Englishman River Habitat Status Report

For

Mid Vancouver Island Habitat Enhancement Society

October 31 2013

By

David Clough, RPBio
D. R. Clough Consulting
Fisheries Resource Consultants
6966 Leland Road Lantzville B.C. V0R 2H0
Ph/fax: 1-250-390-2901, email: drclough@shaw.ca

MVIHES
Mid Vancouver Island Habitat Enhancement Society

PACIFIC SALMON FOUNDATION

livingrivers
GEORGIA BASIN
VANCOUVER ISLAND

Executive Summary

The Englishman River Watershed Recovery Plan (ERWRP) is guided by a Community Steering Committee. The Steering Committee is attended by members of all levels of government, conservation groups, private consultants and forest companies as well as occasional guests. The Mid Vancouver Island Habitat Enhancement Society (MVIHES) has chaired the meetings since the Recovery Plan's inception in 2001. MVIHES also undertakes information, education and community stewardship activities involving restoration and monitoring in the watershed.

With massive numbers of reports, restoration plans and actions, stock assessment reports, inventories, groundwater mapping, water quality monitoring, education and awareness etc. that have focused on the Englishman River both before and after the Recovery Plan was initiated, MVIHES felt that a Habitat Status Report was apropos. It was time to see how the river is doing today. A further objective of this report was to identify habitat indicators of a healthy watershed from the reference material that can generate volunteer projects such as monitoring programs and restoration activities for the stewardship community - the community that will care for and protect, as much as possible, its own watershed.

Fisheries and Oceans Canada has developed the framework as part of its staged implementation of the Wild Salmon Policy (WSP). Work under the WSP started with the identification, in BC, of functionally distinct groups of salmon, these are called Conservation Units. The salmon populations of the Englishman River are part of larger Conservation Units for chinook, coho, pink, chum and river sockeye. Strategy 2 of the WSP informs the assessment of habitat status, which considers the habitat required for each life stage of each species of salmon and has the significant effects of habitat alteration weighed against its life stages (spawner, egg, alevin, summer fry, winter fry, smolt, marine coastal, marine offshore, returning adult). Through the examination of the watershed habitat characteristics and their status, high value habitats can be identified for protection and potential limiting factors to production can be identified for further investigation and restoration. This Habitat Status strategy is to allow habitat managers to understand at the larger CU level as well as the provincial level what are the significant limiting factors of B.C. streams and how they measure up among themselves in health. The reporting of habitat status should also identify the habitat indicators appropriate for monitoring in this watershed to provide baseline information for the stewards to measure the success or failure of their endeavors to keep the watershed healthy and resilient over time.

The reaches of the Englishman River Mainstem and the salmon bearing tributaries, Shelly Creek, Morison Creek, South Englishman and Centre Creek plus the Estuary are described following the template prescribed by Fisheries and Oceans. The descriptions include general habitat conditions, high value habitats, limiting factors and restoration activities completed.

The Englishman River Watershed is well described as a result of initial baseline inventories of Fish Habitat, River Morphology and Watershed Assessments which were funded by the Pacific Salmon Endowment Fund Society, the initiators of the Recovery Plan, in 2001. Many activities have evolved from that start - other assessments, management plans, monitoring, information and awareness and restoration activities. Along with many partners, the Englishman River Watershed Recovery Plan (ERWRP) achieved much in the 5 years of its existence. It carries on today thanks to the commitment of the members of the Steering Committee.

Englishman River Habitat Status Report

Introduction:

The Wild Salmon Policy (WSP) was developed by the department of Fisheries and Oceans Canada (2005) to promote the restoration and conservation of native salmon populations and their habitat. This is to be accomplished by protecting genetic diversity, by conserving salmonid habitat and through fisheries management.

Implementation of the WSP is based on identified Conservation Units (CUs) for all species of Pacific Salmon. A CU can be defined as a group of wild salmon sufficiently isolated from other groups that, if extirpated, is very unlikely to recolonize naturally within an acceptable timeframe, e.g. a human lifetime or a specified number of salmon generations (Stalberg et al., 2009). In the Englishman River watershed there are six identified conservation units (DFO Mapster) most in the East Coast Vancouver Island (ECVI) area;

1. ECVI Qualicum-Puntledge Fall Chinook Salmon
2. Georgia Strait Chum Salmon
3. ECVI –Georgia Strait Coho Salmon
4. Georgia Strait Even Year Pink Salmon
5. Georgia Strait Odd Year Pink Salmon
6. ECVI –Georgia Strait River Sockeye Salmon

The WSP has implemented six strategies to achieve its goals. Listed below are the strategies from WSP 2005.

Strategy 1 – Monitoring of Wild Salmon Stock Status
Strategy 2 – Assessment of Habitat Status
Strategy 3 – Ecosystem Values and Monitoring
Strategy 4 – Strategic Planning
Strategy 5 - Program Delivery
Strategy 6 - Review

The objective of this report is to provide a Habitat Status Report for the Englishman River Watershed. Habitats are to be assessed within particular CUs. Habitats which support or limit salmon production within CUs must be identified. This data is synthesized and used as a tool to develop specific plans which are subject to consistent review.
Strategy 2 of the policy (Stalberg et al 2009) states the Habitat Status principles and identifies four steps:

1) Document habitat characteristics within CUs
2) Select indicators and develop benchmarks for habitat assessment
3) Monitor and assess habitat status
4) Establish linkages to develop an integrated data system for watershed management.

A Watershed scale was selected over an entire CU to expedite and explore the pilot nature of the project, and for the practicality of acquiring information on multiple CU species through single interviews with local watershed–based personnel[1]. Stalberg et al (2009) developed a multi stage approach of the habitat status indicators, metrics and benchmarks to provide a standardized pool of “pressure indicators”. The scope of work for the project included the following actions:

1. Collect and review habitat information for the Englishman River and its four tributaries;
2. Complete Habitat Status Template Tables provided by DFO for 5 species of Pacific Salmon;
3. Identify appropriate indicators and benchmarks (or thresholds), where possible, in conjunction with DFO, and
4. Prepare a report documenting the data sources and results obtained outlining the methodology used i.e. this report.

[1] Pers comm. Margaret Wright, DFO.

Survey Methods:

This habitat status report was prepared by following the steps outlined by Stalberg et al (2009) to provide parameters that could be compared for management purposes across the Pacific Region of Fisheries and Oceans. This project involved reviewing previous reports as well as interviewing personnel that were responsible for assessments and restoration activities that have taken place on the mainstem of the river as well as its four major tributaries.

The Englishman River watershed is unique in assessment efforts for having been chosen as the first river to receive funding in 2001 from the Pacific Salmon Endowment Fund (PSEF) to establish a Watershed Recovery Plan. The PSEF technical committee commissioned a series of reports including the Englishman River Watershed Recovery Plan (Bocking & Gaboury, 2001), Overview Assessment of Fish and Fish habitat in the Englishman River Watershed. (Lough & Morley, 2002) and the Englishman River Channel Condition Assessment (Rood 2002), which led to " A Strategy for Protection and Restoration of the Englishman River Mainstem" (Gaboury 2005). Many other reports have contributed to the knowledge base, some before the Recovery Plan, but most after.

Table 1. Web Based Information Search Sites.

Name and Type	Purpose	Source
Community Mapping Network: - Sensitive Habitat & Mapping (SHIM) - BC Wetlands	to access sensitive habitats and species distributions	http://cmnbc.ca/
Mapster - Fisheries and Oceans data base map	to access distribution maps, conservation units, WSP policy, escapement.	http://www.canbcdw.pac.dfo-mpo.gc.ca/ows/imf.jsp?site=mapster
Fisheries Information Summary System (FISS) - B.C. Environment data files	to access fish habitat data, historical escapement, watershed codes	http://www.env,gov.bc.ca/fish/fiss/index.html
Hectares BC	to access summarized data on natural resources including terrestrial ecosystems and climate	http://www.hectaresbc.org/app/habc/HaBC.html
Cross-Linked Information Resources • BC Species and Ecosystems Explorer • Biodiversity/Environmental Information Resources • Environmental Protection Information Resources • Ecocat • Ministry of Forests and Range Library • Species Inventory Web explorer	Umbrella search to access files throughout a variety of catalogues	http://www.env.gov.bc.ca/clir/

Personal interviews and questionnaires were conducted to assist with completing information either not published or out of date. The questionnaires followed a standard format supplied by DFO to answer up to 13 topics on river habitat status. Appendix 2 contains the replies of key people from various affiliations involved in the watershed over many years.

Besides the questionnaires, many other people were important resource information sources or provided Interviews were done with members of stewardship groups, BCCF, DFO, MOE and other organizations. A list of contacts is shown below ;

Table 2: List of local interview contacts.

Interviewee	Occupation	Information
James Craig	Fisheries Technician, BCCF	Questionnaire Appendix 2
Margaret Wright	Restoration Biologist, DFO	Questionnaire Appendix 2
Rosie Barlak	Water Quality Biologist, MOE	Questionnaire Appendix 2
Patrik Zetterberg	Stock Assessment Technician, DFO	Questionnaire Appendix 2
Steve Baillie	Stock Assessment Biologist, DFO	Questionnaire Appendix 2
Joan Michel	RDN Parks and Trails Director	Questionnaire Appendix 2
Craig Wightman	Director & Senior Biologist, BCCF	Questionnaire Appendix 2
Graham Hill	Engineering Consultant	Suggestions for restoration initiatives
Bob Hurst	Biologist, Fisheries and Oceans (Ret.)	History and suggestions for restoration
Mike McCulloch	Fisheries Specialist, MOE	History and suggestions for restoration
Mike Squire	Manager, ER Water Service	Information about AWS and water usage
Ken Epps	Island Timberlands	Report edits and watershed information
Gilles Wendling	GW Solutions Inc., Hydrogeologist	Groundwater edits and information
Carol Stewart	MVIHES, Coordinator (Ret.)	Information about riparian restoration
Faye Smith	MVIHES Coordinator	Information -planning and history of ERWRP

The literature and interview information was collected, interpreted and synthesized into the Habitat Status Report template provided by DFO. Important information included: known limiting factors, high value habitats, data gaps, possible measures to address limiting factors, possible measures to maintain productivity, habitat protection and restoration measures undertaken, as per the spreadsheet. The information collected identified habitat pressures and indicators, which were discussed in the Stalberg et al (2009) report. These indicators were developed, along with metrics and benchmarks by a DFO habitat working-group and provide the foundation for an in-depth monitoring program to track the status of habitat condition in the watershed. Where there were information gaps, personal interviews were conducted in an effort to obtain the missing data.

Watershed Information:

The Englishman River watershed is 324 km^2 in area. The headwaters begin on Mount Arrowsmith (1,817 m) and drain east through Parksville to Georgia Strait, a distance of over 35 km. The river empties into an extensive estuary that measures approximately 129 ha in size, including adjoining uplands.

There are three main biogeoclimatic zones (hectaresbc.org) for the Englishman River Watershed – Coastal Douglas Fir (CDF) with 3,057 ha, Coastal Western Hemlock (CWH) with 14,009 ha and Mountain Hemlock (MH) with 4,027 ha[2] . The lower salmon bearing reaches are in the CDF zone and the headwaters are in the CWH zone with Moist Maritime (MM) primarily Eastern Very Dry Maritime (xm1) to approximately 350m elevation. In the higher elevations above 350 m are other CWH zones starting lowest with Western Very Dry Maritime, (xm2), and then rising to Montane Moist Maritime (mm2) with the mountain tops Mountain Hemlock Windward moist maritime (MHmm1).

Rare and endangered species of this watershed are listed by the Conservation Data Centre mapping (http://webmaps.gov.bc.ca) and BC Ecosystems Explorer (http://a100.gov.bc.ca/pub/eswp/). The Table below identifies some of the key endemic species. A more complete list, including migratory species is listed in Hawkes et al (2008) in their study of the Regional District of Nanaimo Park Management Plan.

Type	Name	Species	BC listing	Locations
CDF mm forest community	Douglas-fir / dull Oregon-grape	Pseudotsuga menziesii / Mahonia nervosa	Red	Errington
Plant	Howell's Violet		Blue	Errington

[2] Ken Epps, Island Timberlands pers. comm.

Plant	Montia diffusa	branching montia	Red	Errington
Plant	Macouns groundsel	Packera macouni	Blue	
Plant	sand-dwelling wallflower	Erysimum arenicola var. torulosum	Blue	Mt Arrowsmith
Plant	Olympic Onion	Allium crenulatum	Red	Mt. Arrowsmith
Plant	Olympic Mountain Aster	Eucephalus paucicapitatus	Blue	Mt. Arrowsmith
Plant	Lance-fruited Draba	Draba lonchocarpa var. vestita	Blue	Mt. Arrowsmith
Animal	Rainbow Trout (Steelhead)	Oncorhynchus mykiss	Yellow	Throughout river
Animal	Cutthroat Trout	Oncorhynchus clarkii clarkii	Blue	Throughout river
Animal	Vancouver Island Marmot	Marmota vancouverensis	Red	Mt Moriarty
Animal	Ermine	Mustela erminea anguinae	Blue	Parksville
Animal	American Water Shrew	Sorex palustris brooksi	Blue	Morison Creek
Animal	Western Meadowlark	Sturnella neglecta	Red	Estuary
Animal	Northern Red-legged Frog	Rana aurora	Blue	Headwaters

The river has salmon access from the estuary mainstem and has an anadromous length of 15.8 km where it meets a fish barrier at the Englishman River Falls (Brown et al 1977). Hamilton and Kasakoski (1982) identified populations of salmon species as Chum, Coho, Chinook, Pink and Sockeye as well as Steelhead and Cutthroat Trout. There are resident Dolly Varden Char in the headwater tributaries (e.g. Moriarty Creek). They noted Chum and Coho as the most abundant historic (1949-1979) adult returns.

Mean annual discharge (MAD) for the entire watershed is approximately 13 m^3/s (McCulloch, 2005). The Englishman River has four anadromous tributaries. They are: South Englishman River, Shelly Creek, Morison Creek and Centre Creek. The South Englishman River has 4.5 km of anadromous fish access, Shelly Creek has 1.0 km, Morison Creek has 2.1 km and Centre Creek has 5.2 km.

Of the total watershed area, 27% is below 300 m in elevation, 47% is between 300 m and 800 m, while 26% is found above 800 m (McCulloch, 2005).

The upper reaches do not support anadromous populations although they previously had been stocked with Coho, Chinook and Steelhead. The upper reaches should be surveyed or monitored for channel stability and sediment sources (Rood 2002). This would be included within a watershed level assessment. Most of this land is currently owned by Island Timberlands (82%), previously owned by Weyerhaeuser until 2005 and MacMillan Bloedel until 1999. TimberWest, the second largest ownership, owns land (6.3%) mostly on the lower river (Bocking & Gaboury, 2005). The timber companies attend the Englishman River Watershed Steering Committee meetings and share knowledge and resources. There have been many projects undertaken along the lower reaches of the river by the timber companies in partnership with stewardship and government.

Figure 1: Englishman River Watershed with Reach Breaks.[3]

[3] *Adapted from Rood 2002.*

Results

History

The Englishman River habitat is a product of its history as most of it has been impacted by humans. There has been a long history of logging in the watershed that left it vulnerable to winter flooding and acute summer low flows according to Brown et al (1977) in their Preliminary Catalogue of Salmon Streams and Spawning Escapements for Area 14. They noted the best spawning areas were in the lowest (0-4k m) reaches of the river where they were furthest from the impacts of intensive logging over the years. In the headwaters, their over-flight assessment indicated extensive logging to creek banks had left habitat endangered.

Urban development pressures have been slower to take hold but some aspects are significant. The City of Parksville has the river as its southern boundary with a thin rural/residential strip along the lower reach. Most of the roads and properties along Martindale and San Pareil have remained the same since developed in the 1960's. The City of Parksville uses the river as its summer water supply with an intake gallery in the lower river. Dam construction began in 1998 on Arrowsmith Lake to increase available drinking water in summer as well as augment low water flows for fish.

Change has been more significant in the estuary. It was first cleared for farming in 1873 and later it was altered by logging and urban development. During the 1950's, under private ownership, the estuary was dyked and used as a log sort. Then, under another owner, it was dredged for a resort development (Annand et al 1993). Concern over impacts to water quality in the estuary and lower river from three stormwater outfalls was raised by Buechert et al (2009).

Under the auspices of the Coho Colonization Program, Blackman & Hurst (1988) from 1985 to 1987 conducted a biophysical assessment of the Englishman River mainstem and off channel areas. Hurst (1988) then wrote a bioplan that included habitat and stock restoration strategies for targeted salmon species. The program was to identify alternative habitat and stock enhancement strategies to protect or restore salmon populations in non-federal hatchery rivers. Their survey identified two potential sidechannel locations and produced colonization strategies which were then implemented. In 1987 and 1988 the two sidechannels identified from the Colonization Program were initiated in Block 602, owned by Fletcher Challenge, and Block 564, owned by MacMillan Bloedel (Miller 1997). Beginning in 1987, the Colonization Program bioplan included annual Pink Salmon eyed egg transplants, Chum egg and fry, Coho fry and Chinook smolts (Hurst 1988).

The Colonization Program established partners in the community: first the logging companies which owned the land, then organizations/programs such as Youth Corps, Corrections B.C., Horizon Management Ltd. and Community Fisheries Development Centre (CFDC).

In 1992, the year after the washout of the original 1987 channel, another (third) sidechannel (Hill 1992) was constructed in Block 602 property. It began with a river intake and settling pond at the head end just below Morison Creek and an exit into the river above the power lines approximately 1.5 km downstream.

In 1996 the CFDC partnered with DFO on operations and maintenance of the sidechannel. In 1998 the CFDC formalized an agreement with DFO to undertake habitat restoration, stock enhancement and monitoring on the Englishman River (Young et al 1998).They built a hatchery building in 1998 and worked on the sidechannels on land owned by MacMillan Bloedel & TimberWest. The incubation site, sidechannel maintenance and monitoring has been under continuous operation by the CFDC since. The CFDC crews were integral in assessment of the channels' productivity (Decker et al 2003).

From 1980 to 1996 the Ministry of Environment's stocking strategy primarily consisted of releasing Steelhead smolts (annual average of approx. 12,000) (http://www.gofishbc.com/fish-stocking-reports/archive-reports.aspx) and from 1991 to 2009 an average of approx. 5,100 Cutthroat trout smolts

were released annually. The Ministry Staff have been involved in partnership projects with DFO, BCCF, and CFDC involving adult enumeration, juvenile monitoring and habitat restoration.

