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MINISTRY OF ENVIRONMENT

Water Quality Assessment and Objectives for the Englishman River Community Watershed

OVERVIEW REPORT

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SUMMARY

This document is one in a series that presents water quality objectives for British Columbia. This overview report summarizes the findings of the technical report, which is available as a separate document. The overview report provides general information about the water quality of the Englishman River, a community watershed supplying drinking water to the City of Parksville on the east coast of Vancouver Island in British Columbia. It is intended for both technical readers and for readers who may not be familiar with the process for setting water quality objectives. Separate tables listing water quality objectives and monitoring recommendations are included. The technical report presents the details of the water quality assessment for the Englishman River, and forms the basis of the recommendations and objectives presented here.

The primary activities occurring within the watershed that could potentially impact water quality are timber harvesting, agriculture, recreation, and rural, urban and light industrial development.

Water quality objectives are recommended to protect source water (raw drinking water supply), recreation, irrigation, wildlife and aquatic life.

PREFACE

Purpose of Water Quality Objectives

Water quality objectives are prepared for specific bodies of fresh, estuarine and coastal marine surface waters of British Columbia as part of the Ministry of Environment's (MoE) mandate to manage water quality. Objectives are prepared only for those waterbodies and water quality characteristics that may be affected by human activity now or in the future.

Authority to set Water Quality Objectives

The MoE has the authority to set water quality objectives under Section 5(e) of the *Environmental Management Act*. In addition, Section 150 of the *Forest and Range Practices Act* (FRPA) contains provisions for the MoE to establish objectives to protect water quality in designated community watersheds. This legislation is intended to protect consumptive uses of water in designated community watersheds within working Crown forests. For this reason water quality objectives developed for community watersheds generally focus on potential impacts from timber harvesting, range activities and forestry-related road construction.

The Englishman River was designated as a community watershed in 1995, as defined under the *Forest Practices Code of British Columbia Act* ("the drainage area above the downstream point of diversion and which are licensed under the *Water Act* for waterworks purposes"). This designation was grandparented and continued under the *Forest and Range Practices Act* (FRPA) in 2004 and infers a level of protection. The purpose of this

designation is to conserve the quality, quantity and timing of water flow or prevent cumulative hydrological effects.

As the majority of the Englishman River community watershed is on private land, the FRPA does not apply to most of the watershed. However, the MOE uses other tools, such as water quality objectives, and legislation, such as the *Private Managed Forest Land Act* and the *Drinking Water Protection Act*, to ensure that water quality within these watersheds is protected and managed in a consistent manner.

How Objectives Are Determined

Water quality objectives are the safe limits for the physical, chemical or biological characteristics of water, biota (plant and animal life) or sediment that protect all designated water uses in a given waterbody or a watershed. The water uses considered in this exercise are the following:

- source water for public water supply and food processing
- aquatic life and wildlife
- agriculture (livestock watering and irrigation)
- recreation and aesthetics
- industrial (e.g., food processing) water supplies.

Objectives are established in British Columbia for waterbodies on a site-specific basis taking into consideration provincial water quality guidelines, local water quality, water uses, water movement, waste discharges and socio-economic factors. Each objective for a location may be based on the protection of a different water use, depending on the uses that are most sensitive

to the physical, chemical or biological characteristics affecting that waterbody.

How Objectives Are Used

Water quality objectives are not legally enforceable unless established under the Government Actions Regulation (B.C. Reg. 582/2004). Objectives are most commonly used to guide the evaluation of the state of water quality in a watershed, the issuance of permits, licenses and legal orders, and the management of fisheries and the province's land base. Water quality objectives are also a standard for assessing the ministry's performance in protecting water uses.

Monitoring Requirement

Monitoring of water quality objectives is undertaken to determine if the designated water uses are being protected. Monitoring usually takes place at a critical time when a water quality specialist has determined that the water quality objectives may not be met. In the case of forestry-related impacts, these critical times may be associated with periods of peak flows when the majority of suspended and dissolved particulates and other contaminants, such as bacteria, are introduced into a waterbody. Late summer periods of low flow could also be sensitive to impacts due to human disturbances. It is assumed that if all designated water uses are protected at the critical times, then they also will be protected at other times when the threat to water quality is less.

