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Arsenic Total Maximum Daily Load

Submittal Report
For Joint Issuance

January 2004
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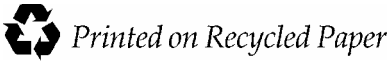

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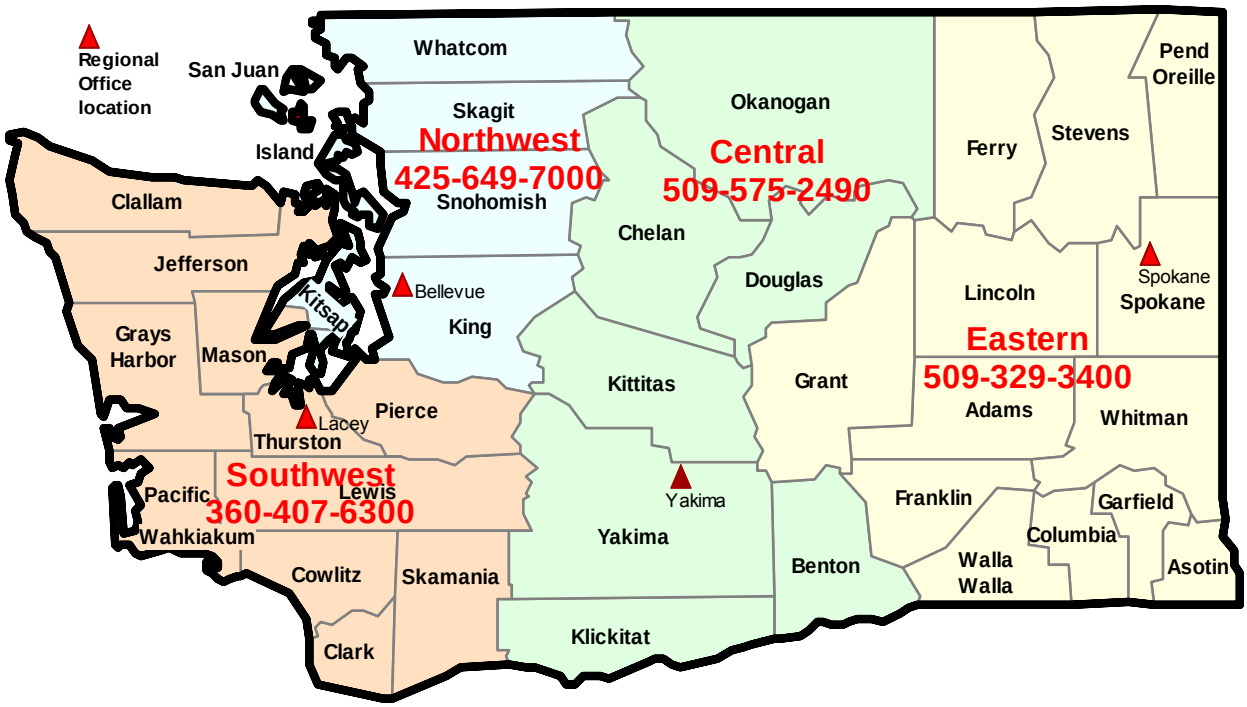

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Executive Summary

Basin:	Okanogan River (Washington)
Sub-basin:	Similkameen
Key Impaired	Resources: Water Quality
Uses Affected:	Class "A" water, Water Supply (Domestic), consumption of aquatic organisms
Type of Impairment:	Elevated concentrations of arsenic
Pollutant:	Arsenic
Contribution Factors:	Historic mining practices and Natural sources

The Similkameen River originates in the Cascade Mountains along the international border between British Columbia and Washington State. The Pasayten River flows north out of Washington to join the Similkameen River in British Columbia. The Similkameen River then turns south to cross the border and meet the Okanogan River at Oroville, Washington. Mining, forestry, agriculture, and recreation are the major land-use activities.