All five species of Pacific Salmon are found in the Englishman River watershed. Fisheries and Oceans escapement records (Mapster v3: http://pacgis01.dfo-mpo.gc.ca). Chum Salmon are the most abundant species with runs cycling below 1,000 up to over 40,0000 recently. Coho Salmon populations are on a steady increase since the lowest record of only 86 in 1986. In 2012 there were over 4,000 coho estimated. Both even and odd year Pink Salmon can be found in the watershed. In the last two years, returns have been over 2,200. There is a small population of river type Sockeye found in the watershed but numbers are very low.

Conservation Background

There has been much public interest in protecting land important to the Englishman River. As early as 1924 public groups sought to purchase and protect the estuary (Annand et al 1993). The public interest continued into the late 1980's and early 1990's with the formation of the Society for the Protection of the Englishman River Estuary that led to the Mount Arrowsmith Biosphere Foundation (MABF[4]) and the formation of the Mount Arrowsmith Biosphere Reserve in 1996 (Sian, 1999).

For 35 years The Nature Trust of BC has been working to conserve the Englishman River anadromous area relying on partnerships and a number of conservation tools to secure key estuarine habitats and riparian woodlands. Fee simple acquisitions, donations of land, conservation covenants and tax benefits have resulted in more than 300 ha of conserved land which includes the ER Regional Park and many other areas that benefit the health of the river. In the Englishman River Watershed the MOE Wildlife Management Area protects the river's estuary and riparian areas up to the Falls as well as the riparian corridor of Morison Creek.

In 2001, the Englishman River was recognized as the most endangered river in B.C.[5] That year, the Pacific Salmon Endowment Fund announced that the Englishman River would be the first recipient of its funding (up to $1.0 M annually) as one of two prioritized watersheds in B.C. The PSEF chose the Englishman River as a target watershed and funded the initial assessments to provide the baseline arguments for recovery of the target species; Coho and Steelhead. The PSEF then sponsored community roundtable meetings to discuss with stakeholders the restoration plans. The resulting Englishman River Watershed Recovery Plan (Bocking & Gaboury, 2001) focused on the recovery of Coho and Steelhead stocks but it was also meant to be "holistic". The overview was supported with two more technical reports documenting the watershed condition, fish and habitat for fish; the Englishman River Channel Condition Assessment (Rood 2002) and the Overview Assessment of Fish and Fish Habitat in the Englishman River Watershed (Lough and Morley, 2002). These documents have provided the basis for restoration of the Englishman River since then. The main river restoration projects were undertaken by the BC Conservation Foundation (BCCF) and the Greater Georgia Basin Steelhead Recovery Plan in subsequent years; 2003, 2004, 2005, 2006.

[4] mabr.ca
[5] Outdoor Recreation Council B.C. *www.orcbc.ca/*

Table 3. Summary of Salmon Habitat Knowledge

Species	Known High Value Habitats	Limited Habitats
Chinook	There is a potential total of 69,000 m^2 of spawning habitat in the Englishman River Mainstem and 73,000 m^2 in the entire watershed.	Pools are limited that support adult holding, and there is limited flow for early migrants. Spawning gravel stability throughout the watershed is inconsistent. Winter flooding fills in spawning gravel with sediment washed down from the upper watershed.
Chum	There is a large area of Chum spawning habitat in the lower Englishman River. This area is found in Reach 1, between the estuary and the top Highway Bridge. The Clay Young Sidechannel offers 3.6 km/7.44 ha offchannel.	There are few deep pools and LWD structures found in the Lower Englishman that would help the adult spawning fish escape predation.
Coho	In the Englishman River mainstem, Top Bridge Pool, Three Arm Pool and Big Tent Run are all examples of good summer habitat locations, as they all hold sufficient levels of water throughout the summer and winter to accommodate adult and juvenile coho. There is also a total of 69,000 m^2 of spawning habitat in the Englishman River Mainstem. Coho also use the tributaries for spawning which hold 12.2 km of anadromous access. The Clay Young Sidechannel offers 3.6 km/7.44 ha offchannel.	The tributaries are prone to dewatering and low summer flows. Coho use the tributaries in the summer and often become stranded in isolated pools, eventually perishing if the pools dry completely.
Pink	Pink Salmon use very similar spawning habitat to that of Chum Salmon. The lower reach of the Englishman River holds large spawning areas between the estuary and the Top Highway Bridge. The Clay Young Sidechannel offers 3.6 km/7.44 ha offchannel.	There are few deep pools and LWD structures found in the Lower Englishman that would help the adult spawning fish escape predation.
Sockeye	The Englishman River mainstem suffers from high winter flows and low summer flows but can offer protection for juvenile fish after hatching.	Much is unknown as to which habitat the Sockeye in the Englishman River use.

Englishman River Reach Habitat Summaries:

The Englishman River reach segments were prescribed by Rood (2002) using gradient, sinuosity and confinement as the primary determinants. The river was found to have six anadromous segments to the falls (15.2 km). Above the falls, assessments ended at the top end of reach E10 next to Moriarty Creek confluence; at 24,720 m and 288 m elevation from the estuary. The river mainstem continues upstream approximately 10,500 m to Arrowsmith Lake (812 m elevation). Lough and Morley (2002) used these reach segments in their description of fish habitat. These baseline studies were somewhat limited in scope due to the short delivery timelines; thus not the entire watershed was assessed. The entire mainstem length is approximately 35.2 km. The authors recommended the other areas be analyzed. The Estuary is part of reach E1 but was segregated for this report due to additional references.

Englishman Estuary

Overview:

The Englishman River estuary has been significantly altered through human settling and development. The history of development is documented in a Fisheries and Oceans study by Annand et al (1993). The estuary, including adjoining uplands is approximately 129.5 hectares in area. It has been used for farming, logging and campsites in modern times. The result is a compartmentalized area based on the type of developments that preceded it. The main estuary area is occupied by the outwash plain of the river. On the east side is a tidal lagoon with a dyke/walking trail isolating an area that was once tidal marsh. The outer perimeter of this boundary is single family residential homes. On the west side is a larger perennially wetted lagoon with dredged ponds from a past development adjacent to a modular home resort encircled in a riprap breakwater. The south (upland) area is an old provincial park campsite with a regenerating mixed forest canopy. Further south are the higher density homes and roads of the City of Parksville with storm water outfalls directed into the estuary. The Englishman River and estuary became part of the United Nations Mount Arrowsmith Biosphere Reserve (www.mabr.ca) in 1996.

Known High Value Habitats:

A more recent study of the estuary was undertaken by the MVIHES (Buechert et al 2009) to compare current habitat status with the 1993 study by Annand et al. The fish, wildlife, benthos and plants were described in Annand et al (1993). The entire estuary is a series of interlocking high value components, each supporting the other. There are upland treed areas, shrub margins, river banks, intertidal sedge/grass benches and sub tidal eelgrass. Buechert et al (2009) also found the spring and summer estuarine fish community remained abundant and diverse including Pink, Chum, Coho and Chinook.

Possible Limiting Factors:

Buechert et al (2009) compared the native plant communities in the estuary from 1976 to 2008. The report identified the decline of the native plant community due to the spread of invasive plant species, anthropogenic shoreline alteration and invasive waterfowl grazing. Shoreline hardening and dykes are significant in the estuary. The stormwater from the streets of Parksville empty into the estuary at two locations with many samples failing the B.C. Standards for Drinking Water and Aquatic Life for coliform, metals and PAH.

Completed Restoration Activities:

There have been stewardship efforts to control invasive species, establish native plants and control erosion and trampling by people through management of trails and fencing (MVIHES 2002). For many years the Arrowsmith Naturalists have conducted regular monthly bird inventories and have been engaged in invasive plant species removal and replanting with native plants (Buechert 2009). The estuary has a series of trails, a viewing platform and information signs. The use by the public is high with it being utilized as a living classroom for school programs annually as well as migratory and other bird inventories. The MVIHES sponsored report, “Caring for the Englishman River Estuary”, identifies the management recommendations that can lead to a healthy estuary. The amount of protected land in the estuary has been increased through

land purchases (65 ha was added in 1993) to allow conservation management by The Nature Trust of BC, stewardship organizations, the RDN, Parksville, provincial and federal governments.

Reach 1 (0-1.3km):

E1 Overview:

The 1,300 m (Lough & Morley, Rood, 2002) long reach begins at the estuary and progresses upstream to the Highway 19a bridge in Parksville. Gaboury (2005) identifies the reach length as 751 m, which likely excludes the long tidal area. This reach is described as an unconfined, low gradient (0.4%) channel with abandoned channels (Rood 2002). The channel width has varied greatly between 1949 (37 m) and 2002 (53 m), with a maximum of 75 m in 1977 (Gaboury 2005).

Lough and Morley (2002) compiled a reach description summary. Reach 1 is wide and shallow, lacking pools. Lough and Morley (2002) found the lowest pool frequency (4%) in Reach 1 of the six reaches surveyed. They report there is deposition of gravels and fines in the few pools that are found. The dominant substrate types in this reach are cobble and gravel. There are small amounts of LWD in the reach with some along the left bank and rip rap along the right bank adjacent to Plummer Road.

Known High Value Habitats:
The pools found below the Highway 19a bridge and the deep run known as the Big Tent run are high value habitats.

Possible Limiting Factors:
Lough and Morley (2002) reported that in Reach 1 the limiting habitat factors for Coho and Steelhead production are: low summer flows, lack of pools for both summer and winter rearing, inadequate cover in pools (summer/winter), lack of winter refuge. Their restoration prescriptions identify flow augmentation and anchoring of LWD/trees on the eroding left bank. Rood (2002) noted the erosion of the left bank from changes since a 1977 orthophoto.

Completed Restoration Activities:
Lough and Morley (2002) had their highest recommendation for low flow augmentation in Reach 1.
From 2000 to the present the Arrowsmith Dam reservoir has been augmenting flow during summer and fall boosting minimum average low flows from approximately 0.75 cms to 1.6 cms (AWS 2011). The MVIHES (C. Stewart, pers. comm.) addressed left bank erosion in 2004 by deactivation of the path, fencing and riparian planting.

Reach 2 (1.3-4.7km):

E2 Overview:

This 3.4 km reach extends from Highway 19a to above the Inland Island Highway (Hwy 19) bridge. Martindale Road runs alongside much of this reach with rural residential properties and Parry's Campground. A sewer line is buried under the river bed in the mid reach. A major feature of this reach is the large bar across from Parry's Campground but otherwise it is a generally confined channel with low gradient (0.4%). It had the highest lateral and vertical stability of the six lower reaches (Rood 2002). In a comparison of fish presence in 2001 snorkel surveys, Reach 2 had the highest total fish counted among reaches 1 to 5 (Gaboury, 2005) but Reach 2 is generally lacking pools. There is deposition of gravels and fines in the few pools that are in the reach.

Morley and Lough (2002) noted the dominant substrate is cobble with subdominant pockets of gravel. They observed few pools other than the deep bedrock canyon pool at the top of the reach. Cover and refuge habitat was found to be lacking as well.

Known High Value Habitats:
Shelly Creek on the left bank from across Martindale Road is a significant tributary (described below). The Top Bridge pool is an important adult spawner refuge. The largest intact riparian area remaining on the river left bank is on the Scouts Canada Property along Martindale Road (D.R. Clough 2004).

Possible Limiting Factors:
This reach has seen some lateral channel movement, and the channel is at its largest average width (35 m) since 1949 (Gaboury 2005). Limiting factors in this reach include reduced summer rearing habitat due to low summer flow, lack of cover (deep pools, LWD, boulders) and lack of flood refuge habitat (Lough and Morley, 2002).

Completed Restoration Activities:
There are five rock groynes on the river left bank above Parry's Park Road (DFO 2006) and four along Parry's Campground (D.R. Clough 2010). There has been LWD added in the vicinity of these structures as well.

Reach 3 (4.7-8.2km):

E3 Overview:
Reach 3, along with Reach 2, constitutes the majority of holding water for salmonids in the Englishman River (Gaboury 2005). Beginning at 4.7 km upstream, it is a long (3,490 m) low gradient (0.6%) reach from Top Bridge to the South Englishman confluence. It is lacking in almost all habitat requirements for salmonids other than spawning gravel. Morley and Lough (2002) cited low summer flows, poor adult holding, inadequate pool frequency and lack of cover (LWD, boulders) as well as poor winter refuge.

The riparian area was logged in the 1900's and a second cut rotation in the 1950's and 60's that covered most of the watershed including this reach (Bocking & Gaboury, 2001). There are pockets of old growth/older trees along the Block 564 (old MacMillan Bloedel property) south east bank canyon areas.

There is a large Clay Bank formation on the right bank approximately 400 m downstream of South Englishman confluence that has been sloughing, which often creates high turbidity in the water and are gradually filling in the large pool at the bottom. There are numerous photos available to track the changes over the years. "Erosion control should be re-considered, as the site appears to be getting more unstable in recent years, perhaps in response to upslope land developments. An assessment of upslope drainage patterns, in combination with design options for stabilizing the bank's toe, should be the focus of geotechnical and river engineering analysis." (Craig Wightman, pers. comm.)

Known High Value Habitats:
Reach 3 of the mainstem Englishman has some high value habitats. There are two existing off-channel habitats in this reach, which have assisted in increasing fish productivity (Rood, 2002). They offer natural production and refuge habitat. There has been considerable development over the years on these channels along with assessments of their productivity (Miller, 1997, Decker et al 2003, Taylor & Wright 2010)

The Clay Young Sidechannel; this is the main offchannel habitat project on the Englishman River. It flows through the entire Block 602 area now operated as a regional park. Constructed in 1988 and increased in size in 2004, it is approximately 3.6 km long and 7.44 ha in wetted area. It is a significant producer of fish. A fish production assessment conducted over 3 years (Taylor & Wright) indicated over 40% (more than 40,000 in 2009) of all the Englishman River coho smolts emigrate from this channel.

The MacMillan Bloedel (later named Weyerhaeuser) Channel was built in 1989 at 600 m length with an infiltration gallery water supply. It was later (1998) extended to approximately 950 m length with a river intake. Later, the river bank eroded and dewatered the intake which was removed in 2011 (pers. comm. D. Poole, DFO Nanaimo).

Possible Limiting Factors:
The riparian forest surrounding the river in this reach, is of an insufficient size to assist in bank stability. The trees, after falling in, are quickly moved downstream into non-functional locations (McCulloch, 2005). The limitations in cover habitat were well identified by Morley & Lough (2002) and Rood (2002) in their overview reports. They recommended LWD placement and cabling standing trees.

Completed Restoration Activities:
Extensive work was done in this including LWD placement and riffle enhancement. Approximately 52 of 70 restoration structures (LWD, Boulders, Riffles) are in this reach. This is summarized in the BCCF report of their activities from 2002 to 2006 (Silvestri, 2007).

Reach 4 (8.2-9.4km):

E4 Overview:

A steeper gradient (0.7%) reach that flows from Morison Creek down to the South Fork at 8.2 km from the ocean. Its most recent channel width is 37 m (Gaboury 2005). It meanders to the left bank past the sidechannel intake and then over a wide bar to right bank before ending at the South Fork. Morley and Lough (2002) noted the long shallow riffles and lack of pool habitat. It is sensitive to low flow and limiting in refuge and cover habitat. Rood (2002) found erosion of a mainstem island over the last 20 years was a significant example of lateral instability of the channel. This reach is adjacent to the hatchery building on the left bank. It is at the top end of road access through the Englishman River Regional Park from Allsbrook Road. There is a TimberWest logging road parallel to the river on the right bank.

Known High Value Habitats:
Morison Creek confluence has the largest pool in the reach. It has been the most abundant holding area for adult Coho in the reach (Clough & Stewart 1991).

Possible Limiting Factors:
Habitat is poor in this reach with the exception of Morison pool. It has low summer flow, erosion, lack of pools, sparse LWD and no refuge habitat, all identified by Morley and Lough/Rood, 2002. Gaboury (2005) noted the average channel width has increased from 26 m to 37 m since 1949.

Completed Restoration Activities:
There have been six LWD placements in the reach (Silvestri, 2007). There is a setback dyke and water intake on the left bank for the Clay Young Sidechannel. In 2005, TimberWest (2005) dedicated an 8 ha riparian covenant area along (1.3 km) the entire right bank of this reach.

Reach 5 (9.4-13.5km):

E5 Overview:

This reach was noted by Rood (2002) as having an irregular meander with a nearly continuous floodplain. Starting at 9.4 km the river gradient is steadily rising with an average gradient of 0.8% for its 4,120 m length and 29 m average width. The reach ends at 13.5 km as the channel changes from frequently confined to confined – characterized by a change to a narrower valley and steeper bank slope. It flows adjacent to the Englishman River Road subdivision on the left bank and the TimberWest logging area on the right bank.

Known High Value Habitats:
The meandering channel results in lateral and point bars, islands and mid channel bars (Rood 2002). The many gravel deposits offer considerable spawning habitat reflected by the high number of Pink salmon found in the reach compared to E4 (Gaboury 2005).

Possible Limiting Factors:
Lough and Morley (2002) noted sparse instream cover and pools which limit adult and juvenile fish holding. Rood (2002) noted that the streamside logging impacts and associated erosion prior to the 1950's created significant sediment accumulation but many bars are now growing vegetation.

Completed Restoration Activities:
No restoration is noted and access may be a challenge. This reach is in a semi confined valley with 30 m sidewalls on the residential (left) side but much lower on the TimberWest (right) side. Blackman & Hurst (1988) noted seven natural offchannel areas in this reach for potential development. Lough and Morley (2002) suggest restoration at two sidechannel locations.

Reach 6 (13.5-15.8 km):

E6 Overview:

The uppermost anadromous reach is 2,340 m long ending at a 30 m bedrock barrier at Englishman River Falls Provincial Park at 15.8 km upstream. Rood (2002) noted it is a steep walled confined reach with a fragmentary floodplain. The channel is an average of 0.9% gradient. Gaboury (2005) noted change of an increase in average width from 22 to 28 m since 1949.

Known High Value Habitats:
Lough and Morley (2002) noted it has a confined and stable channel with boulder cover in most habitat units.

Possible Limiting Factors:
Lough and Morley (2002) note there is a lack of summer flow. No off channel habitat was identified in this reach due to its confinement.

Completed Restoration Activities:
No known published work has been done in this reach. It ends in a provincial park where there is a trail network and two footbridges. This reach is at the end of public road access and used as a departure point for snorkel surveys.

