D Appendix D - Draft Scopes of Work: High Priority Information Needs

Draft Scope of Work:
Study WSD-1 – Streamflow Naturalization and Water Demand Analyses

Background

A detailed summary of what is known about stream flows, water licencing, water use, and dam storage in the Similkameen watershed is provided in Appendix A of the Similkameen Watershed Plan (SWP) Phase 1. Additional analyses are required to determine how actual water use compares to: 1) the licenced surface water allocation at the specific points of interest (sub-basins) identified in the Phase 1 report; and 2) natural river flows across the range of historical and projected future conditions, especially during the summer and fall.

Work Plan

The project will include four tasks, as follows.

Task 1 – Water Use Review and Comparison

The Agriculture Water Demand Model developed by the B.C. Ministry of Agriculture and Agriculture and Agri-Foods Canada provides estimates of current and future agriculture water demands (including both crop irrigation and livestock watering) on a property by property and total basin basis.

Complete a review and comparison of available actual water use information to the Agriculture Water Demand Model estimates for water purveyors within the Similkameen Basin. The review of actual water use (i.e. surface and groundwater) against the model predictions should begin with a number of the larger individual irrigation licensees and their associated supply source (i.e. surface or groundwater).

Note that the water use information presented in the Similkameen Watershed Plan Phase 1 report should be used as a starting point.

Task 2 – Estimate Irrigation Return Flows

In the Similkameen Basin, there is limited information on how much irrigation water returns to underlying aquifers or to nearby streams. Irrigation return flows may be significant in some areas (e.g. with sandy soils), and conversely, they may be insignificant in areas that utilize different irrigation techniques (e.g. drip versus sprinkler).

Identify areas (and/or sub-basins) within the Similkameen Basin where irrigation return flows could contribute significantly to aquifers or nearby streams. Once identified, provide an estimate of return flows using available water use information.

Task 3 – Streamflow Naturalization

For each sub-basin identified in the SWP Phase 1 report, develop an estimate of the natural (or naturalized) monthly streamflows for the following seven flow scenarios:

- Normal (1980-2009 average) monthly streamflow;
- Median monthly streamflow (for the identified normal period);
- 1-in-10 year monthly lows flows (for the identified normal period);
- 1-in-50 year monthly low flows (for the identified normal period);
- Projected 2050 median monthly streamflow;
- Projected 2050 1-in-10 year monthly low flows; and
- Projected 2050 1-in-50 year monthly low flows.

For any sub-basin requiring flow naturalization, estimates of actual water use by water purveyors presented in the Phase 1 report and return flow estimates (identified above) should be considered, and when data is lacking, estimates of water use from the Agricultural Water Demand Model, water licences, or available literature should be considered. Note that licensed water volumes should not be used unless there is reasonable evidence that actual water use information accurately represents licensed use (or a reasonable percentage). In addition, as a large amount of water supply in the Similkameen Basin is from groundwater, surface water-groundwater interactions should also be considered.

For the projected 2050 information, flow estimates should consider available climate change hydrologic modeling results and projections completed by the Columbia Basin Climate Change Scenario Project, the Pacific Climate Impacts Consortium, and others. In addition, estimates of projected 2050 water use should consider reasonable future water demand scenarios (i.e. population growth/decline, irrigation efficiency) available from the Agricultural Water Demand Model.

Any assumptions that are made when developing the naturalized flow estimates must be clearly stated.

Task 4 – Comparison to Existing Water Licences

For each sub-basin identified in the SWP Phase 1 report, develop a table that displays how the existing water licensing in each sub-basin compares to the natural/naturalized flow for the seven flow scenarios listed above. Note that water licensing in each sub-basin should consider the license purpose, the licensed period of use, and actual water use distribution throughout the Similkameen Basin.

Reporting Requirements

The project reporting requirements are:

- Brief (<2 pages) monthly progress reports summarizing the work completed in the previous month and progress against the project schedule.
- A project draft report to be submitted in PDF format, suitable for electronic review and mark-up (i.e. in PDF or MS-Word format).
- A project final report addressing any reviewer comments. The successful proponent will submit three hard double-sided copies and an electronic copy in PDF of the final report.

Scheduling

The Proposal must contain a project work schedule showing the major activities or tasks; the order and interdependence of the project milestone, sub-tasks, and deliverables for each of the required tasks; and the timing of any meetings.

Draft Scope of Work:
Study WSD-1 – Groundwater-Surface Water Interaction

Background

The known water wells in the watershed are heavily concentrated near the Similkameen River and other surface water bodies. Aquifer 259, as mapped by MOE, runs in a narrow band along the Similkameen River and is comprised of unconsolidated sediments deposited in post-glacial times. The concentration of wells in that aquifer, although considered to exert only moderate demand, has raised the question as to whether or not groundwater pumping reduces the flow in the Similkameen River either by intercepting groundwater recharge that would normally reach the river or by "pulling" river water into the aquifer. Furthermore, the water supply inventory completed for the Phase 1 report (Appendix A) has shown that most of the water suppliers in the watershed now obtain most of their water from groundwater wells in or near the valley bottom. The existing MOE observation wells are located within or near communities, so there are large sections of river without groundwater level data from which to draw inferences about groundwater-surface water interaction. Previous assessments of groundwater-surface water interaction are limited to the Keremeos area.