Under Section 303(d) of the federal Clean Water Act, the Similkameen River has been listed by Washington State for non-attainment of the EPA human health criteria for arsenic. A Total Maximum Daily Load evaluation was therefore conducted for the portion of the river that flows through Washington State, as required by the Clean Water Act. The major source of arsenic appears to be a legacy resulting from historical mining activities, mostly in British Columbia between Hedley and the U.S. border. The only significant sources identified in Washington were: 1) Palmer Lake, likely arising from periodic flooding and sediment deposit by the Similkameen River and perhaps inputs from Sinlahekin Creek, and 2) re-suspension of contaminated sediments. It was determined that the Similkameen River naturally exceeds the EPA arsenic criteria upstream of the areas disturbed by mining near Hedley, BC. Under these circumstances, natural conditions constitute the water quality criteria. Because arsenic levels naturally exceed criteria, the loading capacity for the river is set equal to the natural background concentration of arsenic.

Seasonal water quality targets are 0.4 – 0.6 µg/L total recoverable arsenic, and estimates are provided of the load reductions needed in British Columbia and Washington State to meet the targets. The targets make no allowance for the downstream increase in arsenic concentrations that might occur naturally as the Similkameen flows through British Columbia and Washington. If new data or analysis can provide a reliable estimate of what that increase would be, the numerical targets should be revised upward accordingly.

Due to the natural and legacy nature of the contaminant sources, an arsenic monitoring plan is the suggested implementation action for the Similkameen River. The plan recommends: 1) periodic monitoring of arsenic in the Similkameen to further define the long term changes in the

legacy load of arsenic, 2) renewing arsenic monitoring of the river in Washington if and when mining related cleanups are undertaken, and 3) monitoring the Similkameen River at Oroville during a significant high water event to characterize arsenic and sediment movement in the high water conditions.

Introduction

Section 303(d) of the federal Clean Water Act mandates that the state establish Total Maximum Daily Loads (TMDLs) for surface waters that do not meet standards after application of technology-based pollution controls. The U.S. Environmental Protection Agency (EPA) has established regulations (40 CFR 130) and developed guidance (EPA, 1991) for setting TMDLs.

Under the Clean Water Act, every state has its own water quality standards designed to protect, restore, and preserve water quality. Water quality standards consist of 1) designated uses, such as supporting cold water biota and providing a drinking water supply, and 2) criteria, usually numeric, to achieve those uses. When a lake, river or stream fails to meet water quality standards after application of required technology-based controls, the Clean Water Act requires the state to place the water body on a list of "impaired" water bodies and to prepare an analysis called a Total Maximum Daily Load (TMDL).

The goal of a TMDL is to ensure the impaired water will attain water quality standards. A TMDL includes a written, quantitative assessment of water quality problems and of the sources that cause them. The TMDL determines the amount of a given pollutant that can be discharged to the water body and still meet standards; this is called the loading capacity. The TMDL also allocates that load among the various sources.

The TMDL also must consider seasonal variations and include a margin of safety that takes into account any lack of knowledge about the cause of the water quality problem or its loading capacity. The sum of the individual allocations and the margin of safety must be equal to or less than the loading capacity.

In addition to the mandatory components of a TMDL, the general purposes of this document are to:

- Summarize data that document the stream segments exceeding state standards for arsenic.
- Summarize the results of a technical assessment performed to identify probable sources of arsenic loading that cause increases in arsenic concentrations and an estimate of the magnitude of those impacts on stream arsenic concentrations [Johnson, 2002].
- Summarize actions recommended for meeting water quality standards.
- Summarize monitoring that should be used to track TMDL implementation and determine progress toward attaining water quality standards.

A Detailed Implementation Plan will be developed within a year of TMDL approval. Further public input will be sought to help prepare this plan, which will identify how, when, and where voluntary restoration activities will be implemented. Details of a monitoring plan will be developed. The Washington State Department of Ecology (Ecology) and other entities will provide technical assistance and seek additional funding for these activities.

