98 m		44 m		338 m	
Survey Year	1999	2014	1999	2014	1999	2014	1999	2014
% Pool Area	81.1	40.0	100	54.5	100	28.6	61.56	70.13
Debris/Bankfull Channel Width	0.34	0.47	0.1	0.31	0	0	0.72	0.78
% Cover in Pools	42	44	20	23	5	0	45	37
Average % Boulder Cover	0	0	0	0	3	0	0	4
Average % Fines	20	43.3	5	30	55	0	46.3	72.5
Average % Gravel	80	39.3	75	45	5	0	30	14.3
% of Reach Eroded	0	45.6	29	75	0	0	0	87
# of Obstructions	1	11	0	0	1	1	6	16
% of Reach Altered	0	11.1	64	42	64	92	0	1
% Wetted Area	100	58.8	62.0	49.3	42.8	42.8	32.76	48.3
Stream Temp	14.0	14.9	13.0	15.3	10.8	20	10.4	23
Dissolved Oxygen	6.4	6.2	7.9	7.7	8.7	6.4	8.3	6.4
PH	7.8	7.25	7.8	6.4	7.9	7.7	7.8	7.7

* In 1999, reach 2 was subdivided into 4 separate reaches. The table reflects the habitat values found in each sub-reach for each year surveyed.

Habitat differences in the reach between the 1999 and 2014 surveys include the following:

- **Percent Pool Area** – the lower reaches (Blower to Butler Road) of the stream appear to have experienced a decrease (by 50%) in the amount of pool habitat available for fish since 1999. This is a result of sediments from upstream reaches settling into slower pool habitats. Note that the upper reach (Hamilton Rd. to E and N Culvert) had significant erosion values which are moving sediments downstream. Fish are confined to pools in low flow periods, so few pools = less habitat available for fish.
- **Debris/Bankfull Channel Width** – The only significant change in the amount of large woody debris in the area surveyed is between Hamilton Rd and Butler Rd culverts (homeowners/public works crews cleaning out debris to prevent localized flooding?). Fish prefer streams with high debris indices, as they provide complex cover.
- **Average Percent Fines**: A significant increase in the amount of fine sediment covering the bottom of pools throughout the survey area. Fish do not survive in streams with muddy substrates
- **Average Percent Gravels**: A decrease in the presence of gravels as a substrate in the stream. Fish require gravels for spawning.
- **Percent of Reach Eroded**: Significant increases in the erosion of stream banks, associated with (winter) high stream flows. The erodible (alluvial) materials are modifying (infilling) pools downstream.
- **Number of Obstructions:** The survey area had a high number of obstructions to fish movement (upstream or downstream) at these summer low flows. The dominate obstruction type observed were woody debris (root) jams with gravel plugs. There are 4 road culverts in this reach.
- **Percent of Reach Altered:** Within the survey area, the Hamilton Road culvert to Bulter Road culvert have seen the most "alteration" by humans, in the form of rip rap and wood debris management (removal).
- **Percent Wetted Area:** This value is trending negatively, similar to Percent Pool Area (above). The stream's wetted area is "filling in" due to migration of sediments from upstream reaches into the pools. Erosion of the substrates and stream banks in the reach(es) above Hamilton Rd is creating more wetted habitats for fish (note- fish were observed in a 50 meter area of the entire stream survey area).
- **Stream temperatures:** The temperature of the upper reaches seemed high in 2014, despite the excellent riparian cover throughout the survey area.

Figure 2. Measuring Pool Depth on Shelly Creek

Figure 3. Measuring Cluvert at Blower Road

In conclusion, the changes in stream conditions, as seen in reach # 2 have been a result of changes to natural stream flow rates in the watershed over the past 15 years as a result of land use within the watershed, changing the hydrology (Hilsen 2014).

Data captured during the 2014 USHP survey, on the condition of riparian vegetation along reach # 2, shows that much of the stream seems to have adequate shade due to large undisturbed streamside areas (Table 3).