Ultimately, characterization of groundwater-surface water interaction may require installation of new wells, pumping tests and other investigations, and numerical modelling. As a first phase, before moving forward with these investigations, the existing hydrometric, water use, and groundwater data will be analyzed for evidence of groundwater withdrawal effects on streamflows. If the results indicate the potential for groundwater withdrawals to have an effect on surface flows (especially during the mid-summer to mid-autumn period), then a groundwater study will be designed to assess surface water-groundwater interaction in more detail.

Work Plan

Part 1 – Desktop Analyses

1. Obtain from the B.C. government the available observation well groundwater level data from wells in the Similkameen Valley.
2. Obtain available groundwater level and pumping data from community wells.
3. Compile the available Water Survey of Canada (WSC) hydrometric data from several key locations along the river, and if necessary, standardizing the data to a common time period to eliminate variability due to the El Nino cycle and the Pacific Decadal Oscillation (PDO).
4. Compute the runoff (i.e. discharge per unit area) at each of the key locations on a monthly basis, both for specific years (e.g. the year with the lowest August-September flow on record) and for the normal (i.e. 1981-2010 average) year.
5. Analyze downstream changes in runoff along the river to identify any anomalies, and compare to the locations of known pumping wells including the community wells.
6. Plot the existing observation well groundwater level data against the WSC water level data from the nearest stations to see if there is any apparent linkage, and to determine the nature of the linkage (e.g. inflowing, out-flowing, or varying throughout the year).
7. Assess the possible use of shallow groundwater in any areas where runoff results seem anomalous; to confirm the potential for a groundwater withdrawal effect on surface water; and
8. Review the available water quality data (from the river and adjacent wells) to confirm the potential for a surface/groundwater linkage.
9. Based on the results, identify areas in the Similkameen Valley where there is potential for groundwater extraction to have a measureable effect on flows in the Similkameen River mainstem or tributaries with high fisheries values and/or licenced points-of-diversion.

Part 2 – Concept Design of Detailed Assessment

Based on the outcome of the first phase, develop a concept-level study design for a detailed assessment of groundwater-surface water interaction the next step could involve the design of one or more site-

specific studies in locations where the data suggests the potential for a surface/groundwater interaction that could be significantly reducing surface flow. The study design could likely make use of existing groundwater wells in data, but additional wells may be needed.

Reporting Requirements

The project reporting requirements are:

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- A project final report addressing any reviewer comments. The successful proponent will submit three hard double-sided copies and an electronic copy in PDF of the final report.

Scheduling

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Draft Scope of Work:
Study WSD-1 – Surface Water Quality Status and Trends Analysis

Background

Water quality monitoring is on-going (approximately every two weeks) at the two Canada-BC long-term monitoring stations on the main stem of the Similkameen River. However, summary reports were last completed in 2007 using data from up to 2006, focussing primarily on how the data compared to water quality guidelines. Since then, the Copper Mountain mine (formerly Similko) has re-opened and there have been several years with relatively low summer flows when the concentrations of some compounds of potential concern may be elevated because of limited dilution. Furthermore, no watershed-wide summary of water quality has been completed.

The planned study will provide 1) a detailed analysis of the available surface water quality data from the two Canada-BC stations including statistical trend analysis; 2) a quantitative summary of the available water quality data at other locations in the watershed; and 3) a report that provides stakeholders with an up to date understanding of surface water quality status and trends in the Similkameen watershed.

Work Plan

Task 1 – Analysis and Summary of Canada-BC Monitoring Data

1. Review the previous water quality reports that use the Canada-BC data (see reference list at end of this document).
2. Obtain the complete data set for the active Canada-BC water quality sites including the most recent available data.
3. For each parameter calculate descriptive statistics including sample size, mean, median, coefficient of variation, maximum, minimum, and the 10^{th} and 90^{th} percentiles.
4. Compare of the results to applicable water quality guidelines and determination of the frequency of guideline exceedances. The applicable guidelines are those for aquatic life protection, drinking water, recreation, and irrigation. Determine when exceedances are most likely to occur.
5. For nutrients (total nitrogen and total phosphorus), total suspended sediment (TSS), and any metals with guideline exceedances, calculate the average daily load (units kg/day) for the freshet (e.g. April to June) and low flow periods (e.g. August and September) at each site making use of Water Survey of Canada hydrometric data.
6. Complete an assessment for trends (i.e. statistically significant changes over time), including seasonal trends. To assess the potential influences of climate change, the trend analyses should consider whether there have been changes in the past approximately10-15 years when effects of climate change are possible.
7. Assessment of the relationships between river flow and water quality, and an assessment of variations in dissolved and total metals, including the role of total suspended sediment concentrations on total metal concentrations.