This Total Maximum Daily Load (TMDL) for arsenic in the Similkameen River basin addresses the two segments of the Similkameen River as included on the 1998 Section 303(d) list of

impaired surface waters. The water body identification number for the Similkameen River addressed by this TMDL is: **ND93YL**. Additionally, the Similkameen tributary Palmer Creek, connecting Palmer Lake to the Similkameen River, was found to have significant loading of arsenic and is included in this TMDL. The Water Body ID for Palmer Creek is **LE24CF**.

The Confederated Tribes of the Colville Reservation have asked EPA to issue this TMDL for those portions of the Similkameen River that are within Indian allotments and other Indian country, as that term is defined in 18 U.S. C. § 1151. Since the water quality standards issued for the Colville Indian Reservation by the U.S. EPA on July 6, 1989 do not apply to the Indian allotments and other Indian country lands outside of the Colville Reservation that are covered by this TMDL, EPA has used the Washington State water quality standards as guidance for developing those portions of this TMDL to be issued by the EPA.

Components of the TMDL

The five components of a TMDL, as required by the Clean Water Act and applied to this TMDL, are described below:

Loading capacity

The loading capacity is the amount of pollutant that a water body can receive without violating water quality standards. The loading capacity is allocated between waste load allocations, load allocations, natural background, and a margin of safety. In the Similkameen River basin, the water quality is naturally elevated in arsenic. The natural concentration of arsenic in the Similkameen River in British Columbia, upstream of mining activities, exceeds the applicable criteria, taking up the entire loading capacity of the river.

Wasteload allocations

A wasteload allocation is a portion of a receiving water's loading capacity that is allocated to a point source of pollution. The only permitted discharger of waste water to the Similkameen River is the city of Oroville Waste Water Treatment Plant (WWTP)under National Pollution Discharge Elimination System (NPDES) permit number WA-002239-0. Because there is no capacity for a measurable increase in arsenic in the river due to the WWTP discharge, an analysis of the potential impact of the discharge was conducted. This analysis used “worst case” inputs to evaluate the impact the discharge from the plant could have on the Similkameen water quality, and concluded that the impact would not be measurable. Based on this analysis, the Oroville WWTP wasteload allocation was calculated using the current capacity of the WWTP and the federal Safe Drinking Water Act standard for arsenic in municipal water systems. The derived wasteload allocation was found to be an insignificant impact to the water quality at a sensitive low-flow river condition.

Load allocations

The load allocation is that portion of the receiving water's loading capacity that is attributed to nonpoint sources of pollution or to natural background sources. The Similkameen River is over its loading capacity for arsenic compared to natural background at Princeton; therefore load allocations are zero for anthropogenic nonpoint sources. The load allocation for natural nonpoint

sources is the load that would yield a concentration equal to the natural background concentration. Data needed to convert from this concentration to a load do not exist.

Margin of safety

EPA requires that a TMDL include a margin of safety to account for any lack of knowledge concerning the relationship between loads and water quality. In this TMDL, a major unknown is whether there would be a natural incremental increase in arsenic concentrations downstream of Princeton and, if so, what that rate of increase would be. The numeric targets and load reductions recommended to meet them assume no natural increase, thus constituting an implicit margin of safety.

The WLA for the Oroville WWTP has been set to the drinking water standard for the municipal water supply. The potential contribution of arsenic from the WWTP WLA has been examined and found to be insignificant at low flow river conditions when the Similkameen River would be most vulnerable to additional loading.

Seasonal variation

The Similkameen River's natural background arsenic concentration fluctuates over each annual cycle. The arsenic concentration rises with the high water flows that typically occur in May and June. In the months from September through April, water flow volumes are substantially lower and the natural background concentration of arsenic is lower than in the spring, though the arsenic concentration still exceeds the water quality criteria. The goals for this TMDL have been set to reflect the seasonal change of the natural background concentration. Higher goals are set for the spring and early summer seasons to reflect the natural changes in background concentration.