Table 3. Results of USHP Riparian Survey for Reach #2

Riparian Conditions	Value	Rating
Land Use	Natural	Good
Riparian Slope	5%- 10%	Good
Bank Stability	Low to Moderate	Poor
% Crown Closure	80% - 90%	Good
% Reach Accessed by Livestock	0	Good
Average Veg. Depth	30m	Good

3.3   Survey Findings for Reach 3:

The stream channel in reach # 3 climbs to a five percent (+/-) gradient, resulting in a cascade pool type of stream channel with large woody debris jams (Table 4). This reach is confined to a deep forested gully which confines the channel. Several (bankful width) woody debris jams have created obstructions in the channel, where sediment accumulates above the jam and erodes a deep pool into the hardpan clay downstream during high winter flows (Fig. 4).

Table 4. Biophysical Conditions Measured in Reach #3

Reach Segments		Wildwood to Hwy.19 (266.4 m)			Hwy. 19 to Allsbrook Rd. (332.3 m)			Allsbrook Rd. to IT Property Boundary (533.9 m)		
	Channel Conditions	Natural Channel	Obstructed Channel N= 4	Altered Channel N= 2	Natural Channel	Obstructed Channel N= 6	Altered Channel N= 1	Natural Channel	Obstructed Channel N = 6	Altered Channel N = 2
	Cumulative Length (m)	162.3 (61%)	90.8 (34%)	13.3 (5%)	163 m	144.5 m	24.8 m	195.4 m	130.7 m	207.8 m
Channel Measurements	Bankful (Channel) Width	0.7 m	1.85 m	1.5 m	3.0 m	2.0 m	3.0 m	2.5 m	1.75 m	5.0 m
	Average Depth	0.6 m	0.86 m	0.8 m	0.65 m	1.0 m	0.5 m	0.5 m	0.6 m	0.5 m
	Channel Gradient	3.3 %	6.5 %	5.0 %	0.6 %	7.0 %	1.0 %	2.5 %	5 %	1 %
	Erosion Sites	84 m	90 m	0 m	10 m	144 m	0 m	0 m	121 m	50 m
Substrates	Boulder	0 %	0 %	100 %	0 %	0 %	0 %	0 %	0 %	0 %
	Cobble	20 %	< 5 %	0 %	0 %	< 5 %	10	0 %	0 %	0 %
	Gravel	40 %	< 20 %	0 %	20 %	< 5 %	50	10 %	0 %	0 %
	Fines	70 %	30 %	0 %	80 %	90 %	40	70 %	50 %	100 %
	Hardpan Clay	0 %	50 %	0 %	0 %	< 5%	0	20 %	50 %	
Channel Cover	# LWD	2	30 +	0	9	50 +	2	8	35 +	5
	% Crown Closure	60% - 70 %	60% - 70 %	60% - 70 %	60% - 70 %	60% - 70%	60% - 70%	60% - 70%	60% - 70%	60% - 70%
Riparian Conditions	Slope	50 %	50 %	5 %	40 %	40 %	40 %	40 %	40 %	40 %
	Vegetation	NF	NF	NF	NF	NF	NF	NF	NF	NF
	Stability	Moderate	Moderate	High	Moderate	Moderate	High	Moderate	Moderate	Low
	Landuse	Forestry	Forestry	Road Culvert	Forestry	Forestry	Road Culvert	Forestry	Forestry	Road Culvert and Residential