Reach 7 (15.8-16.2):

E7 Overview:

This is the falls reach and consists of a 420 m long bedrock canyon with a falls at the start and end. The lower falls at approximately 10 m is the anadromous barrier. It discharges into a bedrock pool that often holds both Coho and Steelhead under the water spray. Above the first barrier is a deep narrow bedrock canyon with large boulders. It ends at the foot of the main Englishman River Falls. An approximately 30 m vertical drop over bedrock outcrops pours water into a narrow pool often littered with log debris from above.

Known High Value Habitats:
The deep inaccessible canyon is not noted for its fish value but has perennial pools.

Possible Limiting Factors:
There is limited winter refuge in the narrow canyon for resident fish. The falls would likely kill headwater stocked smolts due to the lack of a deep, debris free landing pool.

Completed Restoration Activities:
None.

Reach 8 (16.2 – 19.2 km):

E8 Overview:

This headwater reach above the Englishman River falls is in private land. It is noted by Rood (2002) from aerial photos to be a confined channel with steep left bank on 2.2% average gradient.

Known High Value Habitats:
Hurst and Blackman (1988) considered the headwater habitat potential to be a factor of 0.8 out of 1.0 for Coho fry which was not as high as lower gradient habitats below the falls.

Possible Limiting Factors:
Rood (2002) noted that prior to 1999 there had been logging on the right bank with no leave strip.

Completed Restoration Activities:
None.

Mainstem Headwaters (19.2 – 35 km)

Overview:
The upper reaches are private forest lands currently owned by Island Timberlands, previously by Weyerhaeuser and MacMillan Bloedel. The upper reaches were not prioritized under the initial 2002 inventory but both authors (Lough & Morley, Rood) recommended further assessment. Weyerhaeuser commissioned a watershed assessment (Higman et al 2003) that identified the channel condition and restoration opportunities. In the very uppermost headwaters, a water storage dam was built at the outlet of Arrowsmith Lake in 1999 by the Arrowsmith Water Service (AWS). The dam releases water in summer which is used by fish all the way to the infiltration gallery above the tidal area in the lower reach.

Known High Value Habitats:
Several tributaries enter the mainstem from side valleys: Middle Fork, Moriarty Creek and an upper South Fork. No published surveys are available to indicate their present status but they offer opportunities for winter refuge and spawning from the mainstem. An unpublished fry stocking and smolt study of Moriarty Creek found Coho fry did not grow especially well in the cold water but native Dolly Varden Char were abundant in perennial pools (pers. comm. R. Hurst).

Possible Limiting Factors:
Rood (2002) noted that from historic air photos of the 1950's that the reaches (E8-E10) in the vicinity of Moriarty Creek were very unstable and the likely source of sediment that caused problems downstream. They suggest an inventory of this section of the river to determine if there are any remaining concerns before they make recommendations on stabilization of bars and deposits.

Completed Restoration Activities:
The timber companies have been helpful and permit access to the headwaters for establishment of data loggers monitoring water temperature and other water quality field samples (MVIHES Water Stewardship Program). Gaboury (2005) discussed the potential for remediation of sediment sources in the upper watershed identified in a 2003 Weyerhaeuser assessment. Stabilization of sediment sources has been undertaken by Island Timberlands as a follow-up to the Higman et al (2003) assessment. Work on priority areas has been completed since by Island Timberlands who regularly tour the Watershed Committee to inspect their projects (pers. comm. F. Smith MVIHES).

The completion of the dam at Arrowsmith Lake has resulted in a significant benefit to low summer flows for 25 km of the river. The AWS website (http://www.englishmanriverwaterservice.ca/fisheries_benefits.asp) identified the 10 year average before and after augmentation and showed the improvement of 1.13 cms over the critical summer period.

Shelly Creek:

Overview:
Shelly Creek is the lowest tributary on the Englishman River. It enters the mainstem Reach E2 on the river-left (Parksville) side just above Hwy 19a. Morley & Lough (2002) identified Reach S1 as approximately 200 m from the river through a wetland to Martindale Road. Reach S2 is approximately 830 m from Martindale upstream through wide deep pools created by low beaver dams to a 5 m barrier at an escarpment with a hanging culvert in the farm area. This is the end point of salmon access as the channel was ditched and diverted from its original course (Burns 1995). It has another approximately 4 km of mainstem habitat length above the culvert that flows through farm, residential and transportation corridors. An Urban Salmon Habitat Assessment was conducted on the stream from the Englishman River up to the railway crossing identifying 12 reach segments (Walshe 1999). The Shelly watershed has the highest proportion of private residential/rural ownership (84.5%) with timber companies owning 13% (Bocking & Gaboury 2005). This reach was mapped and inventoried by the MVIHES (2009).

Known High Value Habitats:
The anadromous lower reaches (S1 & S2) drain Shelly Farm and are highly productive flood refuge and winter habitat (Morley & Lough 2002, Walshe 1999, PVSK 2002). Members of the MVIHES set up a smolt

trap in 2011, 2012 and 2013, at Martindale Road capturing 2,638, 8,094 and 7,564 coho smolts respectively. Reach 2 is almost entirely pool habitat aided by low beaver dams that provide an extensive wetted area in winter / spring.

Possible Limiting Factors:
This is the most farm and urban developed sub basin of the Englishman watershed. The mid reach area was historically ditched and relocated from its natural channel (Burns 1995), it appears to have had anadromous access in its historic state. Buechert (1999) noted farm areas of riparian impairment where the trees were removed. Parksville Streamkeepers (2002) identified a list of restoration opportunities from a literature review. Most restoration opportunities were from Walshe (1999) which described limiting factors such as; ditching, storm water, riparian, low flow, spawning gravel, water quality and fish barriers. In 2012 the MVIHES assessment found three problem culverts for fish migration; at Martindale Road (submerged), hanging culverts in Reach S2 (5.0 m ht.) and Blower Road crossing (1.2m). The reach S2 ponds have critically low oxygen in spring as the last Coho smolts leave[6] which is likely due to the high nutrient loading (detritus) and lack of high riparian cover adjacent to the farm pasture. The high nutrients and sun exposure are also the reasons why the Coho smolts stay and rear in spring long after the floods are over in the mainstem.

Completed Restoration Activities:
In 2002 a riparian planting project was undertaken in headwaters along the park corridor off Hamilton Road MVIHES (2002). There are no other restoration activities referenced. Habitat assessment of the entire stream was limited to non farm areas below the railway crossing. Permission granted to MVIHES members from the farm owners has allowed overview assessments of the mid reach just below and above the barrier (S2/S3). An inspection of the barrier was undertaken in late 2012 by the MVIHES[7] with more assessment and restoration plans to follow in 2013. The smolt trap at Martindale Road has completed three years of assessment being operated in 2013 for its third year by MVIHES to monitor fish and water quality.

Morison Creek:

Morison Creek consists of two anadromous reaches (M1& M2) as well as headwater reaches (M3-M6) and Swayne Creek.

Morison Anadromous Reach (M1 & M2) Overview:

Morison Creek enters the mainstem Englishman River on left bank at 9.4 km upstream at the top of Reach E4. Its 35.6 km^2 (Bocking and Gaboury, 2001) watershed was historically logged and then the lower and mid reaches were developed into rural residential and farm lands in the Errington postal area.

The stream has two low gradient reaches of anadromous access of 2,050 m ending at “Triple Falls” (local name). An unpublished assessment noted the falls are one 8 foot and two 6 foot drops onto bedrock[8]. Reach M1 is a short (135 m) initial reach of boulder riffle (2%). Reach M2 is 1,855 m long on 0.7% gradient with more riffle (40%) glide (53%) than pool (7%) based on samples by Lough and Morley 2002. These accessible reaches have Coho, Cutthroat and Steelhead utilization[9]. This section of the creek is in a treed gully 100-250 m wide with rural properties and access road on the outside of the riparian area. There is one recreational trail crossing at the lower reach near the mouth.

Known High Value Habitats:
This creek offers off channel refuge from the mainstem river. It has a 100– 250 m wide riparian area. It also offers some spawning areas for salmon and trout. There is LWD cover in this portion of the creek (Lough and Morley, 2002).

[6] *Oxygen levels of 3ppm were recorded at the trap site in June 2012.*
[7] *GPS mapping and overview habitat measures, F. Smith & D. Clough Nov. 2012*
[8] *D .R. Clough field notes Aug. 11, 1988.*
[9] *Unpublished smolt trap operated by D. Clough & G. Stewart at mouth from 1989 to 1992 on behalf of DFO.*

Possible Limiting Factors:
Boulder and bedrock dominated substrates limit spawning locations. Pools are limited in number. Flow is limited (Lough and Morley, 2001). Trail access may result in quad damage to the channel and riparian. There may have been historic fish access over Triple Falls prior to logging and degradation of the jump pool crests.

Completed Restoration Activities:
There have been no completed restoration activities to date.

Morison Headwaters Overview:

There are approximately 15.0 km of identified reach segments in Morison Creek headwaters. The headwaters have resident cutthroat trout and three spine stickleback (Clough 1988). Lough and Morley (2002) identify reach M3 (2,780 m) as further confined reach above the falls. Reach M4 (800 m) is noted as above Swayne Creek confluence in an unconfined channel ending at Errington Road. Reach M5 continues as 3,300 m of primarily low gradient ditched mainstem through farm pastures. The headwaters M6 begin as it crosses the private logging spur off Fisher Road. This private land logging reach ends approximately 6,300 m upstream at the headwaters on Rowbotham Ridge (determined by Google Earth image). There is fish access in the headwaters as it starts off as low gradient above reach M5 of the mainstem which originates from multiple channels draining forest lands on southern hillsides. There is an unsurveyed south branch of Morison Creek that drains (approx. 1,800 m) from the Englishman River Park across Dunn Road to join reach M5 in farm pasture above Errington Road.

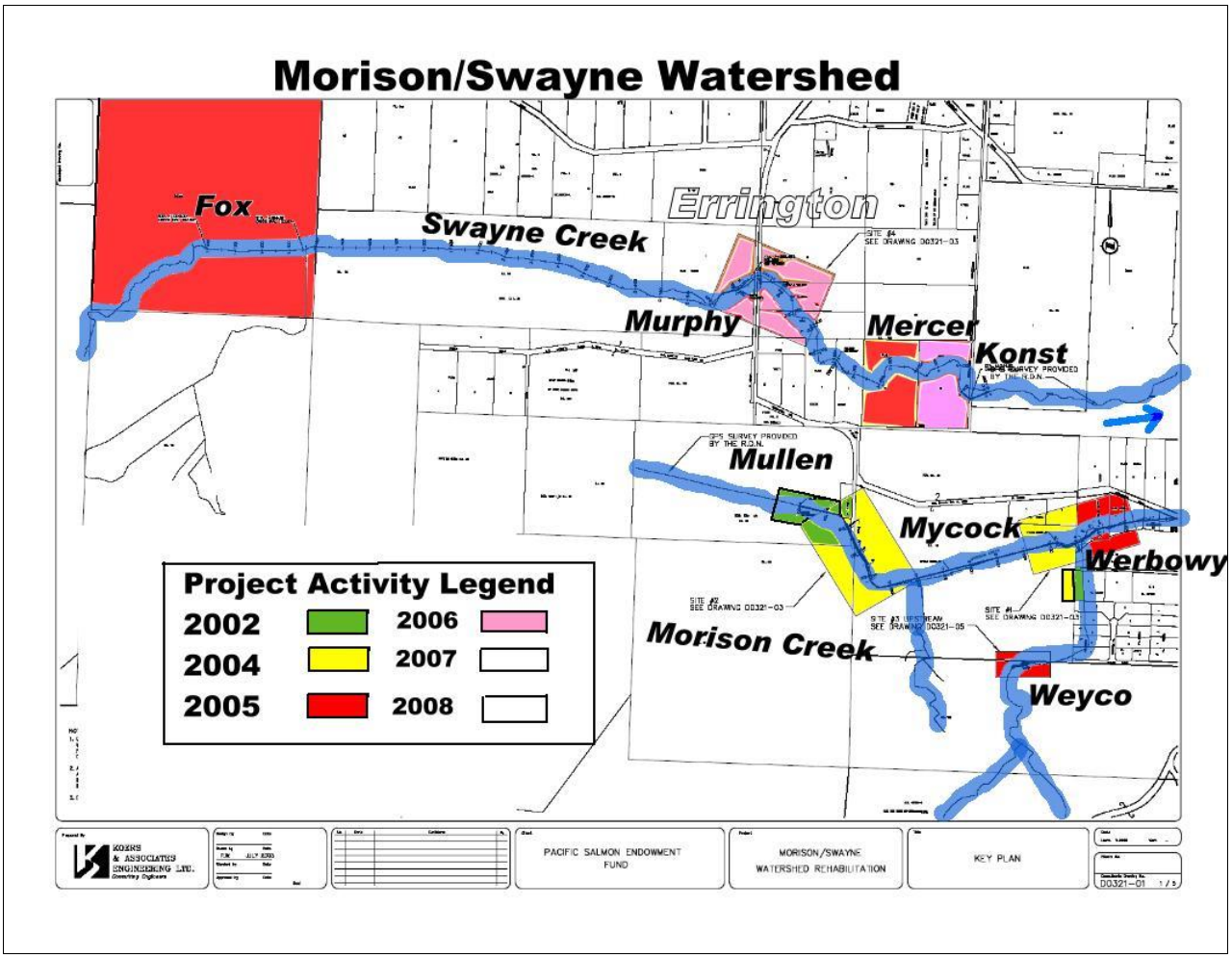
Swayne Creek enters Morison Creek reach M3 above the Triple Falls. It has resident Cutthroat Trout throughout the approx. 6,100 m length low gradient reach adjacent to farm land to the top of Fisher Road. The unsurveyed (approx. 6,000 m) headwaters drain Rowbotham Ridge through private forest lands.

Known High Value Habitats:
The lower anadromous reaches of Morison Creek are important off channel refuge habitat to fish species from the mainstem as well as offering year round but limited rearing and spawning. The upper reach has a historically dredged section 3-4 m wide and 2-4 m deep at approximately 600 m length which offers year round fish habitat on the Mycock Farm.

Possible Limiting Factors:
There is limited flow, LWD cover and spawning gravel in the lower anadromous reaches but it does exist (Lough and Morley, 2002). The Triple Falls may have once been passable (approx. 3.5m drop) if pool crest height was supplanted by large old growth logs (which were removed with development). The falls were surveyed for potential passage by MOELP (Mottram & Wells) in 1979. The headwater reach M5 is ditched along pastures with limited riparian but there is tall grass in many sections. The entire watershed was logged and the lack of LWD and washed out gravels are likely a response to this event. Logging persists only in the headwater reach and with riparian buffers visible on most channels (RDN Map 2011 air photo). Lough and Morley (2002) placed sediment source identification and control as highest priority due to new residential developments in lower reaches.

Completed Restoration Activities:
As part of the ER Watershed Recovery Plan, farm stewardship was initiated by farmer Paul Mullen and the Morison/Swayne Landowners Committee was formed which included properties situated along the headwater M4 and M5 reach as well as Swayne Creek. This work involved eight large farm properties as well as private forest lands (Weyco) and was supported by PSEF, PSF, DFO, MVIHES and the property owners. Planning and restoration work was done from 2000 to 2007 (MVIHES 2005). It included a channel profile survey by Koers and Associates Engineering (2005) of the farm reaches to determine restoration areas where pastures were flooding from sedimentation, bank erosion from livestock and riparian improvement. This work reduced the sediment sources from farms identified as high priority in the Lough & Morley report.

Figure 4: Morison/Swayne Watershed Rehabilitation Area Map, 2005.



South Englishman River:

Overview:

The South Englishman River has the largest watershed (82 km^2) and longest (25 km) catchment of the anadromous tributaries in the Englishman River watershed with a mean annual discharge of 3.5m^3/s (Bocking and Gaboury, 2001). It drains Shelton and Healy lakes at the height of land (550 m elev.) separating it from the Nanaimo watershed. It picks up drainage from Rhododendron Lake as well as Ferguson Swamp, an approx. 3.0 km long wetland complex and then it enters a steep sided canyon area with a series of fish barriers before crossing the 155 mainline, at which point salmon have access for the approximately 5.0 km to the Englishman River. The anadromous length of the river is 4,475 m where it ends in a canyon with bedrock cascades (Lough & Morley 2002). The existence of the barrier is debated based on high water possibly allowing further fish access in the high gradient and confined areas of a long canyon. The habitat assessments by Lough & Morley (2002) divided the river into four reaches below the falls (SE1-SE4). They did not survey the non anadromous areas.

South Englishman Reach SE1 (0-0.3 km)

Overview:

This short lowest reach is wide and unconfined. Centre Creek enters at the top end of the reach. It is noted for sparse LWD, gravel deposits and lack of summer pools.

Known High Value Habitats:

The lower reach is accessible to Chum and Coho and has plenty of spawning gravel, but it was not highly recommended by Lough & Morley (2002) for restoration due to instability. They recommend cabling standing trees as an opportunity to control loss of LWD adjacent to unstable banks. Blackman & Hurst (1988) noted 52,000 m2 of the wetted habitat in Ferguson Swamp.

Possible Limiting Factors:

As noted by Rood (2002) in the channel assessment, this reach is an unconfined alluvial fan that is aggrading. These conditions would result in disturbance or burial of spawn.

Completed Restoration Activities:

The BCCF built twelve LWD and completed riffle enhancement in the lower reach from 2003 to 2005 (Silvestri 2007).

South Englishman Reach SE2, SE3, SE4 (0.3-4.6 km)

Overview:

These reaches are located upstream from Centre Creek to the logging road mainline. They are similar in habitat with steadily increasing gradient; 1,000 m on 0.8%, 1,820 m on 1.3% and 1,600 m on 4.3% respectively. Among the three reaches they were described by Rood (2002) as confined steep valley walls that were historically logged and are now vegetated. They were noted as now generally stable with some sidewall instability in Reach SE4.

Known High Value Habitats:

Lough and Morley (2002) suggested the LWD jam in reach SE3 may offer a flood refuge area.

Possible Limiting Factors:

Lough & Morley (2002) offered similar prescriptions for the three reaches due to similar limiting factors; summer drying, lack of LWD and lack of winter refuge habitat. Lough & Morley (2002) recommend cabling standing trees, adding LWD and stabilizing the SE3 debris jam. They also suggest investigating improving the barrier at 4.5 km to access 6.0 km further habitat. Gaboury (2005) noted no high priority restoration opportunities, and Lough & Morley (2002) ranked restoration as moderate.