Background

The 72-mile long Similkameen River originates in the Cascade Mountains along the international border between British Columbia and Washington State. It flows north out of Manning Provincial Park, then turns south to cross the border and meet the Okanogan River at Oroville, the last 27 miles being in Washington (Figure 1). The climate is semi-arid over much of the basin. Mining, forestry, agriculture, and recreation are the major land-use activities.

The Similkameen drains 9,308 square miles, over 90 percent of which is in British Columbia. Peak flows normally occur in April to July as a result of snowmelt (Figure 2). Stream flow during the winter generally stays low due to freezing weather that maintains or contributes to the snowpack; exceptions occur when mild weather and heavy rain combine to cause flooding. The annual average discharge is 2,300 cfs; the average for September is 609 cfs (at Nighthawk, WA).

Mining occurs at a number of locations in British Columbia, although a detailed accounting of the mining activity was not obtained for the present report. Pommen (2001) summarized the early gold mining as follows: "Placer gold mining took place in the 1860s and 1870s, and hard rock mining began in the late 1890s, with 1905-55 being the most productive period. There have been 77 past producers in the basin."

Shaw and Taylor (1994) mention the following mines in British Columbia: Similco Mines copper mine between the Similkameen River and Wolfe Creek, below Princeton; eleven placer mines along the Similkameen and Tulameen rivers, including the Dankoe silver/gold mine near the U.S. border; and the large Corona Nickel Plate Mine and Candorado Mines Ltd. near Hedley, which mine gold or process tailings for gold. As of 1994, other mines were proposed near Hedley. Similco is currently in caretaking status. The Nickel Plate and Candorado mines have been closed and under reclamation since about 1997.

Downstream of the border, the Similkameen flows though arid sagebrush terrain typical of north-central Washington. Approximately six miles below the border, the river meets Palmer Lake outlet, sometimes called Palmer Creek. A unique hydrologic feature of their juncture is that, during the spring, high flows in the Similkameen can cause Palmer Creek to reverse direction and the river flows into the lake. Based on observations during the technical study (Johnson 2002), this appears to occur at flows greater than 5,000 cfs. Other than Palmer Lake, Washington tributaries to the Similkameen are dry most of the year, except at higher elevations.

Table 1: Water Body Identification Numbers for water bodies addressed in this Similkameen River Arsenic TMDL

Water Body Name	New Water Body ID Number	Old Water Body ID Number	Included in 1996 303(d) List for arsenic	Included in 1998 303(d) List for arsenic
Similkameen River	ND93YL	WA-49-1030	No	Yes
Palmer Creek	LE24CF	-NA-	No	No