Task 2 – Summary of Water Quality Data and Reports

In addition to the analyses, the data that are available from sites other than the two Canada-BC sites should be compiled and summarized, and compared to the Canada-BC data. Quantitative analyses will be completed for sites with sufficient data (e.g. more than about sampling dates spread over at least 3

years). The report should also summarize the water quality and aquatic ecosystem monitoring information that has been collected in recent years by industrial operators in the valley.

Reporting Requirements

The project reporting requirements are:

- Brief (<2 pages) monthly progress reports summarizing the work completed in the previous month and progress against the project schedule.
- A project draft report to be submitted in a format suitable for electronic review and mark-up (i.e. in PDF or MS-Word format). The draft report will include the results of Tasks 1 and Tasks 2 as well as recommendations. The report will be written in a clear and concise manner that is accessible to watershed stakeholders and the public.
- A project final report addressing any reviewer comments. The successful proponent will submit three hard double-sided copies and an electronic copy in PDF of the final report.

Scheduling

The Proposal must contain a project work schedule showing the major activities or tasks; the order and interdependence of the project milestone, sub-tasks, and deliverables for each of the required tasks; and the timing of any meetings.

References

Swain, L.G. 1985. Okanagan Area – Similkameen River Sub-Basin Water Quality Assessment and Objectives. Ministry of Environment, Resource Quality Section. November 1985.

Swain, L.G. 1990. Water quality assessment and objectives for the Okanagan area Similkameen river sub-basin. BC Ministry of Environment. Technical appendix.

Swain, L.G. 2007a. Water quality assessment of Similkameen River at U.S. border (1976-2006). Prepared by the Ministry of Environment and Environment Canada.

Swain, L.G. 2007b. Water quality assessment of Similkameen River at Princeton (1984-2006). Prepared by the Ministry of Environment and Environment Canada.

Draft Scope of Work:
Study F-1 – Updated Overview Report on Fish and Fish Habitat in the Similkameen Watershed

Background

Over 60 different fish inventories and assessments have been completed on lakes and sections of the Similkameen River and its tributaries. However, the most recent Similkameen-specific fish and fish habitat data compilation (Glenfir Resources 2000) is more than a decade old and should be updated with the more recent government and industry assessments. Such information would support fisheries management decisions, and aid in the identification and prioritization of additional research and habitat restoration initiatives.

Work Plan

1. Assemble and review fisheries reports, data, creel surveys, fish habitat and riparian assessments, environmental effects monitoring (EEM) reports, and other relevant information developed since about 1995 (Note: the Similkameen Water Information Database (SWID) should be used as a starting point for the information search).
2. Contact fisheries and aquatic habitat personnel in federal, provincial, and First Nations agencies and research organizations (e.g. universities) to determine if there are any on-going research, inventory, or restoration activities in the watershed and to request any recent reports not in SWID.
3. After evaluating the data and reports, develop fish population estimates and identify population trends for specific locations or sub-basins.
4. In cases where there are insufficient data to make quantitative estimates of fish populations and trends, comment on the state of the information base and develop recommendations for the investigations needed to develop reasonable estimates.
5. Based on the review of habitat assessment and land use data, identify priorities for habitat restoration and/or protection.
6. Prepare a report that presents the findings in a manner that is accessible to Similkameen Watershed Plan stakeholders and the public. The report will update and expand on the information presented about the Similkameen Watershed in Rae (2005) and will include an assessment of risks to fish populations related to climate change (e.g. the combination of changes in flow, water temperature, and withdrawals).
7. This summary report should include a map showing the areas in the Similkameen River watershed where fisheries inventories and other research have occurred in order to identify spatial and temporal gaps in the information.
8. Enter any new reports or data sets that are found into SWID.

Reporting Requirements

The project reporting requirements are:

- Brief (<2 pages) monthly progress reports summarizing the work completed in the previous month and progress against the project schedule.
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- A project final report addressing any reviewer comments. The successful proponent will submit three hard double-sided copies and an electronic copy in PDF of the final report.

Scheduling

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References

Glenfir Resources Ltd. 2000. Similkameen watershed fisheries information and action plan. Prepared for Similkameen River Planning Committee and Fisheries Renewal BC.

Rae, R. 2005. The State of Fish and Fish Habitat in the Okanagan and Similkameen Basins. Prepared for the Canadian Okanagan Basin Technical Working Group, Westbank, B.C. Working Group: Okanagan Nation Alliance, Fisheries and Oceans Canada, B. C. Ministry of Water, Land and Air Protection. http://www.obwb.ca/fileadmin/docs/state_of_fish_habitat_obwb.pdf