The monitoring usually takes place during a five-week period, twice during the calendar year which allows the specialists to measure the worst, as well as the average condition in the water. For some water bodies, the monitoring period and frequency may vary, depending upon the nature of the problem, severity of threats to designated water uses and the way objectives are expressed (e.g. mean value, maximum value, 95^{th} percentile, etc.).

Vancouver Island Eco-Region Approach

There are over 60 community watersheds within the Vancouver Island Region of the Ministry of Environment. Rather than develop water quality objectives for each of these watersheds on an individual basis, an ecoregion approach has been implemented, whereby Vancouver Island has been split into six ecoregions based on similar climate, geology, soils and hydrology. Representative lake and stream watersheds within each ecoregion are selected and a three year monitoring program is implemented to collect water quality and quantity data, as well as biological data. Watershed objectives will be developed for each of the representative lake and stream watersheds based on this data, and these objectives will also be applied on an interim basis to the remaining lake and stream watersheds within that ecoregion. Over time, other priority watersheds within each ecoregion will be monitored for one year to verify the validity of the objectives developed for each ecoregion and to determine whether the objectives are being met for individual watersheds.

INTRODUCTION

This report examines the existing water quality of the Englishman River community watershed and recommends water quality objectives for this watershed based on potential impacts of certain key water quality parameters of concern.

The Englishman River provides a significant source of drinking water to the local community and has important fisheries values, with chinook, chum, coho, sockeye and pink salmon, cutthroat and rainbow trout, and steelhead all present at some point during the year. Anthropogenic land uses within the watershed include timber harvesting, agriculture (primarily in the Morison Creek sub-basin), rural residential, urban residential (in the lower watershed), light industrial development and recreation. These activities, as well as natural erosion and the presence of wildlife, all potentially affect water quality in the Englishman River.

The purpose of this report is to develop water quality objectives for this watershed to help ensure long-term sustainability of the water resource.

BASIN PROFILE

Watershed Description

The Englishman River is a fourth-order stream 39 km in length, entering Georgia Strait near the community of Parksville, BC. The community watershed portion of the Englishman River watershed is approximately 31,890 ha in area and ranges from approximately 1,800 m elevation at Mount Arrowsmith in the upper watershed to

near sea level at the City of Parksville water intake (located about 1 km from the confluence of Georgia Strait) (Figure 1). There are seven named lakes within the watershed.

The lower portion of the watershed (below 100 m elevation) lies within the Coastal Douglas-fir (moist maritime, CDFmm), progressing through Coastal Western Hemlock (eastern very dry maritime, CWHxm1) above 100 m, Mountain Hemlock (windward moist montane, MHmm1) above 1,000 m elevation, and small areas above 1,300 m composed of Alpine Tundra (ATunp). The Englishman River falls within the Nanaimo Lowland (NAL) ecoregion established for Vancouver Island by MOE staff.

Figure 1. Map of watershed, with sampling location

Hydrology

Water Survey Canada (WSC) has operated a hydrometric station on the Englishman River for 33 years between 1913 and the present downstream from Highway 19A. Peak flows measured between 1913 and 2004 were approximately 393 m^3/s, while minimum flows were approximately 0.085 m^3/s.

Climate

The nearest climate station to the watershed for which climate normal data are available is the Nanaimo A station (elevation 28 m) (Environment Canada Climate Station 1025370), located approximately 44 km south-east of Parksville. Average daily temperatures between 1971 and 2000 range from 2.9°C in January to 18.0°C in August. Average total annual precipitation between 1971 and 2000 is 1,163mm, with only 81 mm (water equivalent) (7%) of this falling as snow. Temperatures at higher elevations in the watershed would be cooler than recorded at sea level. A larger portion of the annual total precipitation occurs as snowfall in the higher-elevation terrain of the watershed. Most precipitation (909 mm, or 78%) falls between October and March.

Water Uses

Water Licenses

Twenty-four water licenses have been issued for the Englishman River, allowing for the withdrawal of 9,796 dam^3/year (cubic decameters/year, where 1 dam^3 = 1,000 m^3) of water and the storage of 9,005 dam^3/year of water. The majority of the water is licensed for use in waterworks and domestic use. There have also

been three water licenses issued for Morison Creek (total volume 61 dam^3/year) and one water license for Shelley Creek (total volume 19 dam^3/year), primarily for irrigation purposes.