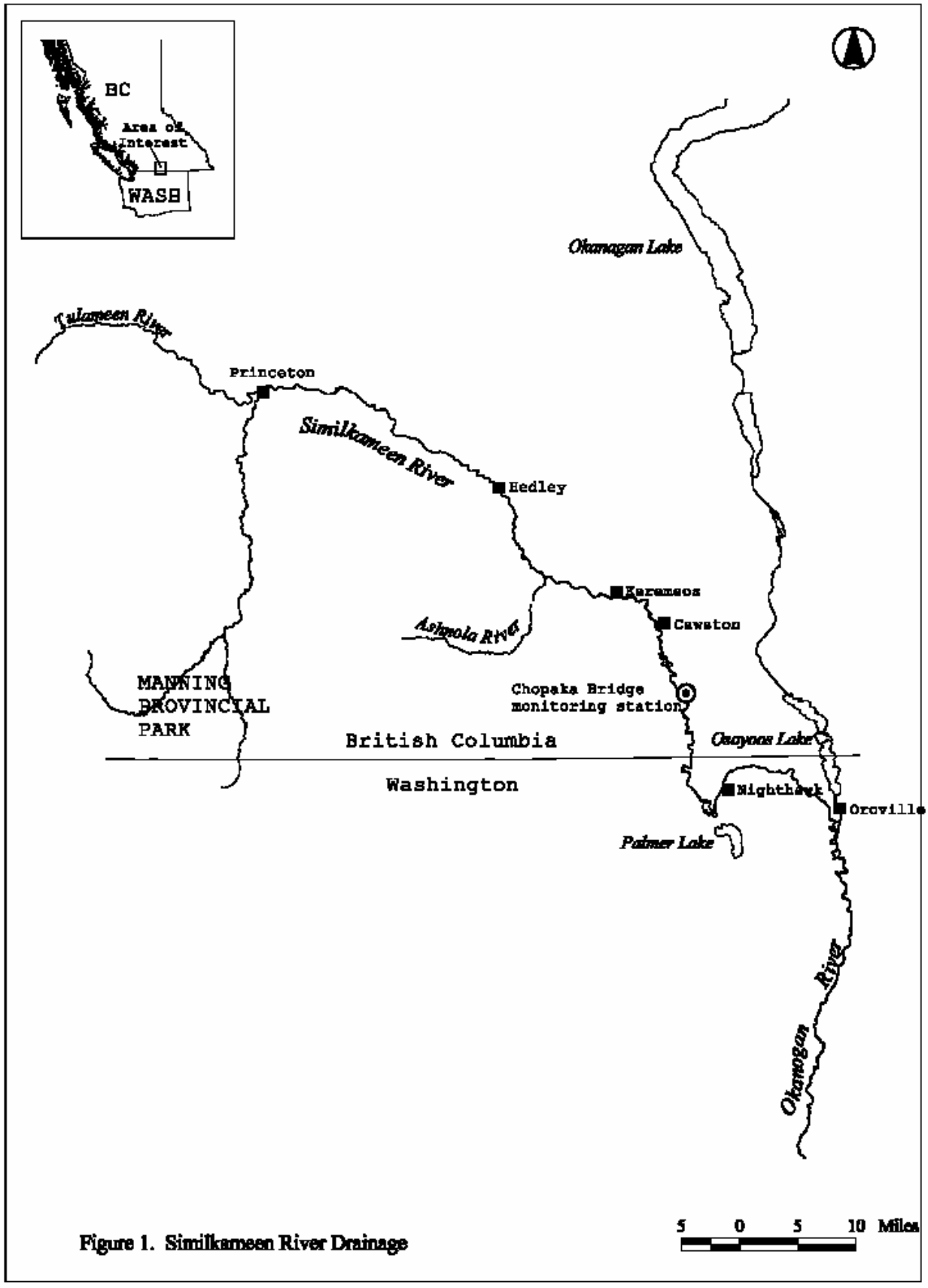

Figure 1. Similkameen River Drainage

Applicable Criteria

Within the state of Washington, water quality standards are published pursuant to Chapter 90.48 of the Revised Code of Washington (RCW). Authority to adopt such rules, regulations, and standards as are necessary to protect the environment is vested with the Department of Ecology. Under the federal Clean Water Act, the EPA Regional Administrator must approve the water quality standards adopted by the state (Section 303(c)(3)). Through adoption of these water quality standards, Washington has designated certain characteristic uses to be protected and the criteria necessary to protect these uses [Washington Administrative Code (WAC), Chapter 173-201A].

Streams in the Similkameen watershed are designated as Class A as designated under WAC 173-201A-120(6). The characteristic uses designated for Class A waters and protection in Similkameen River basin streams are as follows (Chapter 173-201A WAC):

"Characteristic uses. Characteristic uses shall include, but not be limited to, the following:

(i) Water supply (domestic, industrial, agricultural).

(ii) Stock watering.

(iii) Fish and shellfish:
- Salmonid migration, rearing, spawning, and harvesting.
- Other fish migration, rearing, spawning, and harvesting.
- Clam and mussel rearing, spawning, and harvesting.
- Crustaceans and other shellfish rearing, spawning, and harvesting.