Completed Restoration Activities:

The BCCF reported (Silvestri 2007) two of their 12 structures in the South Englishman were installed in reach SE2 just above Centre Creek.

Centre Creek

Overview:

Centre Creek is the longest anadromous tributary of the Englishman River. Coho are found in this creek up to the barrier at 5.2 km (Lough and Morley, 2002). The total watershed area is 20.8 km^2 and has a mean annual discharge of 1.5m^3/s (Lough and Morley, 2002). Centre Creek was historically logged to its stream banks and Rood (2002) noted historic channel changes from significant sediment accumulation in the 1950's has evolved to a narrower, stable vegetated channel. Four reaches were surveyed in the detailed habitat assessment, three are in the anadromous area and the fourth ended at the logging road crossing 7.0 km upstream. The MVIHES commissioned a "Detailed Salmon Habitat and Riparian Overview with Level II Prescriptions" (Warttig & Clough, 2004, 2008). The habitat summary table is presented below;

Table 4. Centre Creek Habitat Assessment and Ratings

Habitat Parameter	Reach C1		Reach C2		Reach C3		Reach C4	
	Value	Rating	Value	Rating	Value	Rating	Value	Rating
Length (m)	1042	N/a	1929	N/a	2341	N/a	458	N/a
Gradient (%)	1.75	N/a	1.57	N/a	1.57	N/a	2.57	N/a
LWD Frequency (lwd/cw)	0.3	5	0.4	5	0.2	5	0.1	5
% Cover in Pools	1	5	6	3	8	3	2	5
% Boulder Cover	1	5	1	5	3	5	0	5
% Pool Area	30	5	24	5	12	5	15	5
% Wetted Area	50	5	27	5	12	5	15	5
% Reach Eroded	6	3	4	1	4	1	0	1
Substrate - % Fines	14	3	6	1	9	1	6	1
Substrate - % Gravel	19	N/a	24	N/a	29	N/a	20	N/a
% Reach Altered	6	3	4	1	0	1	0	1
No. Obstructions	0	0	0	0	1	1	0	0

Known High Value Habitats:

Centre Creek offers 5.2 km of salmon accessible habitat (Lough and Morley, 2002). It has relatively good accessibility, spawning habitat and pool abundance. It offers summer and winter refuge from low and high water periods (Lough and Morley, 2002). Centre Creek offers 2,700,m^2 of pool habitat, out of a total of 10,000 m^2 total wetted area in the lower 2.9 km of the 5.2 km of accessible habitat at low flow (Warttig & Clough, 2004).

Possible Limiting Factors:

The stream channel was historically logged to its banks and the resultant changes to the channel width, sediment transport and resulting loss of habitat diversity are identified by Rood (2002) and Lough & Morley (2002). The detailed habitat assessment proved the previous overview assessments were not incorrect in their poor habitat predictions. Warttig and Clough (2004/2008) found LWD and instream cover was well below provincial fish habitat standards (Johnston & Slaney, 1996)

Completed Restoration Activities:

First record of effort was in 1986 when a Chum egg incubation box was installed by DFO in the creek bed near the mouth (Hurst 1988). In the late 1990's to 2003 a stock assessment fence was operated by the Community Fisheries Development Centre on behalf of DFO Stock Assessment. The trap site was dismantled in 2003. In 2005, the Mid Vancouver Island Enhancement Society (MVIHES) began implementing the Level II prescriptions (Warttig & Clough 2004, 2008) in the lower reach. From 2005 to 2012 the MVIHES have been involved with instream LWD placements, riparian planting offchannel test pits and other habitat measures (MVIHES 2005-2012).

WATER IN THE ENGLISHMAN RIVER

Surface Water Quality

The Englishman River was designated as a community watershed in 1995. This designation is to conserve the quality, quantity and timing of water flow or prevent cumulative hydrological effects.

In 2010 (Barlak et al) the MOE developed water quality objectives for the Englishman River in order to set safe limits for the physical, chemical or biological characteristics of water, biota or sediment in the watershed. In 2011 MOE partnered with the RDN to form the Community Watershed Monitoring Network (CWMN) where stream stewards (volunteers) are trained in the use of monitoring equipment and are responsible for collecting data over five weeks during the summer low flow period and five weeks during the fall flush period. MVIHES volunteers monitor seven sites in the Englishman River watershed.

MVIHES also samples river water at Hwy. 19a bridge every two weeks for Environment Canada. Water quality variables used to calculate the Water Quality Index at this station are: temperature, pH, turbidity, total cadmium, total copper, total lead, total zinc, total dissolved nitrogen, total phosphorus. The most recent assessment results for the Englishman river are from 2005 to 2007. Generally, the chemical and biological assessments indicated “good” and “mildly divergent” water quality conditions.

Water quality has been sampled during the course of some MVIHES water and stormwater projects at the inflows into the estuary, the beach and also in the storm drains in downtown Parksville. Results tended to be poor or marginal for aquatic life. Provencher et al (2013) published initial geochemical results from a groundwater well and river sampling program in the Englishman River watershed carried out in 2010-2011 the intent is to aid development of hydrogeological models, which can be used to support decision makers in water allocation.

Efforts have been made to make the public aware and improve water quality; MVIHES partnered with the City of Parksville to build a large rain garden at the newly-renovated Fire Hall site in 2010. The central location of the rain garden makes it ideal for public awareness and it is hoped that more rain gardens will become part of the stormwater management system.

Drinking Water Usage

The Arrowsmith Water Service was formed in July 1996 as a joint venture between the Regional District of Nanaimo, the City of Parksville and the Town of Qualicum Beach. The Arrowsmith Dam controls the release of water from the Arrowsmith Lake Reservoir to the Englishman River. The dam was formally commissioned in September 2000. There is no pipeline from the reservoir down the mountain to the bulk water service areas. The river serves as the conduit to convey the water from the reservoir to the point of extraction from the river, which is currently at the City of Parksville intake below Highway 19A in Parksville. A conditional water license was issued in March 1997 authorizing the construction of the Arrowsmith Dam, a maximum withdrawal of 47,888 cubic metres per day of water from the Englishman River for the proposed bulk water system and the storage of 9,000,000 cubic metres of water at Arrowsmith Lake. The Conditional Water Licence and corresponding Provisional Operating Rule were issued based on the premise of utilizing the existing City of Parksville water intake in the interim until the future proposed water intake and treatment facility were completed. The location for the new proposed ERWS drinking water intake is at the Highway 19 crossing of the Englishman River. This site is downstream of the originally proposed location at the confluence of the south Englishman River and the Englishman River.
(www.englishmanriverwaterservice.ca)

Groundwater

Phase 1 of a Groundwater Mapping and Education project – “Lower Englishman River Watershed Groundwater and Surface Water Interaction” for MVIHES by GW Solutions Inc. - was completed in early 2012. Local involvement through the volunteering of well access and monitoring was key to reaching the objectives of this project. In the area below the falls, the interaction between the aquifers and the river increases and becomes even more significant in the lower 10 km., Some of the key conclusions are:

- There are up to a dozen overburden (sand and gravel) aquifers on both sides of the Englishman River in its lower reach (below the Englishman River Falls).
- The groundwater direction is generally towards the Englishman River. The river acts as a drain and receives groundwater.
- The aquifers play a key role in controlling the river temperature because groundwater is at a constant temperature (around 10 deg. C), thus cooling the surface water in the summer and having a warming effect in the winter. This is particularly important for the smaller and shallower tributaries.
- The estimated contribution of the overburden (sand and gravel) aquifers to the Englishman River is approximately 1/3 of its summer low flow (or over 300 l/s).
- The shallow aquifer in Reach 3 (left bank) plays a key role in providing flow to the side channels.

It was also determined that bedrock plays an important role in providing groundwater flow to the river in the low flow period. Possibly up to 30% of the flow would originate from the fractured bedrock. Phase 2 is now underway and will focus on the Groundwater Regime in Bedrock.

Current Salmon Stock Status

Table 5: Englishman River Salmon Escapement

Year	Chinook	Chum	Coho	Pink	Sockeye
Mean:					
1953-1958		9125	1458	1000	17
1959-68	39	3175	919	88	22
1969-78	60	5175	1020	34	58
1979-88	7	1820	664	15	14
1989-98	46	3105	619	479	17
1999-08	872	12065	3406	4958	12
2010-11	1472	23096	5300	3580	6
2012	218	21282	4244	6912	5

not surveyed in 2009, DFO Stock Assessment Escapement Data

Habitat Status Tables

The Fisheries and Oceans template for the Habitat Status Tables is shown on Appendix 1. This template was completed for each of the salmon species conservation units found in this watershed. Information was extracted from existing literature and any information gaps were completed by personal interviews where possible. The tables assist this report in identifying existing high value habitats, limiting factors, performance indicators, information gaps, possible indicator thresholds, potential measures to maintain productivity and habitat restoration which has been undertaken.

Pressure State Indicators

Similar to other large watersheds on east coast Vancouver Island, the habitat pressures on the Englishman River are due to human activities; starting with logging, mining and farming, and then later, urbanization. The historic first pass (1800-1950) of logging in the watershed appears to have had the most significant effect based on the habitat and river channel assessments by Morley & Lough (2002) and Rood (2002).

The selected indicators/thresholds were chosen based on:

1. Loss of bank stability, reduced water quality, and reduction in potential LWD;
2. Reduction of instream channel complexity caused from logging the riparian vegetation, cross stream yarding and dredge mining all of which are responsible for bank erosion, channel aggradation, and channel instability.
3. Increased sedimentation leading to a reduction of spawning success and reduction in wetted areas during low flow periods.

These factors lead to the selection of the following habitat indicators (Table 7) which were most appropriate for the Englishman River. Habitat indicators, metrics and benchmarks were selected from Appendixes 12 and 14 in Stalberg et al (2009).

Table 6: Application of Recommended Habitat Indicators

Habitat Type	Action	Indicator
Estuary	State	Estuarine Habitat Area
Stream	Pressure	Disturbance of Riparian Areas
Stream	Pressure	Total land cover alteration (Forestry and Mining)
Stream	State	Stream Discharge
Stream	State	Water Temperatures
Stream	State	Suspended Sediment

Potential Restoration Projects

The literature and interviews identified the following habitat impacts;

1. Increased sedimentation from upland sources
2. Increased bank erosion
3. Reduced riparian areas
4. Reduction in summer flow and wetted area
5. Reduction of channel complexity
6. Loss of rearing area
7. Loss of spawning gravel

The lower reaches of the Englishman River are the highest value fish habitat but the headwaters may still be in control of the fate of fish living in the mainstem. Restoration work must remain in balance between upland and lower reaches. To date, the list of past project activities reflects a sharing among upper watershed and lower watershed restoration.

The completed successful restoration projects indicate the direction for the future. Below is a summary of what was described in the reach segments above.

Estuary

The estuary has been protected with land purchases. It has had two major assessment and monitoring projects on its status - Annand et al 1993, Buechert et al 2009. The findings indicated that there are threats

to water quality from storm water inputs and invasive species (including wildlife) have overtaken many plant community areas and threaten others. The habitat quality of the estuarine areas has declined as a result of the vegetation and human developments. The more recent publication (Buechert et al 2009) has a very complete list of restoration actions that should address these issues. It recommends invasive plant removal, invasive species management, storm water quality improvements and more monitoring.

Mainstem Reaches

The construction of off channel habitat along the mainstem to provide rearing and spawning refuge from the fluctuating flows has been successful. There may be more opportunities to install off channel or improve the existing sites (habitat complexity/spawning gravel/water supplies). There have been mainstem channel habitat complexing structures (LWD/ Groynes/Boulder clusters) installed by DFO/BCCF in areas of need but they have met with mixed success. There are erosion and deposition areas along the mainstem that should be addressed such as the clay banks just below the South Englishman River entrance and the aggraded bars above and below the old Highway crossing. There are other small but locally significant habitat/bank stability issues that occur when conifers are failing on the adjacent banks (i.e. Reach E2 – Martindale Road Scout Canada/Parry's Campground).

Headwater Reaches

Most of this land is currently owned by Island Timberlands (82%), previously owned by Weyerhaeuser until 2005 and MacMillan Bloedel until 1999. TimberWest, the second largest ownership has land (6.3%) mostly on the lower river (Bocking & Gaboury, 2001). The monitoring of erosion/sediment sources has been recommended by Gaboury (2005) and Rood (2002). Bank stability work has been addressed on Island Timberlands property in the upper watershed based on their Watershed Assessment (Higman et al 2003). The Timber Companies have been significant partners in many projects along the lower reaches of the river with stewardship groups and government. They attend the Englishman River Steering Committee meetings and share knowledge and resources.

Potential Restoration Projects Tributaries

Shelly Creek

There has been no documented restoration on this creek. The assessments (gps mapping, barrier locations and smolt trapping) from 2011 to 2013 by the MVIHES indicate it is important off channel habitat to the mainstem Englishman River that should continue to be protected. There are barrier culverts on the creek at almost every road crossing that, if repaired, could offer further improvements to migration for both salmon and resident trout.

Morison Creek

This creek has potential projects with fish barrier removal, riparian protection and farm stewardship (fencing, planting, sediment removal, erosion protection). Past projects are the templates for further work (MVIHES 2005).

Centre Creek

This long flat tributary lacks cover, pool depth and habitat complexity throughout its length. The Restoration Plan (Warttig & Clough, 2004, 2008) identified opportunities for the entire anadromous length with template prescriptions. The work has been almost annual since 2004 and more is planned in 2013 by the MVIHES and the Pacific Salmon Foundation Community Salmon Program.

Possible Measures to Maintain Productivity

Protection of existing aquatic values is on-going by all the participants on the Recovery Plan Steering Committee. This includes land purchase for park reserve, riparian reserve areas, and voluntary land owner protection/practices. The opportunity to secure all the riparian areas of the river and tributaries in some form of protection; either by purchase, covenant or landholder agreement is desirable. Some key areas in this watershed that may offer an opportunity to improve their protection status are the estuary foreshore held as private property as well as riparian areas on the tributaries of Shelly and Morrison Creek.

With respect to protection of the existing habitat values of the Englishman River the following attributes and challenges are going to play a significant role in recovery outcome:

1. The majority of the watershed headwaters are in privately held lands.
2. The estuary and lower salmon bearing reaches are mostly publicly owned and managed.

The private land owners have over the years contributed to many restoration actions on their land and off site. The continued partnership and communication with private land owners is vital to maintain productivity in the watershed.

Reasonable Information Gaps

The previous assessments on the Englishman River provided a fair picture of the salmon bearing reaches. However none of the reports form complete surveys of the entire watershed. The last habitat assessment was limited in scope and more than 10 years old. Since then, conditions and habitat treatment strategies have changed. Up to date assessments are needed. This assessment should include the headwaters. The watershed fish habitat should be assessed at a level that allows monitoring the changes in standard fish habitat (i.e. WRP Level 2) metrics such as channel/wetted width, LWD and pool/riffle frequency. Information gaps include:

1. Up to date fish habitat information is needed for the mainstem and many tributaries. Critical rearing habitat must be measured and monitored using a comparable habitat assessment methodology (i.e. RIC/WRP Level 2) to provide an overall habitat status that provides direction on management.

2. A performance review of restoration structures is needed. Multiple agency activities over many years has left a gap in understanding the entire scope of what has been undertaken, where it is located and its performance through effectiveness monitoring (i.e. Koning et al 1997) . A single repository of information on fish habitat restoration and enhancement for this watershed is needed. An interactive web based file using an application such as Google Earth© could permit partners to contribute their project location information to the ERWRP.

3. More hydrological information is needed on groundwater and surface water to understand specific flow requirements and the watershed's vulnerability to climate change.

Conclusions

The River has been negatively affected by historic forestry practices. Logging removed nearly the entire riparian zone of the river which has contributed to the unstable terrain and large sediment volumes in the lower reaches. The main causes and consequences are well described in context of River Geomorphology (Rood 2002), Fish Habitat (Lough & Morley 2002) and Recovery Plan (Bocking & Gaboury 2001, Gaboury 2005). These studies provided the foundation for activities by the Englishman River Watershed Recovery Plan and included stream/riparian restoration, monitoring of water quality and quantity, fish assessments, awareness, coordination and detailed habitat assessments. The Pacific Salmon Endowment Fund Society provided the main funding for the Recovery Plan from 2001 until 2006. The Plan was, and is now, overseen by a Steering Committee consisting of members from DFO, MOE, RDN, City of Parksville, The Nature Trust of BC, forest industry (TimberWest, Island Timberlands) and private consultants, and is chaired by MVIHES.

This report covers most of the activities undertaken on the Englishman River in the last 30 years. The results can be looked at from several perspectives. All are positive but many studies and reports identify significant challenges.

- Perhaps the most important positive action in the recent history of the watershed is the increase in protected and park land in the watershed. The protected lands are mostly held by The Nature Trust of BC, both in the estuary and in the Englishman River Regional Park. There are also private land covenants by TimberWest along the river. Other high value areas need guaranteed protection through purchase or covenants such as the remaining private land areas in the estuary and riparian areas along the mainstem adjacent to Martindale Road, as well as headwater wetlands such as Ferguson Swamp on the South Englishman.
- The historic logging impacts of the river morphology are such that even with sediment sources from sidewalls attenuated, there is significant stockpiled sediment in the channel still available for transport and deposition in the lower river (Rood 2002).
- There is a good list of watershed recovery projects to undertake thanks to recovery strategy publications (Bocking and Gaboury 2001, Gaboury 2005)
- There is significant low flow in summer months and while this is still a concern, it has been improved considerably with water releases from Arrowsmith Lake (AWS 2012).
- The adult spawner salmon populations in the river are generally far stronger than they were 20 years ago (Chinook 20X, Chum 4X, Coho 5X, Pink 10X). The only exception is Steelhead which has not shown a similar response. The CFDC have operated the hatchery at the Englishman River since 1997 and can take some credit for this success.
- Sidechannels are an effective tool in habitat restoration for many species of fish. The Clay Young Sidechannel in the RDN Park on the west side contributes a huge proportion of the Coho smolts and other species to the river (Taylor & Wright 2010).
- Sidechannel installations are not always reliable. Two earlier sidechannel sites on the Englishman River were lost or decommissioned due to flooding or lack of consistent water supplies (Miller 1997).
- Instream fish habitat in the mainstem is significantly lacking and needed (Lough & Morley 2002) and addressed in several applications but is expensive to install with higher risk of maintenance requirements (Silvestri 2007, Clough 2010).
- Instream fish habitat in tributaries addresses similar issues of LWD, bank stabilization and off channel habitat (MVIHES 2005-2012).
- There is a need to monitor and record all instream restoration sites from every organization on one shared record to assess for performance and maintenance (i.e. Koning et al 1997). This will provide further direction on the best approaches to use in the Recovery Plan.
- More funds are needed. The program began with the Pacific Salmon Endowment Fund contributing 1 million dollars in 2001. This core fund was reduced over the years as more watersheds were added for Recovery, and then it finished in 2006 when the funding was re-allocated to the Fraser River. However, other contributors have also been significant in programs benefiting the Englishman River: TimberWest, Island Timberlands, Georgia Basin Living Rivers, Pacific Salmon

Foundation CSP, Arrowsmith Water Service, Regional District of Nanaimo, Fisheries and Oceans Canada, Environment Canada and Ministry of Environment as well as many foundations (Vancouver, Real Estate Foundation of BC, Mountain Co-op, RBC Blue Water etc. etc.).