Recreation

There are no BC Forest Service recreation sites located in the Englishman River watershed. A provincial park (the Englishman River Falls Provincial Park) is located within the watershed, with an area of 97 ha and providing 105 campsites. A regional park (Englishman River Regional Park: a Conservation Area) is also located within the watershed, with an area of 207 ha and includes a trail system frequented by hikers, bikers, and people on horseback. Logging roads are present throughout the watershed, but access to logging roads on private land (the majority of the watershed) is controlled by a manned gate and no overnight camping is allowed. The river is known to be utilized by fisherman throughout the year and by swimmers during the summer. While no specific studies have been conducted to determine the recreational use of the Englishman River watershed, it is likely that impacts from these activities are minimal in the upper portion of the watershed

Fisheries

The Englishman River has high fisheries values, and species present include chinook (*Oncorhynchus tshawytscha*), pink (*O. gorbuscha*), coho (*O. kisutch*), sockeye (*O. nerka*) and chum (*O. keta*) salmon, as well as cutthroat trout (*O. clarkii*), rainbow trout (*O. mykiss*), and steelhead (*O. mykiss*). All seven named lakes within the watershed contain salmonid species.

The Englishman River is stocked on an annual basis with anadromous cutthroat trout smolts from the Big Qualicum fish hatchery, with a total of 24,374 smolts stocked between 2000 and 2005. As part of the Englishman River Watershed Recovery Plan over $1M has been invested since 2001, on numerous habitat enhancement and restoration projects, to improve water quality and increase salmonid populations, especially coho and steelhead. Partners include the Mid-Vancouver Island Habitat Enhancement Society, the BC Conservation Foundation, Weyerhaeuser, Island Timberlands, TimberWest, BC Ministry of Environment, Fisheries and Oceans Canada, the Community Fisheries Development Centre, the Regional District of Nanaimo, The Nature Trust of BC and others.

Flora and Fauna

The Englishman River watershed provides habitat to a variety of wildlife species typical of west coast Vancouver Island, including the endangered Vancouver Island marmot (*Marmota vancouverensis*), the anguinae sub-species of ermine (*Mustela erminea anguinae*), blacktail deer, black bear, cougar, and numerous other small mammals and birds. A number of rare plant species, including red and blue-listed species, are also found within the watershed.

Designated Uses

Based on the information presented here, the water uses to be protected should include drinking water, recreation, irrigation, wildlife and aquatic life.

Influences on Water Quality

Clay Bank

A potential contributing factor to impacts on water quality in the lower Englishman River is likely an exposed clay bank located approximately 400 meters downstream of the South Fork confluence. This clay bank, which is approximately 300 m in length and 30m in height, contributes significant fine sediment to the river through constant weathering, in particular, freezing and thawing cycles, and erosion by the river at the toe causing sloughing of materials into the river.

Forest Harvesting and Forest Roads

Forestry activities can impact water quality both directly and indirectly in several ways. The removal of trees can decrease water retention times within the watershed and result in a more rapid response to precipitation events and earlier and higher spring freshets. The improper construction of roads can change drainage patterns, destabilize slopes and introduce high concentrations of sediment to streams.

The Englishman River watershed consists primarily of private lands, managed by Island Timberlands LP (69% of the overall watershed) and TimberWest Forest Corp. (18% of the overall watershed). In the area managed by TimberWest Forest Corp., the weighted equivalent clearcut area (ECA), as of 2006, is 4% overall. Within this area, there are 141 km of roads, resulting in a road density of 2.5 km/km^2, and 48 stream crossings, resulting in 0.8 stream crossings per square kilometer. The road density is high, while the stream crossing density is low, within the

TimberWest Forest Corp. management area. While these data are not available for the area managed by Island Timberlands LP, they are likely similar. In the area managed by Island Timberlands LP the ECA, as of 2002, was 10% overall, with values as high as 22% for individual sub-basins. By 2001, 81% of the watershed managed by Island Timberlands LP had been logged, the majority of it during the 1960's and 1970's. As a result of historical logging practices, nearly all alluvial reaches (19% of total stream channel length) have experienced impacts which can contribute to increased turbidity during rain events.