(iv) Wildlife habitat.

(v) Recreation (primary contact recreation, sport fishing, boating, and aesthetic enjoyment).

(vi) Commerce and navigation."

This TMDL is designed to address impairments of characteristic uses caused by elevated arsenic concentrations.

WAC 173-201A contains arsenic criteria to protect aquatic life. Because this criteria does not protect all designated uses for class A waters (i.e. use of water as a domestic supply and harvesting of organisms), the Clean Water Act requires the use of the water quality criteria set in National Toxics Rule, Chapter 40 of the Code of Federal Regulation part 141.36 (40CFR131.36).

The National Toxics Rule defines the criteria for arsenic for the protection of human health. The numeric arsenic criterion is 0.018 µg/l for the consumption of water and organisms. In this case, the natural background value of the Similkameen River exceeds the NTR criterion at Princeton, BC, which is high in the watershed and upstream of the areas disturbed by gold mining activity.

WAC 173-201A-070 is applicable to the Similkameen River's condition where the natural background arsenic concentration is higher than the arsenic criterion in the NTR. Sub-part 2 states: "Whenever the natural conditions of said waters are of a lower quality than the criteria assigned, the natural conditions shall constitute the water quality criteria."

The Safe Drinking Water Act was applied in determining the reasonable maximum loading from the city of Oroville municipal WWTP. Discharge of arsenic from the WWTP is controlled by the concentration of arsenic in the drinking water. The city of Oroville has a municipal water source that complies with the maximum contaminant level for arsenic in drinking water set in 40CFR141.62.

Water Quality and Resource Impairments

The Similkameen River was included in Washington's 1998 list of impaired waters compiled under section 303(d) of the Clean Water Act. The 1998 listings for the Similkameen river included two segments for arsenic (segment locations by township-range-section: 40N 25E 13 and 40N 27E 28) and one segment for temperature (40N 27E 28). This TMDL addresses only the arsenic listings. The Similkameen River consistently has higher concentrations of arsenic than other water bodies in Washington. The Similkameen River was included on the 1998 303(d) based on data collected at the Nighthawk Bridge in 1995 and 1996.

Technical Approach and Results

An approach of mass balancing was used in TMDL evaluation for arsenic in the Similkameen River. The mass balancing was used to evaluate the sources of arsenic loading and their potential impacts to the Similkameen River water quality. This study approach used several techniques for the collection of surface water data, sediment data, and discharge information from the Oroville WWTP, the only permitted discharger in Washington. Data collected was used to provide assessment of potential arsenic sources and to provide for the comparison data from the current study to other data sources. (Johnson 2002)

Routine monitoring for arsenic in the Similkameen was provided for the TMDL by including arsenic in the monthly monitoring program maintained by Ecology's Environmental Assessment Program's Freshwater Monitoring Unit. The monthly monitoring was conducted at stations 49B070, Similkameen River at Oroville and 49B110, Similkameen River at Chopaka Bridge, B. C.

Intensive sampling surveys were conducted for the Similkameen River mainstem and for tributary streams that enter the river in Washington State. Tributary stream and mainstem sampling occurred together during the intensive sampling events. Coupling these sampling studies allowed for the direct comparison of the stream inputs and the loads measured in the river itself. The intensive sampling did reveal that Palmer Creek, the outlet from Palmer Lake, is a significant arsenic source to the reach of river within Washington.

Sediment data used in the technical assessment were collected by Ecology staff and staff of the Colville Confederated Tribes (Hurst, 2003). The sediment data revealed values of arsenic as high as 230 mg/Kg. These reported sediment values are sufficient to create water quality impairment if they were to be re-suspended into the water column.