- Volunteer Stewards have contributed significantly to the restoration of this watershed. Almost all restoration work done in Shelly Creek, Morison Creek, Swayne Creek and Centre Creek was done by Streamkeepers. They have contributed significant projects in the mainstem and estuary as well. The MVIHES stewards have been undertaking water quality monitoring with Environment Canada and the Community Watershed Monitoring Program of the RDN and MOE for several years. They also monitor flow and groundwater-surface water interaction and are involved in education programs in the community and the local schools, fry salvage and smolt monitoring.
- MVIHES will be establishing a watershed stewardship monitoring program based on the outcomes of this report.

In closing; the Englishman River Habitat Status could be described as having an excellent foundation of assessments. These assessments have been used with success to conduct recovery plan activities that have a coordinated and purposeful strategy. Each salmon bearing reach in the watershed has seen some improvement in habitat condition due to direct action by the partners in the recovery plan. The habitat condition of the river is definitely improving from deathly low levels of habitat it once had and that is perhaps most clearly observed in the return of the salmon stocks.

Volunteer Stewardship Opportunities (Draft Outline)

Many past publications have identified their own segments of action required for the Englishman River watershed. Starting with the Estuary (Caring for the Englishman Estuary, MVIHES 2009) on up to the headwaters with water quality monitoring . A synopsis of action items for projects is presented with references noted;

Englishman Estuary
Reference : Caring For the Englishan River Estuary
Action Items:
Plants – monitor, assess the decline of sedge and recover
Water – Storm Water Quality, Bank erosion,
Fish Utilization – Salmonids, Forage fish.
Habitat Restoration – invasive species removal, native planting,
BCCF –potential estuary restoration project

Mainstem
Park management Plan (2008) spells out a long list
Riparian Planting, invasive removal, , awareness signage, access etc, all stuff geared to "Friends of ER Park"(see friends of Mt Douglas Park for ideas FOMD.ca)
LWD – mainstem maintenance, monitoring, partner with BCCF/DFO for re-tying LWD in summer
Off Channel development advice - Bruce Carpenter property development, map and design and help find funds, small LWD, spawning gravel sites scaled to volunteers is possible
Existing Off channels – need spawning gravel and cover, also planting and trail redo
Erosion protection/bioengineering
Water Quality –Community Watershed Monitoring Network (MOE & RDN), EC at Hwy. 19a bridge
Storm Water projects – Rain gardens for roadways & parking lots, The two main highway bridges over the river lack detention of runoff and require diversion to infiltration/settling areas.

Headwaters
Marmot recovery – wildlife branch inventory people may have some tagging or other
Water Quality –BCCF data logger areas, Community Watershed Monitoring Network (MOE & RDN)
Partner with Timber company projects – ORR/garbage clean up/any other forest projects – possibly stabilization, grass seeding ditches/small road cuts, sump clean out – by partnering funding for them to hire summer students for the work??

Tributaries
Centre Creek
Centre Creek Restoration Plan (2004)
A long list of ongoing activities,
LWD, Riparian, off channel
Data Logger – flow & temperature
revisit riparian treatments done 10 years ago, invite W Warttig to review and report

Morison/Swayne
Farm/Property stewardship plans (resurrect 2009 plans)
Improve drainage, water quality, fencing, planting, monitoring,
Fish access at triple falls- was once considered – open up vast coho habitat
Water Quality –Community Watershed Monitoring Network (MOE & RDN) Morison

South Englishman
Monitoring –determine species access past barriers in the lower riiver to find the extent of steelhead and coho habitat use.
Water Quality –Community Watershed Monitoring Network (MOE & RDN)

Shelly Creek
Walshe 1999 plan
Continue smolt trap, inventory and map entire creek, write management plan
Possible – fencing, planting, water quality, instream improvements
Upland storm water project
Barrier removals – bad culverts/erosion
Water Quality –Community Watershed Monitoring Network (MOE & RDN)

Sidechannels
Add spawning gravel, plants, cover logs,
do maintenance on past structures
Do spawner counts/redd counts
Plant edges, maintain trails with improved surfaces and drainage and crowd control (see rdn parks list)

Hatchery
Help with egg transfers, fish husbandry,
Brood capture local brood stock of Pinks, Chums if low in abundance
Assist with setup of classroom egg incubators

References

Annand, C.,A., B. Hillaby and J. Naylor. 1993, Englishman River Estuary. Prepared for the Pacific Estuary Conservation Program
A comprehensive field collection of Fish, Benthos, Epibenthos, Water Chemistry, Vegetation and Bird species of the Englishman River estuary in 1993 as well as history of ownership and development.

Arrowsmith Water Service, 2012. Fisheries Benefits Bulletin.
www.arrowsmithwaterservice.ca/fisheries_benefits.asp

Barlak, Rosie, Deborah Epps and Burke Phippen, 2010. Water quality assessment and objectives for the Englishman River Community Watershed, British Columbia. Environmental Protection Division, Ministry of Environment Nanaimo B.C.

Buechert, R., D. Clough and M. Deakin, 2009. Caring For The Englishman Estuary. A bio-inventory and Volunteer Monitoring Project. Commissioned for the Mid Vancouver Island Habitat Enhancement Society. Parksville B.C.
A 2007 & 2008 inventory of estuarine Fish, Water Quality, Vascular Plants, Terrestrial Fauna, Mapping Special Places and features, Invasive Species, and Near Shore Studies (Shoreline Inventory, Marine Riparian Areas, Eel Grass Mapping, Forage Fish). Analysis of current status compared to historic references.

Buechert, R.D. 1999. Streamside Protection Areas: Shelley Creek Stewardship Project. A MVIHES project for City of Parksville.
A trial streamside protection zoning for maintaining the riparian area of Shelley Creek.

Brown, R.F.,V.D. Chahley and D.G. Demontier. 1977. Preliminary Catalogue of Salmon Streams and Spawning Escapements of Statistical Area 14 (Comox-Parksville) Fisheries and Oceans Vancouver.

Blackman, B.G. and R.E. Hurst, 1988. An Evaluation of the Enhancement Potential of the Englishman River. Fisheries and Oceans. Nanaimo B.C.

Bocking, R. and M. Gaboury, 2001. Englishman River Watershed Recovery Plan. Prepared for the Pacific Salmon Endowment Fund Society. L.G.L. Limited, Sidney B.C
This recovery plan was targeted for Steelhead and Coho as part of the Georgia Basin Recovery Planning process with funding primarily from the Pacific Salmon Endowment Fund. It provided an overview of the watershed, the components of a recovery plan and the gaps in data. It prioritized 12 Recovery Projects.

Boom, A. and G. Bryden, 1993. Englishman River Water Allocation Plan. Province of British Columbia, Regional Water Management Branch, Ministry of Environment, Lands and Parks, Vancouver Island Region, Nanaimo B.C.
An overview of the water supplies, flows and allocations in the watershed with recommendations on storage for future use including details for the proposed Arrowsmith Lake Reservoir.

Burns, Ted & Associates, 1995. Environmental Assessment of the Proposed Corfield and Butler Development near Parksville.
This report of Shelly Creek noted the stream channel was diverted in its mid reach and cut off salmon access.

Clermont, H. (ed) 2011. The State of the Mount Arrowsmith Biosphere Reserve. Global and Climate Change in Mountain Sites 2011. (www.mabr.ca)

Clough, D.R. & G. Stewart, 1988. Morison Creek Summer Electroshock Survey above and below Triple Falls. Unpublished field notes. D.R. Clough Consulting, Lantzville B.C.

Clough, D.R. & G. Stewart, 1991. Englishman River Salmon Brood Capture and Swim Survey Records. Unpublished Records. D.R. Clough Consulting, Lantzville B.C.

Clough, D.R. 2004. Environmental Assessment- Camp Douglas, Englishman River. On behalf of 1st Parksville Troop, Scouts Canada c/o Peter Jorgenson, Jorgensen/Osmond Ltd.11A – 1009 Allsbrook Centre Parksville, B.C.V9P2A9.

Clough, D.R. 2010. Englishman River Bank Stabilization. Parry's Campground B.C. Water Management, Nanaimo: Approval File Number A1-1490, Parksville, B.C.V9P2A9. D.R. Clough Consulting, Lantzville B.C.

Decker, A. S. M.J. Lightly and A.A. Ladwig, 2003. The Contribution of Two Constructed Sidechannels to Coho Production on the Englishman River. Fisheries and Oceans. Can. Tech. Rep. Fish & Aq. Sciences 2442. .

Fisheries and Oceans Canada. 2006. Englishman River Bank Stabilization as built survey, Lot A, DL 128, Nanoose District. Oceans and Community Stewardship, Nanaimo B.C.

Gaboury, M. N. 2003, Fish habitat Restoration Designs for the Englishman River. On behalf of the BC Conservation Foundation for the Pacific Salmon Foundation. L.G.L. Limited, Sidney B.C.
Restoration prescriptions for 15 LWD and one Boulder placement in the mainstem from 3.7 to 9.3km.

Gaboury, M.N, 2005. A Strategy for Protection and Restoration of the Englishman River Mainstem. Prepared for the Englishman River Watershed Recovery Plan Community Roundtable and Pacific Salmon Endowment Fund Society. L.G.L. Limited, Sidney B.C.
A prioritization and budget for the top ten restoration measures on the Englishman River mainstem, particularly in Reach E3. It collects and analyzes considerable data on channel morphology.

GW Solutions, 2012. Lower Englishman River Watershed Groundwater and Surface Water Interaction.. Commissioned for the Mid Vancouver Island Habitat Enhancement Society.
This project was designed to collect aquifer and groundwater information and relationships with the Englishman River.

Hawkes, V.C., M. Gaboury, & J. Fenneman. 2008. 2008-2012 management Plan for the Englishman River Regional Park. Prepared for the Regional District of Nanaimo, Recreation and Parks. By L.G.L. Ltd. Sidney B.C.

Hamilton, R.E. and G.T. Kasakoski, 1982. Water Requirements for the Fisheries Resource of the Englishman River. Vancouver Island, B.C. Can. Man. Rep. Fish. Aquat. Sci. 1676.

Higman, S. , B. Pollard, I. Redden and G. Horel. 2003. Englishman River Watershed Assessment, Weyerhaeuser, Nanaimo B.C.

Hill, N.1992, Fisheries and Oceans, Salmon Enhancement Program, Fletcher Challenge Sidechannel-Site Plan 31-65-01 to 03. Design Drawings. Fisheries and Oceans Vancouver B.C.

Hurst, R. H. 1988. Englishman River Salmon Maintenance Plan. Sep.15, 1988 Planning letter sent to Gary Logan, Head, Small Projects Unit. Fisheries and Oceans, Vancouver
This memo outlined the intent of sidechannel, stock enhancement and monitoring strategies that formed the basis of the programs.

Hurst, R. H., D.R. Clough & G. Stewart, 1990. Coho Colonization Program. Unpublished field operations, Fisheries and Oceans, Nanaimo B.C.
This program ran from 1986 to 1994 and undertook alternative habitat and enhancement strategies for restoration of native stocks on the east coast of Vancouver Island.

Johnston, N.T. and P. A. Slaney, 1996. Fish habitat Assessment Procedures. Watershed Restoration Program Technical Circular No. 8. Ministry of Environment, Ministry of Forests, Nanaimo.

Koning, C.W., M.N. Gaboury, M. N. Feduk and Pat A. Slaney, 1997. Techniques to Evaluate the Effectiveness of Fish habitat Restoration Works in Streams Impacted by Logging Activities. Proc. CWRA Footprints of Humanity, June 3-6, 1997, Lethbridge AB

Lough, M and C. Morley, 2002. Overview Assessment of Fish and Fish habitat in the Englishman River Watershed. Prepared for the Pacific Salmon Foundation and funded by the Pacific Salmon Endowment Fund.
An overview biological assessment by reach of fish species presence and limiting habitat conditions from 74 habitat and 36 fish sample locations. They recommended addressing low flow, as well as summer and winter fish habitat.

Labelle, M. 2009. Status of Pacific Salmon Resources in Southern British Columbia and the Fraser River Basin. Vancouver, BC: Pacific Fisheries Resource Conservation Council.

Mathews, I. and A. Eden, 2005. Salmon Escapement to the Englishman River, 2005. Fisheries and Oceans, South Coast Area, Nanaimo B.C.17 pp
The last of six PSEF funded escapement surveys.

Mount Arrowsmith Biosphere Foundation, mabf.ca

Miller, L. 1997. Englishman River – The MacMillan Bloedel Channel, a summary of present and historical biological data. Habitat and Enhancement Branch, DFO, Nanaimo.
References the 1980's DFO research and development leading to the Englishman sidechannels as well as their current carrying capacity.

McCulloch, M.P. 2006, Englishman and South Englishman River Restoration Activities – 2005. For pacific Salmon Endowment Fund, Ministry of Transportation Environmental Enhancement Fund and the Habitat Conservation Trust Fund. Prepared by BC Conservation Foundation Nanaimo B.C.
A total of 22 large woody debris and boulder riffle enhancements in the Englishman mainstem and South Englishman River in 2005.

MVIHES 2002, Englishman River Estuary and Shelly Creek Riparian Restoration Project 2002 PSEFS Final Report.

MVIHES 2005. ER 015 2005 Morison Swayne Rehabilitation 2005. Funded by Pacific Salmon Endowment Fund, 2005. Mid Vancouver Island Enhancement Society, P.O. Box 935 Parksville B.C.

MVIHES 2008, Englishman River Flow Management 2007. Englishman River Recovery Plan Roundtable.
Mentor local stewards in standardized science based stream flow gauging and work on Water Management Plan (WMP) with local government.

MVIHES 2009, Fish in the Ditch Atlas- Deep Bay to Lantzville. Prepared by the Mid Vancouver Island Enhancement Society. mvihes.ca
A stream and fish presence atlas of RDN ditches and small drainages to protect and provide a tool for better management practices.

MVIHES 2005, Centre Creek Phase One. Final report for Pacific Salmon Foundation CSP .

MVIHES 2006, Centre Creek Phase Two. Final report for Pacific Salmon Foundation CSP 06-045.

MVIHES 2008, Centre Creek Phase Four. Final report for Pacific Salmon Foundation CSP 08-043.

MVIHES 2010, Centre Creek Restoration 2010. Final report for Pacific Salmon Foundation CSP 050.

MVIHES 2011, Centre Creek Restoration 2011. Final report for Pacific Salmon Foundation CSP S.

MVIHES 2012, Centre Creek Restoration 2012. Final report for Pacific Salmon Foundation CSP 038.

MVIHES 2013. Shelly Creek Smolt Trap Report 2013. For DFO Stock Assessment and Dave Davies, Community Programs , DFO Comox B.C.

Mottram, W. & L. Wells, 1979. Vancouver Island Obstruction Surveys, Morison Creek, File 0637. Ministry of Environment Engineering, Victoria B.C.

Nature Trust. Vancouver Islands Englishman River – A Case Statement for Conservation. Prepared for under Environment Canada Ecological Gifts Program. Unpublished pamphlet.

Parksville Streamkeepers Society, 2002, Shelly Creek Literature Review with Focus on Stream Stewardship and Fish Habitat Restoration. co-written with Fisheries and Oceans Community Programs, unpublished manuscript April 2002.

Provencher, S.K., B. Mayer, and S.E. Grasby 2013. Aqueous Geochemistry of the Englishman River Watershed, Parksville, British Columbia for use in assessment of potential surface water-groundwater interaction. Geological Survey of Canada Open File 7406.

Rood, K., 2002. Englishman River Channel Condition Assessment. Prepared for the Pacific Salmon Foundation, funded by the Pacific Salmon Endowment Fund Society.by Northwest Hydraulic Consultants Ltd. , North Vancouver B.C.
This baseline study established the reach breaks, noted the changes over time of the channel and then recommended action on flow monitoring and fish habitat improvements.

Sian, Sherry, 1999, Mount Arrowsmith; Building a Biosphere Reserve, Fostering a Community. On behalf of Parks Canada under a Masters Program for the Faculty of Environmental Design at The University of Calgary, AB.

Silvestri, S.W. 2007. Fish Habitat Rehabilitation in the Englishman River, 2006. Prepared for the Georgia Basin Living Rivers Program, Habitat Conservation Trust Fund and Pacific Salmon Foundation. Prepared by the BC Conservation Foundation
This project added six LWD and Boulder groynes and two Boulder Riffle enhancements (now 68 total) to the mainstem Englishman.

Stalberg, H.C., R.B. Lauzier, E.A. MacIsaac, M.Porter and C.Murray. 2009. Canada's Policy for Conservation of Wild Pacific Salmon: Stream, Lake, and Estuarine Habitat Indicators. Canadian Manuscript Report of Fisheries and Aquatic Sciences No.2859.

Taylor, J. and M. Wright, 2010. Assessment of the contribution of off-channel habitat to the production of coho in the Englishman River. For the Community Fisheries Development Centre.

Tutty, B.D., B.A. Raymond and K. Conlin. 1983. Estuarine Restoration and Salmonid Utilization of a Previously Dyked Slough in the Englishman River Estuary, Canadian MS Rep. Fish.Aquat.Sci. 1689.

TimberWest Forest Corp. Sep. 25, 2005, News release: TimberWest & The Nature Trust increase protected area along Englishman River.