While the relatively low ECA in both the Island Timberlands and TimberWest management areas suggest that there is a low potential for peak flow increases, it is likely that the cumulative effect of the large number of small-scale disturbances associated with road construction and forest harvesting is impacting water quality to a certain degree, especially with respect to turbidity levels during rain events. Improvements in harvesting practices over the past 20 years, coupled with increased legislation and enforcement suggests that these potential impacts to water quality will decrease as hydrologic recovery continues.

Land Ownership

Agricultural activities can contribute nutrients from fertilizers, as well as pesticides. Considerable agricultural development has occurred within the Morison Creek and Shelly Creek sub-basins, primarily hobby farms with horses, and forage crops such as corn and grasses. Agricultural activities such as tilling of peat bogs in

the Morison Creek watershed have resulted in major sediment loadings to this tributary.

There are a number of rural residences within the Englishman River watershed. Potential sources of contamination associated with households (such as septic fields), as well as fecal material from domestic animals such as horses, may affect water quality in the watershed.

Recreation

Recreational activities can affect water quality in a number of ways. Erosion associated with 4-wheel drive and ATV vehicles, direct contamination of water from vehicle fuel, and fecal contamination from human and domestic animal wastes (*e.g.*, dogs or horses) are typical examples of potential effects. As no in-depth studies have been conducted on recreation within the Englishman River watershed, the relative impacts of recreational activities cannot be discussed. However, with the ease of access in the lower watershed, presence of a large provincial park and a regional park within the watershed boundaries, and proximity to population centres, it is possible recreational impacts occur within the watershed.

Wildlife

Warm-blooded animals can carry microorganisms such as *Giardia lamblia* and *Cryptosporidium*, which are harmful to humans, causing gastrointestinal disease.

The Englishman River watershed contains valuable wildlife habitat, and provides a home for a wide variety of warm-blooded species including blacktail deer, black bear, wolf, cougar, red squirrels, eagles, hawks, owls, grouse and numerous other species of small birds.

Water Licenses

Water licenses can impact aquatic habitat downstream from the withdrawal, especially during low-flow periods. There are 24 licensed water withdrawals from the Englishman River community watershed, with an overall maximum volume of 9,796 dam^3/year. Assuming water was withdrawn from the Englishman River at a constant rate throughout the year (an unlikely scenario), the average withdrawal rate would be 0.311 m^3/s. As average daily flows between 1913 and 2004 ranged from 0.085 m^3/s during the mid-summer to 393 m^3/s during spring freshet, water withdrawals are likely to impact downstream flows in the Englishman River only during summer low-flow periods.

Mining and Mineral Claims

Mining activities can impact water quality by introducing high concentrations of metals to the watershed, depending on the location, and can also contribute to acidification of the water.

There are two mineral prospects shown in the BC Provincial Mineral Inventory. One is the Okay Mountain showing, which consists of an ash-rich coal seam containing high concentrations of sulphur, calcium, titanium, nickel and copper. The other is the Hey-Bert showing, which contains high copper concentrations.

Highways and Transportation

Highways and transportation corridors can influence water quality through run-off of pollutants such as oil and gasoline, as well as alter flow patterns. There are two highway crossings in the lower Englishman River watershed: the Inland Island Highway (Highway 19) crosses the river just upstream of Parksville; and the Old Island Highway (Highway 19A), a major highway and local thoroughfare with high traffic volume, crosses the Englishman River just upstream from the City of Parksville intake.

Urban and Industrial Development

Urbanization, particularly in the lower watershed, can impact water quality in many ways, including road runoff, stormwater, nutrients from lawn fertilizers, proliferation of impervious surfaces, direct discharges to the creek from businesses, changes in water flow patterns, and increased sediment loadings from land disturbance. Run off from light industrial development, especially in the lower watershed, may also impact water quality. The Mid-Vancouver Island Habitat Enhancement Society (a local stewardship group) works on stewardship projects within the watershed and educates the public about the sensitivity of the aquatic system.