Figure 4. Example of Large Woody Debris Obstruction in Reach #3

Within the reach, there were sixteen (bankful) debris obstructions with accumulated woody debris that accumulate in jams covering thirty two percent of the reach's length (Fig. 5). Three road crossings in this reach (including Hwy. 19) have culverted (altered) twenty two percent of the channel's length.
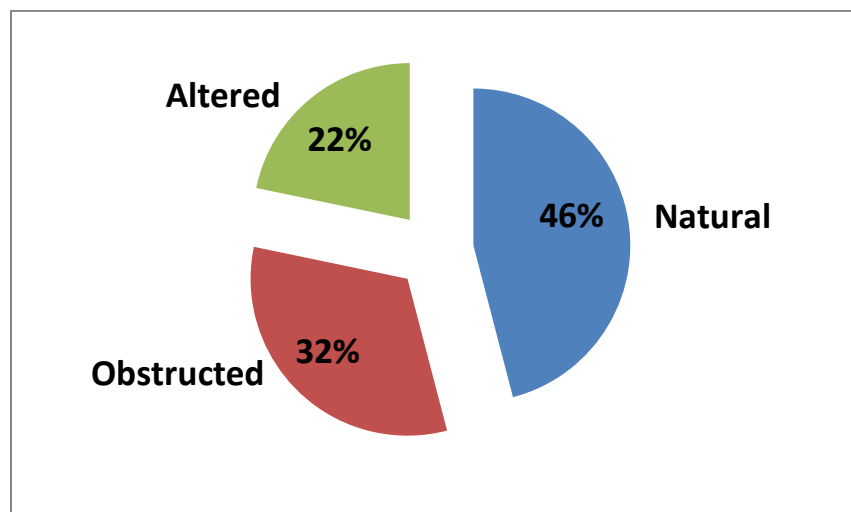

Figure 5. Channel Conditions in Reach #3 as Shown as a Percent of Length

The channel conditions appear to be a unstable, with fourty percent of the reach agrading (eroding) and the remainder being subjected to deposition of sediments during peak winter flows. This reach is devoid of surface water from May to early October every year.

Riparian conditions through much of the reach are exellent, with maturing second growth conifer forest conditions providing stable riparian conditions (Fig. 6). Landuse is primarily forestry (Crown owned). Two hobby farms in the upper portion of the reach have resulted in enroachment of a building and (private) bridge impacting the channel.

Figure 6. Conifer Forests Dominate Riparian in Reach #3

3.4 Survey Findings for Reach 4:

This upper reach of Shelly Creek has limited access due to private property ownership, so only three locations were assessed (where landowner permission was granted). A striking finding at all locations was the fact that the stream channel is uniform with few natural substrates, showing strong evidence of ditching (Table 4). Based on the type of land development in this reach (large acreage hobby farms), and the (landowners) desire to ensure adequate drainage of their property, we conclude this reach has been highly modified by ditching.

Table 5. Biophysical Conditions Measured in Reach #4

Reach Segments		Island Timberlands Property (287.4 m assessed)			Property upstream of Popham Road. (100 m assessed)			Property downstream of Funeral Home. (135 m assessed)		
	Channel Conditions	Natural Channel	Obstructed Channel	Altered Channel	Natural Channel	Obstructed Channel	Altered Channel	Natural Channel	Obstructed Channel	Altered Channel
	Cumulative Length (m)	0	0	287.4	0	0	100 m	0	0	135 m
Channel Measurements	Bankful (Channel) Width	0	0	2.5 m	0	0	3.0 m	0	0	3.0 m
	Average Depth	0	0	0.8 m	0	0	1.0 m	0	0	1.0 m
	Channel Gradient	0	0	0.5 %	0	0	0.5 %	0	0	0.5 %
	Erosion Sites	0	0	0 m (0%)	0	0	0 m	0	0	0 m
Substrates	Boulder	0	0	0 %	0	0	0 %	0	0	0 %
	Cobble	0	0	0 %	0	0	0 %	0	0	0 %
	Gravel	0	0	0 %	0	0	0 %	0	0	0 %
	Fines	0	0	20 %	0	0	0 %	0	0	0 %
	Hardpan Clay	0	0	80 %	0	0	100 %	0	0	100 %
Channel Cover	# LWD	0	0	0	0	0	0	0	0	0
	% Crown Closure	0	0	60% - 80%	0	0	60%	0	0	10%
Riparian Conditions	Slope	0	0	2 %	0	0	0.5 %	0	0	0.5 %
	Vegetation	0	0	NF	0	0	NF	0	0	Gr
	Stability	0	0	High	0	0	High	0	0	High
	Landuse	0	0	Forestry	0	0	Residence/Hobby Farm	0	0	Residence/Hobby Farm