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

Warttig, W. and D. Clough, 2004, Restoration Plan; Detailed Salmon Habitat and Riparian Overview with Level II Prescriptions, Center Creek Sub Basin, Englishman River Watershed. Prepared for the Mid Vancouver Island Habitat Enhancement Society.

Warttig, W. and D. Clough, 2008, December 2008 Addendum; Restoration Plan; Detailed Salmon Habitat and Riparian Overview with Level II Prescriptions, Center Creek Sub Basin, Englishman River Watershed. Prepared for the Mid Vancouver Island Habitat Enhancement Society.

Young, C. 1998. Englishman River Enhancement Project –Stock rebuilding and Side Channel development. A partnership plan with CFDC, Macmillan Bloedel and Dept. Fisheries and Oceans. Unpublished manuscript Feb. 25, 1998.

Appendix 1: Habitat Status Tables Chinook, Chum, Coho, Pink, Sockeye. (5pps)

Chinook Table

Chinook Conservation Unit - Englishman River Watershed Habitat Status Report									
Life Stage	**Known limiting factors**	**Known high value habitats**	**Performance Indicator(s) for habitat limiting factors**	**Performance Indicator(s) Status**	**Performance Indicators Thresholds**	**Information Gaps**	**Possible measures to address limiting factors**	**Possible measures to maintain productivity**	**Habitat Protection & Restoration Measures Undertaken**
Spawner/Egg / Alevin	'Poor logging practices dating to the early 1900's have negatively impacted the riparian area and the river itself[3]. Frequent flood events degraded spawning habitat, permanently alter stream morphology and fill in spawning beds with sediment or wash eggs downstream. The number of returning adults is 1053 for 2011 and a five year average of 716 fish[6].	The Englishman River mainstem has 69000m^2 of spawning habitat while the South Englishman River has 2750m^2. Center Creek has 1100m^2 of spawning habitat and there is 225m^2 in Morison Creek. The total available spawning habitat in the Englishman system is 73000m^2. [3]	Riparian disturbance, land cover alteration, Suspended sediment, Peak and Min discharge, Water temperature, migration & spawning	Discharge peak, min, MAD. Measures of riparian length (m), land disturbance (ECA m^2), Turbidity, Temperature values, spawner counts	Proportion of stream length with disturbed riparian zone: Functioning condition (NOAA 1996) Proper: < 20 disturbed and > 50% of riparian vegetation similar to natural community composition. Equivalent clearcut area (ECA): area harvested, cleared, or burned: proper: < 15 % ECA with no concentration of disturbance in unstable or potentially unstable areas. Total suspended sediments as identified by EIFAC 1964 and DFO 2000: < 25 parts per million (ppm) of suspended solids - no evidence of harmful effects on fish and fisheries; Magnitude of flow events (Richter et al. 1997): 10% MAD minimum instantaneous flow for survival of most aquatic life (though 20% of MAD has been recommended as a minimum instream flow for some streams) 7-day average of mean daily temperature (Richter and Kolmes 2005):Migration 16ºC	Hydrology, Water Quality, including hydraulic sampling	Securing the riparian corridor in reaches E1-E7[4]. Identify sensitive areas to private landowners to be protected, planted to restore the riparian cover. [4] Installation of structures in all reaches to increase Pool/Riffle sequences	Build protected spawning channels (done for Coho but flow limited for Chinook). The river is stocked with 50-250k presmolt BQR chinook held in pens to 5 gm smolt size.	Water flow and quality monitoring[11] Bank erosion protection at critical areas from 1997[8]-2012[7,9,10].
Fry/Juvenile Summer (N/A for immediate ocean migrants, ie. pink, chum, some chinook & sockeye poplns)	Low flows and channel dewatering takes place[1].	References list Top Bridge Pool, Three Arm Pool and Big Tent Run are the best summer habitat locations, as they all hold good levels of water throughout the summer [3] but there are no Chinook specific rearing areas identified (i.e. fast bouldery water)	Low Summer Flows and reduced habitat area[1].	Discharge peak, min, MAD. Instream Cover (% Boulder, LWD, Mean Depth)	Total suspended sediments as identified by EIFAC 1964 and DFO 2000: < 25 parts per million (ppm) of suspended solids - no evidence of harmful effects on fish and fisheries; Magnitude of flow events (Richter et al. 1997): 10% MAD minimum instantaneous flow for survival of most aquatic life (though 20% of MAD has been recommended as a minimum instream flow for some streams) 7-day average of mean daily temperature (Richter and Kolmes 2005)	Summer Water Quality, Chinook Fry/smolt enumeration, Chinook rearing locations	Supplemental flow from the Arrowsmith Lake Reservoir [4]. (since 1999). The water license agreement for the reservoir states that the dam should maintain a minimum of 1.6 cms or approx. 10% of the mean annual discharge. Installation of boulder/ LWD in all reaches to increase Pool/Riffle sequences[1].	Maximize Summer flows from Arrowsmith Resevoir[2]. Add LWD to promote pool scouring and to provide cover	Water flow augmentation [4] Water flow and quality monitoring[11] Bank erosion protection at critical areas from 1997[8]-2012[7,9,10].
Fry/Juvenile Winter (N/A for immediate ocean migrants as above)	Mostly or all $S/_0$ Stock so no summer rearing.				na	Little to none in Chinook specific juvenile population assessment.		.	

Chinook Conservation Unit - Englishman River Watershed Habitat Status Report									
Life Stage	**Known limiting factors**	**Known high value habitats**	**Performance Indicator(s) for habitat limiting factors**	**Performance Indicator(s) Status**	**Performance Indicators Thresholds**	**Information Gaps**	**Possible measures to address limiting factors**	**Possible measures to maintain productivity**	**Habitat Protection & Restoration Measures Undertaken**
Smolt	There is limited smolt data available. The estuary fish production is unchanged in 10 years but the estuarine plant community has significantly declined which will affect productivity[12,13].	There is high value habitat in the Englishman River estuary. Chinook are found there from May-July[12],	Na	na	Egg to smolt survival (needs to be determined for this river)	Lack of Chinook specific studies of smolt escapement. The data reports [12/13] indicate Chinook presence in estuary but not well defined for how long and where.	Chinook specific assessment of the estuary should be completed to better understand the species needs. [4] Issues that should be inspected are: hydrology , biological habitats and alterations that have negatively impacted the out-migration and estuary.	Biophysical monitoring of the estuary should be maintained to manage specific needs. [4] i.e.: hydrology , biological habitats and alterations that have negatively impacted the stream.	
Marine Coastal	As above	There is information available concerning ocean survival found in the Englishman River Escapement Summary[6] and the Big Qualicum Exploitation Rates[7]	na	na	The combined incidental mortality and landed catch (Exploitation Rate) was 0.3427 in 2005. [7]	Na	NA	Increase tagging to provide fish management migration data	
Marine Offshore	Assuming Englishman River Chinook join Big Qualicum Chinook in offshore migrations, can expect similar exploitation rates and marine survival. [7]	There is information available concerning ocean survival found in the Englishman River Escapement Summary [6] and the Big Qualicum Exploitation Rates[7]	na	na	The combined incidental mortality and landed catch (Exploitation Rate) was 0.3427 in 2005. [7]	na	NA	Increase tagging to provide fish management migration data	
Returning Adult Migration	The mainstem has access is to 15.8 kms where a falls barrier is found.Englishman River System[1]... The South Englishman River has anadromous access to where there is a possible barrier of a cascade at 4.5 kms. Preference is to mid and lower reaches but found to falls.	The estuary is wide and open allowing for adults to enter the river easily. This also helps the fish to avoid predation from marine mammals such as seals. There are deep pools formed from bedrock outcrops along the Mainstem to provide holding[1]	Riparian disturbance land cover alteration (mining & forestry) Suspended sediment. Stream discharge. Water temperature. Migration and spawning barriers. [1,2,3,4]	Km of accessible stream length, migration flow and temperature.[22]	Magnitude of flow events (Richter et al. 1997): 10% MAD minimum instantaneous flow for survival of most aquatic life (though 20% of MAD has been recommended as a minimum instream flow for some streams) 7-day average of mean daily temperature (Ricther and Kolmes 2005):Migration 16ºC	Hydrology requirements with respect to future logging. Marine survival including sport and commercial fishing	Improve fall entry flow regime [22]	Improve fall entry flow regime [22]	Restoration structures focusing on creating scour and pool cover[7].

References:

1.) Lough and Morley 2002 2.) NHC 2002 3.) LGL 2001 4.) LGL 2005 5.) GWS 2012 6.) DFO BQR Exploitation Rates. 7.) Silvestri 2007. 8.) Fisheries and Oceans unpublished 1997 Englishman River Bank Restoration Groynes (Kerrys). 9.) Clough, D.R. 2010,. 10.) Higman et al 2003,, 11.) MVIHES 2007. 12.) Beuchert et al 2009, 13.) Annand et al 1993.14.) MVIHES 2013. 15.) Clough 2010. 16.) Taylor & Wright 2010 17.) Boom, A & G. Bryden, 1994. Englishman River Water Allocation Plan 18.) www.wateroffice.ec.gc.ca/ 19.) Tutty, et al 1983. 20.) Mathews & Eden 2005. 21.) Labelle 2009 21.) Clough unpublished data 22.) pers. Comm Bob Hurst, DFO retired.

Coho Conservation Unit - Englishman River Watershed Habitat Status Report									
Life Stage	**Known limiting factors**	**Known high value habitats**	**Performance Indicator(s) for habitat limiting factors**	**Performance Indicator(s) Status**	**Performance Indicators Thresholds**	**Information Gaps**	**Possible measures to address limiting factors**	**Possible measures to maintain productivity**	**Habitat Protection & Restoration Measures Undertaken**
Spawner/Egg/ Alevin	'Poor logging practices dating to the early 1900's have negatively impacted the riparian area and the river itself[3]. Frequent flood events degraded spawning habitat, permanently alter stream morphology and fill in spawning beds with sediment or wash eggs downstream. The number of returning adults averaged 5300 for 2010 & 11	The Englishman River mainstem has 69000m^2 of spawning habitat while the South Englishman River has 2750m^2. Center Creek has 1100m^2 of spawning habitat and there is 225m^2 in Morison Creek. The total available spawning habitat in the Englishman system is 73000m^2. [3] An additional unsurveyed amount of spawning area is available in the Clay Young sidechannel	Riparian disturbance, land cover alteration, Suspended sediment, Peak and Min discharge, Water temperature, for migration & spawning	Discharge peak, min, MAD. Linked to WSC gauge. Measures of riparian length (m), land disturbance (ECA m^2), Turbidity, Temperature values, spawner counts	Proportion of stream length with disturbed riparian zone: Functioning condition (NOAA 1996) Proper: < 20 disturbed and > 50% of riparian vegetation similar to natural community composition. Equivalent clearcut area (ECA): area harvested, cleared, or burned: proper: < 15 % ECA with no concentration of disturbance in unstable or potentially unstable areas. Total suspended sediments as identified by EIFAC 1964 and DFO 2000: < 25 parts per million (ppm) of suspended solids - no evidence of harmful effects on fish and fisheries; Magnitude of flow events (Richter et al. 1997): 10% MAD minimum instantaneous flow for survival of most aquatic life (though 20% of MAD has been recommended as a minimum instream flow for some streams) 7-day average of mean daily temperature (Richter and Kolmes 2005):Migration 16ºC	Hydrology, Water Quality, including hydraulic sampling for egg survival	Securing the riparian corridor in reaches E1-E7[4]. Identify sensitive areas to private landowners to be protected, planted to restore the riparian cover. [4] Installation of structures in all reaches to increase Pool/Riffle sequences	Improve spawning areas in the existing rearing channels . .	Water flow and quality monitoring[11] Bank erosion protection at critical areas from 1997[8]-2012[7,9,10]. Sidechannel construction with spawning areas.
Fry/Juvenile Summer (N/A for immediate ocean migrants, ie. pink, chum, some chinook & sockeye popns)	Low flows and channel dewatering, sparse canopy & instream cover , deposition of gravel in pools, [1].	References list Top Bridge Pool, Three Arm Pool and Big Tent Run as the best summer habitat locations (E2), as they all hold good levels of water throughout the summer [3]	Low Summer Flows and reduced habitat area[1].	Discharge peak, min, Linked to WSC gauge. MAD. Instream Cover (% Boulder, LWD, Mean Depth)	Total suspended sediments as identified by EIFAC 1964 and DFO 2000: < 25 parts per million (ppm) of suspended solids - no evidence of harmful effects on fish and fisheries; Magnitude of flow events (Richter et al. 1997): 10% MAD minimum instantaneous flow for survival of most aquatic life (though 20% of MAD has been recommended as a minimum instream flow for some streams) 7-day average of mean daily temperature (Richter and Kolmes 2005)	Summer Water Quality,	Supplemental flow from the Arrowsmith Lake Reservoir [4]. (since 1999). The water license agreement for the reservoir states that the dam should maintain a minimum of 1.6 cms or approximately 10% of the mean annual discharge. Installation of boulder/ LWD in all reaches to increase Pool/Riffle sequences[1].	Maximize Summer flows from Arrowsmith Resevoir[2]. Add LWD to promote pool scouring and to provide cover	Water flow and quality monitoring[11] Bank erosion protection at critical areas from 1997[8]-2012[7,9,10].
Fry/Juvenile Winter (N/A for immediate ocean migrants as above)	Lack of overwinter refuge especially in E5 & E6[1].	7.4 ha of protected wetted habitat in the 3.6 km long Clay Young channel, All accessible tributaries, i.e Shelly Creek produces over 6,000 smolts from winter rearing habitat only 830m long [14]	Area of accessible tributary and off channel.	Winter habitat assessment of quality, fish usage – pre-smolt studies	Taylor & Wright (2010) note 43% (18,500) of Englishman smolts coming from Clay Young Sidechannel..	Fish use in all off channel/tribs total and percent contribution should be measured	Develop off channel in each reach of the river (i.e. E1, E5,E6)[1] Install secure mainstem LWD/Rock Groyne habitats.	.Maintain access and water quality in existing refuge areas. Mainstem habitat cover installations	Clay Young sidechannel was lengthened last in 2007. No new LWD in mainstem since then [7] except E2 at Parrys

Coho Conservation Unit - Englishman River Watershed Habitat Status Report									
Life Stage	**Known limiting factors**	**Known high value habitats**	**Performance Indicator(s) for habitat limiting factors**	**Performance Indicator(s) Status**	**Performance Indicators Thresholds**	**Information Gaps**	**Possible measures to address limiting factors**	**Possible measures to maintain productivity**	**Habitat Protection & Restoration Measures Undertaken**
Smolt	Lack of cover for migrants.	As above in tributaries and off channels. There is high value habitat in the Englishman River estuary. Coho were found there from May-July[12],	Smolt traps have been in operation in the mainstem and tribs since 1990.	Smolt data total and per km habitat	Taylor and Wright (2010) note off channel production exceeds 4,000 smolts per km	Estuarine residency use[12].	Species monitoring t of estuary use to understand the habitat preferences [4] Items that should be inspected are: hydrology , biological habitats and alterations that have negatively impacted the out-migration and estuary life[12].	Biophysical monitoring of the estuary should be maintained to understand specific needs. [4].	Smolt monitoring [14,16], Monitoring and awareness of Estuary [12]
Marine Coastal	The estuary fish production is unchanged in 10 years but the estuarine plant community has significantly declined which will affect productivity[12,13].	There is information available concerning ocean survival found in the Englishman River Escapement Summary[6] and the Big Qualicum Exploitation Rates[7]	% Foreshore hardening, , % development of estuary,	Measure shore development, , marine riparian areas[12]		As above	As above	Increase tagging to provide fish management migration data	
Marine Offshore	If we are to assume that Englishman River Coho join Big Qualicum Coho in offshore migrations, we can assume similar exploitation rates and similar marine surviva[6]l.	There is information available concerning ocean survival found in the Englishman River Escapement Summary and the Big Qualicum Exploitation Rates6	na	na	na	na	NA	Increase tagging to provide fish management migration data	
Returning Adult Migration	There is total anadromous access to 28 kms on the Englishman River System[1]. Shelly Creek has access to culvert barriers at 1 kms. The mainstem has access to 15.8 kms where a falls barrier is found. Center Creek and Morison Creek also have falls barriers found at 5.2 kms and 2.1 kns respectively. The South Englishman River has anadromous access to a barrier cascade at 4.5 kms.	The estuary is wide and open allowing for adults to enter the river easily. This also helps the fish to avoid predation from marine mammals such as seals, Deep Pools are found along the E2/E3 reach to avoid predation	Riparian disturbance land cover alteration (mining & forestry) Suspended sediment Stream discharge Water temperature migration & spawning	Km of accessible stream length	Magnitude of flow events (Richter et al. 1997): 10% MAD minimum instantaneous flow for survival of most aquatic life (though 20% of MAD has been recommended as a minimum instream flow for some streams) 7-day average of mean daily temperature (Ricther and Kolmes 2005):Migration 16ºC	Restoration opportunities focusing on creating scour and pool cover. Hydrology requirements with respect to future logging. Marine survival including sport and commercial fishing	More Adult migrant cover placements needed throughout river [7] Man made Migration barriers at Shelly creek identified by MVIHES, potential passable barriers at Morison Ck identified at MOELP	Maintain cover structures and add more.	Many existing LWD/Rock groynes in mainstem to hide migrants [7]

References:
1.) Lough and Morley 2002 2.) NHC 2002 3.) LGL 2001 4.) LGL 2005 5.) GWS 2012 6.) DFO BQR Exploitation Rates. 7.) Silvestri 2007. 8.) Fisheries and Oceans unpublished 1997 Englishman River Bank Restoration Groynes (Kerrys). 9.) Clough, D.R. 2010,. 10.) Higman et al 2003,, 11.) MVIHES 2007. 12.) Beuchert et al 2009, 13.) Annand et al 1993.14.) MVIHES 2013. 15.) Clough 2010. 16.) Taylor & Wright 2010