WATER QUALITY ASSESSMENT AND OBJECTIVES

Water Quality Assessment

Five water quality monitoring locations were established within the Englishman River watershed: **Site E248835**, on Morison Creek just upstream from its confluence with the Englishman River (selected to monitor potential impacts from agricultural activities and timber harvesting in the upper watershed); **Site E248834**, the Englishman River just upstream from its confluence with Morison Creek (representing a small amount of timber harvesting, but primarily unimpacted); **Site E248836**, the South Englishman River just upstream from its confluence with the Englishman River (representing potential impacts solely from timber harvesting), **Site E252010**, the Englishman River just upstream from Allsbrook Canyon (a potential new location for the City of Parksville water intake); and **Site 0121580**, the Englishman River at Highway 19A (just upstream from the City of Parksville water intake). Water quality monitoring was conducted in the Englishman River watershed generally on a monthly basis between August 2002 and October 2005. The sampling frequency was increased to weekly for five consecutive weeks during summer low-flows and during fall peak-flows from 2002 to 2004. Continuous monitoring occurred from May 2003-June 2005 at Englishman River at Highway 19A only.

The monitoring results for the Englishman River show that water quality is generally good. Parameters of concern include temperature, true colour, total organic carbon, microbiological indicators, aluminum, as well as occasional high turbidity and suspended solids levels.

Water temperatures were only collected at one location (Englishman River at Highway 19A), and values here are likely considerably higher than those occurring upstream. This is due to the fact that the lower portion of the Englishman River is generally wide and shallow, with little riparian cover, allowing considerable solar infiltration. Maximum summer water temperatures exceeded the guideline for both coho and steelhead rearing, and the aesthetic guideline for drinking water.

True color was only measured at one location (Englishman River at Highway 19A), but exceeded the aesthetic drinking water guideline by a small margin in one of the samples.

Total organic carbon should be measured in the future, to determine if there are potential problems with chlorination by-products in the drinking water.

In general, turbidity levels were low at all sites. While the range of turbidity values measured at most of the sites was similar, mean turbidity values in the Englishman River upstream from Morison Creek and in the South Englishman River were considerably lower than at the other sites. It appears that a significant portion of the turbidity in the watershed originates in Morison Creek and turbidity values increase in a downstream direction, with the highest individual values measured at the City of Parksville intake site and the highest average value in Morison Creek. Contributions to increases in turbidity in the lower watershed likely include natural concerns (the clay bank mentioned above) and those triggered by human activities (agriculture, timber harvesting and urban run-off). Turbidity

values were highest during the winter (between January and March), coinciding with increased rainfall events.

Concentrations of total suspended solids (also referred to as non-filterable residue) tended to increase in a downstream direction, following similar trends as turbidity. Values were typically very low with elevated values generally occurring after rain events.

Nutrient values were generally low, with some higher values in Morison Creek, especially in the spring and fall. Limited phosphorous data suggest that higher spring values may coincide with tilling of soil and fertilizer applications at that time, while fall values coincide with fall flush rainfall events. MoE is working towards developing an interim phosphorous objective for Vancouver Island streams. Phosphorous data should continue to be collected, and the need for a phosphorous objective should be re-evaluated after the next attainment monitoring period.

The concentrations of most metals were below detectable limits and well below guidelines for drinking water and aquatic life. The one exception to this was for dissolved aluminum which exceeded the aquatic life guideline at each of the sites on at least one occasion. This is likely a result of the natural geology of the area but, when combined with soil disturbances from forestry and agriculture, these naturally high values may lead to values elevated above acceptable levels and thus be a cause for concern.

Naturally occurring organics in the watershed can bind substantial proportions of the metals which are present, forming metal complexes which are not biologically available. To aid in future development of

metals objectives, levels of organics, as measured by dissolved organic carbon (DOC), have been recommended in the Englishman River monitoring program.

Concentrations of microbiological indicators were consistently high during the monitoring program. The drinking water guideline for water receiving disinfection only was exceeded in 20 of the 22 sample sets (five samples in 30 days) for fecal coliforms and in 22 of 27 sample sets for *E. coli*. Coliform concentrations were lowest in the Englishman River upstream from Morison Creek and in the South Englishman River, and highest in Morison Creek and at the Parksville intake. Fall values were generally higher than summer values with the exception of one extremely high summer value at Englishman River at Highway 19A that likely represents the real possibility of fecal contamination occurring from recreational use in the populated areas of the watershed. Elevated fall flush values in areas of no impact, such as Englishman River upstream from Morison Creek, are considered natural (due to wildlife) and have been observed in other Vancouver Island watersheds. Higher values in the populated portions of the watershed suggest that a significant portion of these coliforms come from anthropogenic sources, and may also be influenced by wildlife attraction to salmon carcasses in the fall. These exceedances demonstrate the need to treat water for human consumption to prevent potential health risks.