The concentration of arsenic in Palmer Creek appears to be associated with the sediments that accumulate in the reach of the Similkameen between river mile 19 and river mile 24. Stream channel morphology and grain size distribution in the Similkameen /Palmer Creek complex are indicative of deposition of sediments in this reach. The high flows in the Similkameen associated with spring run off carry large sediment loads into this reach; this includes Palmer Creek when high flows from the Similkameen River inundate the creek and backs into Palmer Lake. The

elevated arsenic values in the sediments and waters of this reach are likely a result of the sediment deposition from sources higher in the watershed.

Loading Capacity

Loading capacity is the ability of a water body to receive pollutants and remain within applicable water quality criteria. The Similkameen River upstream of mining disturbances naturally exceeds the water quality criteria set in the NTR. Due to the natural concentrations of arsenic in the river, the loading capacity for the Similkameen River is taken up by the natural background loading to the river. The result of the natural loading is that there is no available loading capacity to allocate to other significant point or anthropogenic non-point sources of arsenic. The natural background arsenic concentration is used as the loading capacity and as the TMDL target concentration for this TMDL.

Derivation of the natural background concentration is described in detail in the attached TMDL Evaluation Report, (TMDL Appendix B), pp 35-39. The analysis uses data from Princeton, BC, a monitoring station upstream from the areas impacted by mining. Data from 1990-1999 were summarized and the results were compared to similar data from some of the least disturbed watersheds in Washington's ambient monitoring database. The natural background arsenic concentration, and the corresponding loading capacity, varies seasonally from 0.4 to 0.6 ug/l (see Table 3 below).

Load and Wasteload Allocations

The "load allocations" and "wasteload allocations" are the portions of the stream's loading capacity that are designated, or "allocated," for each source of pollution. "Wasteload Allocation" refers to that portion of pollution that originates from point sources or permitted discharges to the water body. "Load Allocation" refers to the non-point sources of pollution.

No localized, non-point sources of arsenic were detected in Washington as a result of the present investigations. No load allocations were made for anthropogenic non-point sources. The natural load takes up all of the assimilative capacity of the river resulting in the allocation for natural sources being set equal to the natural background concentration.

The data that would be required to convert from the natural background concentration to a natural nonpoint source load throughout the basin do not exist. The TMDL Evaluation report (Appendix B, p 42) does include estimated load reductions required to meet water quality targets at three locations.

The single wasteload allocation assigned in this TMDL is for the city of Oroville's Waste Water Treatment Plant (WWTP). The city of Oroville WWTP is the only permitted discharger to the Similkameen River. The city of Oroville discharges under the authority of their National Pollution Discharge Elimination System (NPDES) permit number WA-002239-0.

The Oroville waste water treatment plant discharges waste water with a concentration of arsenic that does not appear significantly different than the arsenic concentration in the municipal water system for the city of Oroville. These concentrations are approximately 3 µg/L. Municipal water collected by the waste water system does not appear to change in arsenic concentration as it moves from the ground water source to the WWTP.

Because there is no load capacity for a measurable increase in arsenic in the river due to the WWTP discharge, an analysis of the potential impact of the discharge was conducted. In order to ensure protection of water quality, this analysis used "worst case" scenario inputs to evaluate how much the discharge from the plant might increase the arsenic concentration in the Similkameen River. The inputs included the lowest reasonable flow in the river combined with the highest flow from the current plant along with the highest arsenic concentration that the city's drinking water system could provide to the WWTP.

The revised standard for arsenic in drinking water under the federal Safe Drinking Water Act is 10 µg/L. The worst case contribution from the Oroville WWTP was determined using the allowable concentration of arsenic in the municipal water system combined with the 0.49 million gallons per day design capacity of the wastewater treatment plant. This resulting worst case arsenic load would be 19 g/day.