Chum Conservation Unit - Englishman River Watershed Habitat Status Report									
Life Stage	**Known limiting factors**	**Known high value habitats**	**Performance Indicator(s) for habitat limiting factors**	**Performance Indicator(s) Status**	**Performance Indicators Thresholds**	**Information Gaps**	**Possible measures to address limiting factors**	**Possible measures to maintain productivity**	**Habitat Protection & Restoration Measures Undertaken**
Spawner/Egg/ Alevin	'Poor logging practices dating to the early 1900's have negatively impacted the riparian area and the river itself[3]. Frequent flood events degraded spawning habitat, permanently alter stream morphology and fill in spawning beds with sediment or wash eggs downstream.	The Englishman River mainstem has 69000m^2 of spawning habitat while the South Englishman River has 2750m^2. Center Creek has 1100m^2 of spawning habitat and there is 225m^2 in Morison Creek. The total available spawning habitat in the Englishman system is 73000m^2. [3] An additional unreported amount of spawning area is available in the Clay Young sidechannel. Chum have been reported in all these areas but Mathews & Eden (2005) note over half the chum are spawning below Allsbrook Road (E1& E2)	Riparian disturbance, land cover alteration, Suspended sediment, Peak and Min discharge,	Discharge linked to Water Survey Canada live gauge[18]. Water Allocation Plan Guidelines, BC Env. (1994)[17]. Water flow and quality monitoring[11]	Proportion of stream length with disturbed riparian zone: Functioning condition (NOAA 1996) Proper: < 20 disturbed and > 50% of riparian vegetation similar to natural community composition. Equivalent clearcut area (ECA): area harvested, cleared, or burned: proper: < 15 % ECA with no concentration of disturbance in unstable or potentially unstable areas. Total suspended sediments as identified by EIFAC 1964 and DFO 2000: < 25 parts per million (ppm) of suspended solids - no evidence of harmful effects on fish and fisheries; Magnitude of flow events (Richter et al. 1997): 10% MAD minimum instantaneous flow for survival of most aquatic life (though 20% of MAD has been recommended as a minimum instream flow for some streams) 7-day average of mean daily temperature (Richter and Kolmes 2005):Migration 16ºC	Hydrology, Water Quality, including hydraulic sampling for egg survival	Securing the riparian corridor in reaches E1-E7[4]. Identify sensitive areas to private landowners to be protected, planted to restore the riparian cover. [4] Installation of structures in all reaches to increase Pool/Riffle sequences	Improve spawning areas in the existing rearing channels . .	Bank erosion protection at critical areas from 1997[8]-2012[7,9,10]. Sidechannel construction with spawning areas.
Fry/Juvenile Summer	Fry migrate to estuary in spring, no summer rearing.	na							
Fry/Juvenile Winter	Na								
Smolt	The estuary fish production is unchanged in 10 years but the estuarine plant community has significantly declined which will affect productivity[12,13].	There is high value habitat in the Englishman River estuary. Chum are found there in spring[12], There is information available concerning ocean survival found in the Englishman River Escapement Summary[6] and the Big Qualicum Exploitation.	% Foreshore hardening, , % development of estuary,	Comparison of past and present shore alteration, , marine riparian areas[12]	B.C. Standards for Water Quality ,Chemistry, temperature and Oxygen	Estuarine residency use[12].	Species specific assessment of the estuary should be completed to better understand the species needs. [4] Issues that should be inspected are: hydrology , biological habitats and alterations that have negatively impacted the out-migration and estuary[12].	Biophysical monitoring of the estuary to protect and manage specific needs. [4] Invasive plants and animal control are highly recommended.	Dyke breached to increase estuary in 1979 [19]. Monitoring and awareness of Estuary [12]Invasive plant and animal management programs.
Marine Coastal						na	na	Na	
Marine Offshore	If we are to assume that Englishman River Chum join Big Qualicum Chum in offshore migrations, we can assume similar exploitation rates and similar marine survival.	There is information available concerning ocean survival found in the Englishman River Escapement Summary and the Big Qualicum Exploitation Rates[6]	na	na	na	na	NA	Increase tagging to provide fish management migration data	.

Chum Conservation Unit - Englishman River Watershed Habitat Status Report									
Life Stage	**Known limiting factors**	**Known high value habitats**	**Performance Indicator(s) for habitat limiting factors**	**Performance Indicator(s) Status**	**Performance Indicators Thresholds**	**Information Gaps**	**Possible measures to address limiting factors**	**Possible measures to maintain productivity**	**Habitat Protection & Restoration Measures Undertaken**
Returning Adult Migration	The number of returning adults averaged 23000 for 2010 & 11. There can be impediments to migration for early migrants die to low flow, and turbidity at high flow [20]. Spawning sites may be disturbed by flood events [1]	The estuary is wide and open allowing for adults to enter the river easily. There are broad shoals of gravel in the lower reach and over half spawn there.[20]	Spawner counts. Riparian disturbance land cover alteration (mining & forestry) Suspended sediment Stream discharge Water temperature migration & spawning	Spawner counts usually annually (nuSeds) [20]	Spawner, Redd counts, hydraulic sampling of redds.	Peak counts often difficult when turbid [20]	More frequent counts	Spawning gravel addition in Clay Young Sidechannel	Off channel habitat created is used by Chum spawners
References: 1.) Lough and Morley 2002 2.) NHC 2002 3.) LGL 2001 4.) LGL 2005 5.) GWS 2012 6.) DFO BQR Exploitation Rates. 7.) Silvestri 2007. 8.) Fisheries and Oceans unpublished 1997 Englishman River Bank Restoration Groynes (Kerrys). 9.) Clough, D.R. 2010,. 10.) Higman et al 2003,, 11.) MVIHES 2007. 12.) Beuchert et al 2009, 13.) Annand et al 1993.14.) MVIHES 2013. 15.) Clough 2010. 16.) Taylor & Wright 2010 17.) Boom, A & G. Bryden, 1994. Englishman River Water Allocation Plan 18.) www.wateroffice.ec.gc.ca/ 19.) Tutty, et al 1983. 20.) Mathews & Eden 2005.									

Pink Conservation Unit - Englishman River Watershed Habitat Status Report

Life Stage	Known limiting factors	Known high value habitats	Performance Indicator(s) for habitat limiting factors	Performance Indicator(s) Status	Performance Indicators Thresholds	Information Gaps	Possible measures to address limiting factors	Possible measures to maintain productivity	Habitat Protection & Restoration Measures Undertaken
Spawner/Egg/ Alevin	'Poor logging practices dating to the early 1900's have negatively impacted the riparian area and the river itself[3]. Frequent flood events degraded spawning habitat, permanently alter stream morphology and fill in spawning beds with sediment or wash eggs downstream.	The Englishman River mainstem has 69000m^2 of spawning habitat while the South Englishman River has 2750m^2. Center Creek has 1100m^2 of spawning habitat and there is 225m^2 in Morison Creek. The total available spawning habitat in the Englishman system is 73000m^2. [3] An additional unreported amount of spawning area is available in the Clay Young sidechannel. Pink have been reported in all these areas but Mathews & Eden (2005) note most spawning in lower and middle reaches (E1, E2,E3)	Riparian disturbance, land cover alteration, Suspended sediment, Peak and Min discharge,	Discharge linked to Water Survey Canada live gauge[18]. Water Allocation Plan Guidelines, BC Env. (1994)[17]. Water flow and quality monitoring[11]	Proportion of stream length with disturbed riparian zone: Functioning condition (NOAA 1996) Proper: < 20 disturbed and > 50% of riparian vegetation similar to natural community composition. Equivalent clearcut area (ECA): area harvested, cleared, or burned: proper: < 15 % ECA with no concentration of disturbance in unstable or potentially unstable areas. Total suspended sediments as identified by EIFAC 1964 and DFO 2000: < 25 parts per million (ppm) of suspended solids - no evidence of harmful effects on fish and fisheries; Magnitude of flow events (Richter et al. 1997): 10% MAD minimum instantaneous flow for survival of most aquatic life (though 20% of MAD has been recommended as a minimum instream flow for some streams) 7-day average of mean daily temperature (Richter and Kolmes 2005):Migration 16ºC	Hydrology, Water Quality, including hydraulic sampling for egg survival	Securing the riparian corridor in reaches E1-E7[4]. Identify sensitive areas to private landowners to be protected, planted to restore the riparian cover. [4] Installation of structures in all reaches to increase Pool/Riffle sequences	Improve spawning areas in the existing rearing channels . .	Bank erosion protection at critical areas from 1997[8]-2012[7,9,10]. Sidechannel construction with spawning areas.
Fry/Juvenile Summer	Fry migrate to estuary in spring, no summer rearing.	na							
Fry/Juvenile Winter	Na								
Smolt	The estuary fish production is unchanged in 10 years but the estuarine plant community has significantly declined which will affect productivity[12,13].	There is high value habitat in the Englishman River estuary. Pink were found there [12], There is information available concerning ocean survival found in the Englishman River Escapement Summary[6]	% Foreshore hardening, , % development of estuary,	Comparison of past and present shore alteration, , marine riparian areas[12]	B.C. Standards for Water Quality ,Chemistry, temperature and Oxygen	Estuarine residency use[12].	Species specific assessment of the estuary should be completed to better understand the species needs. [4] Issues that should be inspected are: hydrology , biological habitats and alterations that have negatively impacted the out-migration and estuary[12].	Biophysical monitoring of the estuary to protect and manage specific needs. [4] Invasive plants and animal control are highly recommended.	Dyke breached to increase estuary in 1979 [19]. Monitoring and awareness of Estuary [12]Invasive plant and animal management programs.
Marine Coastal						na	na	Na	
Marine Offshore	Limited data on ECVI Pinks in marine survival [21]		na	na	na	na	NA	Increase tagging to provide fish management migration data	.

Chum Conservation Unit - Englishman River Watershed Habitat Status Report									
Life Stage	**Known limiting factors**	**Known high value habitats**	**Performance Indicator(s) for habitat limiting factors**	**Performance Indicator(s) Status**	**Performance Indicators Thresholds**	**Information Gaps**	**Possible measures to address limiting factors**	**Possible measures to maintain productivity**	**Habitat Protection & Restoration Measures Undertaken**
Returning Adult Migration	The number of returning adults averaged 3580 for 2010 & 11 There can be impediments to migration for early migrants die to low flow, and turbidity at high flow [20]. Spawning sites may be disturbed by flood events [1]	The estuary is wide and open allowing for adults to enter the river easily. There are broad shoals of gravel in the lower reach and over half spawn there.[20]	Spawner counts. Riparian disturbance land cover alteration (mining & forestry) Suspended sediment Stream discharge Water temperature migration & spawning	Spawner counts usually annually (nuSeds) [20]	Spawner, Redd counts, hydraulic sampling of redds.	Peak counts often difficult when turbid [20]	More frequent counts	Spawning gravel addition in Clay Young Sidechannel	Off channel habitat has been created and is used by Pink spawners

References:
1.) Lough and Morley 2002 2.) NHC 2002 3.) LGL 2001 4.) LGL 2005 5.) GWS 2012 6.) DFO BQR Exploitation Rates. 7.) Silvestri 2007. 8.) Fisheries and Oceans unpublished 1997 Englishman River Bank Restoration Groynes (Kerrys). 9.) Clough, D.R. 2010,. 10.) Higman et al 2003,, 11.) MVIHES 2007. 12.) Beuchert et al 2009, 13.) Annand et al 1993.14.) MVIHES 2013. 15.) Clough 2010. 16.) Taylor & Wright 2010 17.) Boom, A & G. Bryden, 1994. Englishman River Water Allocation Plan 18.) www.wateroffice.ec.gc.ca/ 19.) Tutty, et al 1983. 20.) Mathews & Eden 2005. 21.) Labelle 2009

Sockeye Conservation Unit - Englishman River Watershed Habitat Status Report

Life Stage	Known limiting factors	Known high value habitats	Performance Indicator(s) for habitat limiting factors	Performance Indicator(s) Status	Performance Indicators Thresholds	Information Gaps	Possible measures to address limiting factors	Possible measures to maintain productivity	Habitat Protection & Restoration Measures Undertaken
Spawner/Egg/ Alevin	' Poor logging practices dating to the early 1900's have negatively impacted the riparian area and the river itself[3]. Frequent flood events degraded spawning habitat, permanently alter stream morphology and fill in spawning beds with sediment or wash eggs downstream.	The Englishman River mainstem has 69000m^2 of spawning habitat while the South Englishman River has 2750m^2. Center Creek has 1100m^2 of spawning habitat and there is 225m^2 in Morison Creek. The total available spawning habitat in the Englishman system is 73000m^2. [3] An additional unreported amount of spawning area is available in the Clay Young sidechannel. Pink have been reported in all these areas but Mathews & Eden (2005) note most spawning in lower and middle reaches (E1, E2,E3)	Riparian disturbance, land cover alteration, Suspended sediment, Peak and Min discharge,	Discharge linked to Water Survey Canada live gauge[18]. Water Allocation Plan Guidelines, BC Env. (1994)[17]. Water flow and quality monitoring[11]	Proportion of stream length with disturbed riparian zone: Functioning condition (NOAA 1996) Proper: < 20 disturbed and > 50% of riparian vegetation similar to natural community composition. Equivalent clearcut area (ECA): area harvested, cleared, or burned: proper: < 15 % ECA with no concentration of disturbance in unstable or potentially unstable areas. Total suspended sediments as identified by EIFAC 1964 and DFO 2000: < 25 parts per million (ppm) of suspended solids - no evidence of harmful effects on fish and fisheries; Magnitude of flow events (Richter et al. 1997): 10% MAD minimum instantaneous flow for survival of most aquatic life (though 20% of MAD has been recommended as a minimum instream flow for some streams) 7-day average of mean daily temperature (Richter and Kolmes 2005):Migration 16ºC	Hydrology, Water Quality, including hydraulic sampling for egg survival	Securing the riparian corridor in reaches E1-E7[4]. Identify sensitive areas to private landowners to be protected, planted to restore the riparian cover. [4] Installation of structures in all reaches to increase Pool/Riffle sequences	Improve spawning areas in the existing rearing channels . .	Bank erosion protection at critical areas from 1997[8]-2012[7,9,10]. Sidechannel construction with spawning areas.
Fry/Juvenile Summer	No records of where they live, fry thrive with lake summer rearing	na							
Fry/Juvenile Winter	As above								
Smolt	No records of smolt captures[12,13].	There is high value habitat in the Englishman River estuary. But no Sockeye were found there [12], There is information available concerning ocean survival found in the Englishman River Escapement Summary[6]	Unknown river sockeye,			Adult spawning areas, fry rearing areas.		.	.
Marine Coastal						na	na	Na	
Marine Offshore	no data on ECVI Sockeye		na	na	na	na	NA	tagging to provide fish management migration data	.
Returning Adult Migration	The number of returning adults averaged less than 100 annually (nuSeds) . They have no lake to spawn above.	The adults hold in the deep Top Bridge pool and the Falls pool[21].	Spawner counts.	Spawner counts usually annually (nuSeds) [20]	Spawner, Redd counts, hydraulic sampling of redds.	[0]			This species will always likely be in low abundance due to lack of lake habitat

References:
1.) Lough and Morley 2002 2.) NHC 2002 3.) LGL 2001 4.) LGL 2005 5.) GWS 2012 6.) DFO BQR Exploitation Rates. 7.) Silvestri 2007. 8.) Fisheries and Oceans unpublished 1997 Englishman River Bank Restoration Groynes (Kerrys). 9.) Clough, D.R. 2010,. 10.) Higman et al 2003,, 11.) MVIHES 2007. 12.) Beuchert et al 2009, 13.) Annand et al 1993.14.) MVIHES 2013. 15.) Clough 2010. 16.) Taylor & Wright 2010 17.) Boom, A & G. Bryden, 1994. Englishman River Water Allocation Plan 18.) www.wateroffice.ec.gc.ca/ 19.) Tutty, et al 1983. 20.) Mathews & Eden 2005. 21.) Labelle 2009 21.) Clough unpublished data

Appendix 2: Transcripts of Personal Interviews

Interview Preface:

It is just over 10 years since the Englishman River Watershed Recovery Plan was initiated by the Pacific Salmon Endowment Fund. In that time (and before as well), there have been many studies, reports and actions taken to support the health of this watershed and its fish stocks. In an effort to sum up all the work that has been done and what the habitat status is now, Mid Vancouver Island Habitat Enhancement Society (MVIHES) is compiling a Status Report Card on the river. Unfortunately we do not have the funding to produce another LGL-type report, but we can do the literature search and interviews that will give all of us a better idea of how the Englishman is faring today. Using that base-line we will establish some "indicators" that volunteers can monitor over the long term. You can help by sending along any information about reports etc. that you may have and by jotting down comments in this questionnaire. If you can offer any other assistance we would very much appreciate it. Thanks in advance for your input!

Englishman River Habitat Questionnaire: Name: James Craig, BCCF

1.) How familiar are you with this system?
Very

2.) For each reach and tributary do you know of any limiting habitats (ie spawning, rearing, migration) for each life stage (egg, alevin, fry, smolt, adult) for each species

Mainstem:
Due to less than ideal base flows, high quality riffle habitat for rearing is limited, particularly for steelhead
habitat complexity is still low, compromised by excessive bedload, overwidening and a lack of old growth recruitment large enough to form permanent jams.

Nutrients (for productivity) are likely limiting in most years (exception may be following high CM escapements over sequential years), though this is natural for ECVI.

Tributaries:

Rearing space is limited by low water in summer
Culverts may be issue in some tribs

3.) **What is the most limited habitat in this system? (summer water quality, migration, lack of spawning gravel).** For ST and CO: high quality rearing habitat. For CM, CK, PK: clean gravel.

4.) **Do you know of any seasonal limitations in habitats (flooding, erosion, base flow, water temperature) in the stream**. Base flow, July-Sep.

5.) **Are there any high value habitats in the watershed? Where? For what species? Can you locate them on a map**? Yes. Too many to list. Most are species specific.

6.) **How has land development affected fish habitat? Can you compare to an adjacent watercourse that has had less development.** Culverts have isolated upstream areas, or create bottle necks.

7.) **Would you recommend any enhancement/restoration to increase fish populations in this watershed? It is typical to start in the headwaters and work downstream but might not be applicable in this case.** Off-channel habitats (CO, CT) are safer to build, and effective at adding production. Work in smaller tributaries for CO and CT.

8.) What shape is the estuary in? Have you noticed any changes over time with respect to plant communities and general morphology?
Fairly good, but some impacts and threats remain. Suggest breaching or putting tidal gate in Mine Road Dyke. Also, supply fresh water to western half of estuary via Turner Road relic channel.

9.) **Are there any high value habitats present in the estuary? Do you know anything about the water quality in the estuary**?
Eastern braid (along mine road dyke) extremely productive, with the highest use by salmonids after the mainstem channel. We believe this is a function of the freshwater it receives from the split at the bottom of Plummer Road. BCCF has salinity and O2 data from its sampling in 2011

10.) **Do you know the percentage of the watershed that has been developed**? No

11.) **Any invasive species present ? Where?** Too many to list. But, no hogweed or knotweed that I'm aware of…

12.) **Other observations?**

13.) **How much has the river changed since you have been involved with it**?