The riparian conditions of each assessment site assessed depended on the landuse. Where the stream channel crossed through a hobby farm's open pasture, the riparian conditions were limited to a two meter fringe of alder and shrub (Fig. 7).

Figure 7. Riparian Conditions of Shrubs Common to Reach #4

4.0   Conclusion

Results from the USHP field surveys in 2014 and 2015, provide strong evidence that Shelly Creek is undergoing significant impacts to it's ability to sustain viable biologically functioning aquatic ecosystems. Changes to stream channel conditions over the past 16 years have resulted in severe erosion and deposition of fines, choking off the stream's ability to remain an important contributor to salmon and trout production.

Efforts to repair the stream's biological health will have to be "watershed based", designed to restore proper hydrologic functioning over the long term. We support the implementation of a Water Balance Model study that will provide a complete understanding of how water flows can be restored, while balancing the needs of landowners. A campaign to "enlighten" local landowners of the health of the creek needs to be undertaken. Site specific issues associated with major channel obstructions and culvert management should also be a priority.

5.0   References

Barlak, R. RDN Community Watershed Monitoring 2011-2013 Trends.
http://www.mvihes.bc.ca/images/pdfs/Barlaktrends.pdf

Bocking R. and M. Gaboury 2001. Englishman River Recovery Plan
http://www.mvihes.bc.ca/images/pdfs/Bocking2001.pdf

Clough, Dave R. 2013 Englishman River Habitat Status
Report.http://www.mvihes.bc.ca/images/pdfs/D.R2013.pdf

Hilson, W. 2014. Shelly Creek Geomorphic Overview and Conceptual Level Habitat
Enhancement Program Development.
http://www.mvihes.bc.ca/images/pdfs/ShellyCreek.final.pdf

Hogan, D.L, S.A Bird and D.J. Wilford 1996. Channel Conditions and Prescritions Assessment
(Interim Methods) WRP Circular No. 7. MELP.

Johnston N.T. and P.A. Slaney Fish Habitat Assessment Procedures. Watershed Restoration
Technical Circular No. 8. B.C.MELP and Ministry of Forests.

Michalski, T.A., G.E. Reid and G.E. Stewart. 2001. Urban Salmon Habitat Assessment
Procedures for Vancouver Island. B.C. MELP Nanaimo B.C.

Mid Vancouver Island Habitat Enhancement Stewards 2009. Fish in the Ditch Atlas. Deep Bay
to Lantzville. Prepared by the Mid Vancouver Island Enhancement Society. mvihes.ca

MVIHES (D.R. Clough and B. Riordan authors) 2011, 2012, 2013, 2015, 2016. Shelly Creek
Smolt Trap Reports. For DFO Stock Assessment and Dave Davies, Community Programs , DFO
Comox B.C.

Thomas, P. 1999. Restoration and Species at Risk and Recovery: The Urban Slamon Habitat
Experience. Restoration of Natural Systems. UVic, Environmental Studies. Proceedings of
Biology and Management of Species at Risk Conference. Kamloops BC.

Walshe, P. 1999. Shelly Creek Urban Salmon Habitat Assessment. Commissioned by City of
Parksville on behalf of Mid Vancouver Island Habitat Enhancement Society

6.0   Appendix

USHP Data set for Reach 2 and Stream Photos for Reach 2, 3 and 4 available at the MVIHES
digital library http://www.mvihes.bc.ca/documents/mvihes-digital-library-river-resources