Water Quality Objectives

Water quality objectives set for temperature, non-filterable residue and aluminum are for the protection of aquatic life, while the remaining objectives are for the protection of drinking water (Table 1). These objectives will also protect recreation, irrigation and wildlife uses in the

Englishman River. As there has been little activity at the Englishman River upstream of Morison Creek site, these objectives were developed using the background concentration approach, whereby data collected from this site reflects the natural or background conditions in the watershed. These objectives are required to ensure that inputs from timber harvesting, agriculture, recreation, and rural, urban and light industrial development do not impair water uses.

Monitoring Recommendations

The recommended minimum monitoring program for the Englishman River watershed is summarized in Table 2. In order to capture the periods where water quality concerns are most likely to occur (i.e., freshet and summer low-flow) we recommend that a minimum of five weekly samples be collected within a 30-day period between August and September, as well as between October and November. Samples collected during the winter months should coincide with rain events whenever possible. In this way, the two critical periods (minimum dilution and maximum turbidity) will be monitored. For nutrients only, a minimum of five weekly samples should also be collected within a 30-day period between April and May

Table 1. Summary of proposed water quality objectives for the Englishman River Community Watershed. All objectives apply to the site Englishman River at Highway 19A, unless stated otherwise.

Parameter	Objective Value
Fecal Coliform Bacteria	≤10 CFU/100 mL (90th percentile) Dec-Sept ≤54 CFU/100 mL (90th percentile) Oct-Nov (based on a minimum 5 weekly samples collected over a 30-day period)
***E. coli* Bacteria**	≤10 CFU/100 mL (90th percentile) Dec-Sept ≤41 CFU/100 mL (90th percentile) Oct-Nov (based on a minimum 5 weekly samples collected over a 30-day period)
Turbidity	October to December: 5 NTU maximum January to September: 2 NTU maximum
True Colour	15 TCU maximum
Total Organic Carbon	4.0 mg/L maximum
Temperature	Short Term, at any location in the river - ≤17^{o}C average weekly temperature Long Term, at Highway 19A site - ≤ 15 ^{o}C average weekly temperature
Non-Filterable Residue (TSS)	October to December: 33 mg/L maximum in a 24-hour period 13mg/L average (based on a minimum of five weekly samples collected over a 30-day period) January to September: 26 mg/L maximum in a 24-hour period 6 mg/L average (based on a minimum of five weekly samples collected over a 30-day period)
Dissolved Aluminum (mg/L)	At any location in the river: 0.05 mg/L average (based on a minimum 5 weekly samples collected over a 30-day period) 0.10 mg/L maximum

Designated water uses: drinking water, aquatic life, irrigation, recreation and wildlife

Table 2. Proposed schedule for future monitoring in the Englishman River.

Frequency and timing	Characteristic to be measured	Sites
August – September (low-flow season): once per week for five consecutive weeks	Temperature, TSS, turbidity, TOC, DOC, colour, nutrients (nitrate, nitrite, total phosphorous), dissolved metals, fecal coliforms and *E. coli*	all
October - November (high-flow fall flush season): once per week for five consecutive weeks	Temperature, TSS, turbidity, TOC, DOC, colour, nutrients (nitrate, nitrite, total phosphorous), dissolved metals, fecal coliforms and *E. coli*	all
At least once during each summer and fall 5 weekly samples in 30 day sample period	Total metals, hardness	all
April-May (spring planting) (once per week for five consecutive weeks)	Nutrients (nitrate, nitrite, total phosphorous)	Englishman River upstream Morison Creek (E248835) and Morison Creek upstream Englishman River (E248834) only
Once every five years in September	Benthic invertebrate sampling	all
Continuous	Turbidity, temp, DO, conductivity	Englishman River at Highway 19A (0121580) only