Englishman River Habitat Questionnaire –Name :Joan Michel, RDN

1.) **How familiar are you with this system?** Moderately.

2.) For each reach and tributary do you know of any limiting habitats (ie spawning, rearing, migration) for each life stage (egg, alevin, fry, smolt, adult) for each species

We've been having an interesting time at the out-take of the ERRP channel over the last couple of years with summertime recreationalists building stone dams and blocking migrating salmon from getting into the channel. Our Volunteer Park Warden reported last week of visitors throwing boulders into fish channel. I fear there is much degradation caused by pure ignorance of the nature of habitat and the needs of the fish.

3.) **What is the most limited habitat in this system? (summer water quality, migration, lack of spawning gravel)** I understood it was ocean conditions.

4.) **Do you know of any seasonal limitations in habitats (flooding, erosion, base flow, water temperature) in the stream**. No.

5.) **Are there any high value habitats in the watershed? Where? For what species? Can you locate them on a map**? According to VIU monitoring over three years, the ERRP side channel offers pretty good habitat.

6.) How has land development affected fish habitat? Can you compare to an adjacent watercourse that has had less development.

As noted in Q2, the more people around, the more potential interference in natural processes. Insofar as the greater Top Bridge/ERRP area is highly used by recreationalists, we're going to see interface issues like dogs not discouraged from going after spawning salmon.

7.) Would you recommend any enhancement/restoration to increase fish populations in this watershed? It is typical to start in the headwaters and work downstream but might not be applicable in this case.

I'd certainly like to see continuation of regular monitoring, smolt and spawning counts, swims etc., that help us understand what's going on in the river.

8.) What shape is the estuary in? Have you noticed any changes over time with respect to plant communities and general morphology?

Not good and suffering from the same problems as the LQ, as I understand. I rarely go to the estuary.

9.) **Are there any high value habitats present in the estuary? Do you know anything about the water quality in the estuary**? Don't know.

10.) **Do you know the percentage of the watershed that has been developed**? No

11.) **Any invasive species present ? Where?** We have broom in ERRP. Haven't seen any hogweed so far.

12.) **Other observations?**

13.) **How much has the river changed since you have been involved with it**?

We lose a bit more of the side of ERRP every year. The Clay Banks continue to erode. DFO's groin at the side channel intake seems to be working nicely.

Englishman River Habitat Questionnaire Name: Margaret Wright, Restoration Biologist, Fisheries and Oceans Canada

1.) **How familiar are you with this system?** I became involved in the Englishman River in 2009 following the constructed extension of the Clay Young fish channel. I familiar with both of the DFO side channel projects on the river and I have been involved in their maintenance and evaluation over the last 6 years.

2.) **For each reach and tributary do you know of any limiting habitats (ie spawning, rearing, migration) for each life stage (egg, alevin, fry, smolt, adult) for each species**. I am not familiar with the tributaries on the Englishman, but there may be an issue with early pink migration in the lower mainstem during low water years. DFO commissioned Ecofish Research to prepare a report in 2010 entitled: Englishman River Instream Flow Study – Background Data Review to look at existing flow transect data and develop a study plan to re-assess minimum flow requirements for salmonids in the river. I have provided the background report, the subsequent work to develop min flow requirements was not funded.

3.) **What is the most limited habitat in this system? (summer water quality, migration, lack of spawning gravel).** The smolt surveys have shown us that a constructed side channel can consistently produce 43% of the entire watershed production of coho. Whether the tributaries and other off channel habitats are producing to their full capacity or not has not been assessed but there may be limiting factors associated with low flow and temperature, perhaps water quality in the tributaries. A potential habitat limiting factor may be sediment transport and deposition from erosion, but this has not been proven through assessment.

4.) **Do you know of any seasonal limitations in habitats (flooding, erosion, base flow, water temperature) in the stream**. Erosion of unstable banks is an issue which results in the loss of mainstem rearing habitat.

5.) **Are there any high value habitats in the watershed? Where? For what species? Can you locate them on a map**? High value habitats are mapped in the Ecofish report. This information was acquired from DFO and contractors who regularly provide adult swim survey data for stock assessment.

6.) How has land development affected fish habitat? Can you compare to an adjacent watercourse that has had less development.

The Englishman River is typical of a logged watershed with a hydrograph that exhibits low and high flows not ameliorated by a functioning forest.

7.) **Would you recommend any enhancement/restoration to increase fish populations in this watershed?** It is typical to start in the headwaters and work downstream but might not be applicable in this case. Contrary to popular opinion, I don't really think we need to increase the salmon populations of the river; I am more interested in healthy sustainable populations that are not heavily enhanced. Although I am not suggesting an outcome either way, I believe a review of enhancement in the river is required, both in terms of which species are being enhanced and why.

Englishman River Salmon Escapements

Year	Chinook	Chum	Coho	Pink	Sockeye
Mean:					
1953-1958		9125	1458	1000	17
1959-68	39	3175	919	88	22
1969-78	60	5175	1020	34	58
1979-88	7	1820	664	15	14
1989-98	46	3105	619	479	17
1999-08	872	12065	3406	4958	12
2010-11	1472	23096	5300	3580	6

not surveyed in 2009

8.) **What shape is the estuary in? Have you noticed any changes over time with respect to plant communities and general morphology?** I have not done any work in the estuary**.**

9.) Are there any high value habitats present in the estuary? Do you know anything about the water quality in the estuary? I believe all estuaries are high value habitats.

10.) Do you know the percentage of the watershed that has been developed? No

11.) **Any invasive species present ? Where?** I don't know

12.) **Other observations?**

13.) How much has the river changed since you have been involved with it? A bit of movement in the mainstem in the lower river at long run and certainly some erosion along the south bank.

Englishman River Habitat Questionnaire – Rosie Barlak, Ministry of Environment

1.) How familiar are you with this system? Very, from a water quality perspective. I am the lead on the Water Quality Objectives and objectives attainment sampling done on the system. Data from 2010 monitoring has not been compiled yet, but will be summarized into a WQO attainment report in the future. At that time I will better be able to give a scientifically based opinion on the state of water quality in the watershed.

2.) For each reach and tributary do you know of any limiting habitats (ie spawning, rearing, migration) for each life stage (egg, alevin, fry, smolt, adult) for each species. There are some high water temperatures in the summer that could limit certain life stages but I cannot comment on these in detail without analyzing the available water quality data.

3.) What is the most limited habitat in this system? (summer water quality, migration, lack of spawning gravel). Same as above.

4.) Do you know of any seasonal limitations in habitats (flooding, erosion, base flow, water temperature) in the stream. Same as above.

5.) Are there any high value habitats in the watershed? Where? For what species? Can you locate them on a map? I am not a habitat specialist**.**

6.) How has land development affected fish habitat? Can you compare to an adjacent watercourse that has had less development (tranquil). Increased turbidity, increased contaminants levels and higher water temperatures all have been observed in areas where more development has occurred. Higher water temperatures may not be from development alone as the wide flat lower parts of most of our east coast VI systems typically have elevated temperatures in summer; climate change may also affect temperatures. Details cannot be commented on without analyzing water quality data.

7.) Would you recommend any enhancement/restoration to increase fish populations in this watershed? It is typical to start in the headwaters and work downstream but might not be applicable in this case. I am not a fisheries specialist.

8.) What shape is the estuary in? Have you noticed any changes over time with respect to plant communities and general morphology? I have never collected data in the estuary.

9.) Are there any high value habitats present in the estuary? Do you know anything about the water quality in the estuary? See above.

10.) Do you know the percentage of the watershed that has been developed? No, but closer land use analysis for our WQO attainment report may present these figures.

11.) Any invasive species present ? Where? I haven't researched this.

12.) Other observations? Not at this time.

13.) How much has the river changed since you have been involved with it? I will better be able to be able to comment on this when we summarize our data.

Englishman River Habitat Questionnaire – Patrik Zetterberg and Steve Baillie_DFO Stock Assessment

1.) How familiar are you with this system?
Somewhat familiar with the section from the hatchery down to the estuary from doing swims.

2.) For each reach and tributary do you know of any limiting habitats (ie spawning, rearing, migration) for each life stage (egg, alevin, fry, smolt, adult) for each species.
I understand that the upper section (falls to the end of Englishman Road) is fairly limited to spawning adults due to lack of conducive spawning gravel.

3.) What is the most limited habitat in this system? (summer water quality, winter water quality, migration, lack of spawning gravel marine survival, fishing).
I would think low summer flows which can impair migration of pinks and early Chinook.

4.) **Do you know of any seasonal limitations in habitats (flooding, erosion, base flow, water temperature) in the stream**.No.

5.) **Are there any high value habitats in the watershed? Where? For what species? Can you locate them on a map**?
I think all areas are high value habitats but a couple areas I see used consistently by Chinook is: 1) the area from the stump pool down past the log jam and past the end of the gravel bank almost to the large rock just above the cascades. 2) the northern bank of the river from roughly the Hwy 19 bridge to about half way to the campground pool. Yes, I can locate these areas on a map if you like.

6.) How has land development affected fish habitat? Can you compare to an adjacent watercourse that has had less development (tranquil).
I have not been around long enough to comment on this.

7.) Would you recommend any enhancement/restoration to increase fish populations in this watershed? It is typical to start in the headwaters and work downstream but might not be applicable in this case.
I think the best bang for the buck would be to fix up the old spawning channel.

8.) What shape is the estuary in? Have you noticed any changes over time with respect to plant communities and general morphology?
I have not seen the estuary portion of this system other than the small tributary on the south side.

9.) **Are there any high value habitats present in the estuary? Do you know anything about the water quality in the estuary**? NA

10.) **Do you know the percentage of the watershed that has been developed**? No.

11.) **Any invasive species present ? Where?** Not that I am aware of.

12.) **Other observations?**

13.) **How much has the river changed since you have been involved with it**?
I have only noticed slight shifts in the stream path and some large trees that have fallen into the system in the last couple of years but this is a good thing – they create new pools and areas for holding fish and also new gravel introduction.

Englishman River Habitat Questionnaire – Craig Wightman, RPBio., BCCF

14.) How familiar are you with this system? Very! I have worked on the Englishman as a fisheries biologist since 1987.

15.) For each reach and tributary do you know of any limiting habitats (ie spawning, rearing, migration) for each life stage (egg, alevin, fry, smolt, adult) for each species

My sense is that for the mainstem Englishman and its larger sub-basins (South Eman, Morison Creek) summer base flows and overall "structural" quality of rearing habitat (especially for winter Steelhead, Coho and anadromous Coastal Cutthroat Trout) continue as the most important habitat limiting factors in the watershed. Structural quality mostly relates to the presence/frequency of stable LWD jams and sediment/compaction free large substrate (boulders/cobbles). Both are important for nourishing healthy aquatic invertebrate populations ("fish food"), and provide valuable rearing space for Coho, Steelhead and Cutthroat. Flow sustainability and water quality in smaller tributaries (like Shelly Creek) are equally important as limiting factors for salmonid species. Maintaining established groundwater/surface water connections/pathways in the lower floodplain is critical to long-term aquatic ecosystem health and fish sustainability objectives.
Augmented flows from Arrowsmith Dam/Reservoir have had a positive influence on summer rearing conditions in the mainstem Englishman, but are still just meeting the minimum provincial fisheries standard for fish habitat conservation (below):

Table 13 Fisheries Criteria

Modified Tennant (Montana) Method Instream Flow Requirements	
Flows	**Description**
30-60% MAD	Excellent spawning/rearing
20-30% MAD	Good spawning/rearing
10-20% MAD	Fair spawning/rearing
5-10% MAD	Poor spawning/rearing
>5% MAD	Severely degraded spawning/rearing

*Eman Mean Annual Discharge is 13.6 cms; the base summer flow target is 1.6 cms or about 11.8% of MAD, supported by storage releases from Arrowsmith Dam. The base flow target is frequently compromised by summer droughts and existing storage limitations at the Arrowsmith Reservoir.

16.) What is the most limited habitat in this system? (summer water quality, migration, lack of spawning gravel)

Summer/early fall rearing habitat for juvenile salmonids (see above).

17.) **Do you know of any seasonal limitations in habitats (flooding, erosion, base flow, water temperature) in the stream**.

As above….plus large-scale floods in November-December can be very damaging to incubating salmon eggs (Chinook, Coho and Chum).

18.) **Are there any high value habitats in the watershed? Where? For what species? Can you locate them on a map**?

The entire watershed accessible to anadromous fish species should be considered "high value" habitat given these species collectively support significant commercial and recreational fisheries (under recent changes to Federal Fisheries Act regulations). Headwater reaches, above anadromous barriers, are populated by resident trout and char species. In small lakes like Shelton and Healy, these support important recreational fisheries in "near wilderness" conditions.

19.) How has land development affected fish habitat? Can you compare to an adjacent watercourse that has had less development (tranquil).

The Englishman watershed has been significantly altered from its "pre-contact" condition more than 100 years ago. The original old growth forest is virtually logged (87% of watershed in within Private Managed Forest Land), and the coastal plain has been heavily populated (City of Parksville) or converted to small hobby farms (Coombs-Errington). Impacts on aquatic habitats have been aptly described by Bocking and Gaboury (2001)[10], and in several subsequent reports completed under auspices of the ERWRP. There are no neighbouring watersheds that haven't suffered the same types/scales of development during a similar time period (e.g., Nanaimo, French Creek, Little Qualicum River).

20.) Would you recommend any enhancement/restoration to increase fish populations in this watershed? It is typical to start in the headwaters and work downstream but might not be applicable in this case.

There has already been a significant amount of fish habitat restoration undertaken in the watershed as a result of the ERWRP (2001), and companion programs like the Greater Georgia Basin Steelhead Recovery Plan and Living Rivers Trust Fund. There are probably more mainstem/tributary sites where anchored LWD jams could be installed, and side-channels where flow control and habitat improvements could be beneficial. Through this *Status Report Card, t*he ERWRP Steering Committee should lead development of an up-dated list of potential restoration projects.

Erosion control at the large *Clay Bank* formation (right bank ~400m downstream of South Englishman confluence) should be re-considered, as the site appears to be getting more unstable in recent years, perhaps in response to upslope land developments. An assessment of upslope drainage patterns, in combination with design options for stabilizing the bank's toe, should be the focus of geotechnical and river engineering analysis.

21.) What shape is the estuary in? Have you noticed any changes over time with respect to plant communities and general morphology?

The estuary has been heavily impacted by flood control works, abandoned/orphaned industrial dikes, residential developments (shoreline infilling/hardening), Canada geese grazing and loss of LWD. A plan is being (slowly) developed to address these issues, but probably needs more coordination and dedicated long-term funding for implementation. The ERWRP Steering Committee, Ministry of Forests, Lands and Natural Resource Operations, The Nature Trust of BC, and Guardians of Mid Island Estuaries should collaborate in this regard.

[10] Englishman River Watershed Recovery Plan (LGL Ltd., Sidney, BC).

22.) **Are there any high value habitats present in the estuary? Do you know anything about the water quality in the estuary**?

All estuary habitats are high value, although some are currently in a degraded condition. The latter can be restored over time, but this will necessarily take several years to complete, and needs reliable funding to be most effective. Restoring the Carex sedge community is a very high priority, as is adding habitat structure in the form of LWD to the estuary's dendritic channels and man-made features like the Surfside RV Park pond/channel complex.
The Mine Road Dike needs to be either upgraded/breached to restore a tidal water exchange with the old salt marsh next to the Shorewood Drive sub-division, or decommissioned and rebuilt as a set-back dike to protect the Shorewood residential neighborhood.
Continuing/enhancing the current CAGO management project led by the Guardians should be encouraged, particularly with respect to restoring native estuary plant communities.
The feasibility of a new 1km side-channel development extending from the mainstem Englishman near the current AWS Intake site (end of Turner Road), northwest into the estuary on Nature Trust land should be investigated. This could be considered as part of the AWS fish habitat compensation requirement for moving the intake approximately 2.75km upstream from its current site. The primary objective of the side-channel would be juvenile salmonid rearing and adding freshwater to the west side of the estuary where there is currently little freshwater influence.

23.) **Do you know the percentage of the watershed that has been developed**?

No, but it depends on what you mean by developed. If you're only focusing on urban/agricultural developments (not forestry), then it appears as if about 25% of the watershed has been developed. The Arrowsmith Biosphere Reserve may have more specific information on this topic.

24.) **Any invasive species present ? Where?**

I believe MVIHES has a pretty strong handle on invasive plant species in the watershed, as would the two private forest companies. Obviously Scotch broom is very widespread and needs annual attention in terms of removal/control. Also refer to http://www.bcinvasives.ca/.

25.) **Other observations?**

It would be useful to compile a list of blue/red listed species known to occupy the Englishman watershed. This can be done through a web site search at http://www.env.gov.bc.ca/atrisk/red-blue.htm.

26.) **How much has the river changed since you have been involved with it**?

The lower alluvial reach of the river has changed dramatically since 1987. This is essentially the area from Morison Creek confluence downstream to lower Martindale Road, above Highway 19A. This area has been affected periodically by major floods, like the rain-on-snow events in late November 1991, and has been heavily impacted by massive bedload deposition, bank erosion and transient woody debris.

Appendix 3. Englishman River Reach Photographs[11]-

Estuary and Reach E1 Photographs

Estuary

Estuary

Reach E1 DS

Reach E1 US

[11] Photo credits to Brad Rushton, Faye Smith & David Clough

Englishman Reach E2 and E3 Photographs

Reach E2 DS

Reach E2 US

Reach E3 DS

Reach E3 US

Englishman Reach E4 and E5 Photographs

Reach E4 DS

Reach E4 US

Reach E5 DS

Reach E5 DS

Englishman Reach E6 and E7 Photographs

Reach E6 US

Reach E6 DS

Reach E7 US

Reach E7 DS

Englishman Reach E8 and E9 Photographs

Reach E8 US

Reach E8 DS

Reach E9 DS

Reach E9 US

Englishman Reach E10 Photographs

Reach E10 US

Reach E10 DS

Shelly/Morison Creek Photographs

Shelly Creek R2

Shelly Creek R2

Morison Creek R1

Morison Ck R2

South Englishman /Centre Creek Photographs

S. Eng. R. DS

S. Eng. R. US

Centre Ck US

Centre Ck US