At a loading rate of 19 g/day, Oroville WWTP would have an essentially undetectable effect on arsenic concentration in the Similkameen River. This conclusion was derived by considering the potential effect of the loading from the treatment plant on a "7Q10" river low flow condition. A 7Q10 low flow is the lowest flow averaged over a seven day period that would be expected to occur once every ten years. The Similkameen River's 7Q10 low flow of 186 cfs is most likely to occur during the August to March portion of the annual cycle which has the most restrictive target arsenic concentration of 0.40 µg/L (Johnson 2002). In a case where the river meets the 0.40 µg/L target value and experiences a 7Q10 low flow, an arsenic concentration of 10 µg/L in the effluent from the Oroville WWTP operating at the design capacity calculates to a downstream concentration of 0.44 µg/L after mixing. This would be essentially an undetectable effect on arsenic concentration in the Similkameen River.

The WLA for the Oroville plant is set to 19 g/day, with a concentration not to exceed 10 ug/l because the worst case evaluation showed this potential loading to have an undetectable effect on the river.

There are several reasons to base the wasteload allocation for the arsenic discharge from the Oroville WWTP on the arsenic standard in the federal Safe Drinking Water Act. These reasons include, but are not limited to: acknowledging the small data set available on the discharge from the waste water treatment plant, recognizing a single regulatory value for the municipal water system, and providing a stable target for the municipal system that does not fluctuate seasonally.

Current data on the WWTP discharge concentration of arsenic consists of only two data points. These data points may not be truly representative of the WWTP discharge. Setting a WLA based on the small data set could be unfairly restrictive to the city when expansion of the system is needed or if other changes are needed to the municipal water/waste water system. Because the source of the municipal system is ground water, any expansion that required new wells could

result in a slightly different arsenic content. Future upgrades to Oroville's municipal water/wastewater systems should examine water quality data from the municipal source water and discharge data to assure all known and reasonable treatments are incorporated into the water/wastewater systems improvements to protect the water quality of the municipal drinking water and the Similkameen River.

Using the federal Safe Drinking Water Act standard as a basis for the WLA makes the regulation of the municipal water system consistent. Changes to the system, such as replacing a municipal supply well, will need to address drinking water standards and the TMDL WLA through compliance with a single standard. A cautionary note on this is that the city will need to watch for industrial practices that have the ability to concentrate minerals in water, potentially raising the concentration of arsenic in water above that supplied in the city's potable water.

Seasonal variability of arsenic in the municipal water system cannot be determined with the currently available data. Using the Safe Drinking Water Act as a basis for the WLA provides assurance that the WLA can be attained throughout the year. There will not be significant seasonal impacts from a WLA that does not vary seasonally. The WLA is considered to have insignificant impact at river low flow conditions with the most restrictive target value and its impact on the river will be even less at higher flows.

Table 2: Waste Load Allocation

Waste Load Allocation			
Discharger	NPDES Permit Number	Pollutant	Daily Load Allocation
Oroville WWTP	WA-002239-0	Arsenic	19 grams / day ≤ 10 ug/l

Seasonal Variation

Analytical data on the arsenic concentrations in the Similkameen River was examined from sources that included sample collection points in Washington and British Columbia. The arsenic concentration data used in this TMDL has been specifically targeted to river discharge volumes, but by comparing data collection dates to river flow data, an estimate of seasonal variation can be developed. The data review indicated that fluctuation of the arsenic concentration in the river occurs seasonally at Oroville, WA, at Chopaka, BC, near the international boundary and above the Princeton where natural background values for the TMDL are established. The seasonal variation appears to be tied to the seasonal fluctuation of the river flow, with the highest measured values having been measured at river stages that are rising and nearing the spring peak flows.

The Total Maximum Daily Load Evaluation for arsenic in the Similkameen River (Appendix B) included monthly monitoring of arsenic at the Chopaka and Oroville bridges over the Similkameen. Data from 2000 - 2001 followed the pattern of higher concentrations in the spring flows tapering off to a more modest level as the river flow volumes diminished and stabilized over the remainder of the year (figure 2). This data from monthly monitoring from May 2000 to June 2001 occurred over a period when the Okanogan valley received a record low amount of

precipitation, resulting in river lows approximately half of normal with only modest spring peaks of flow and arsenic.

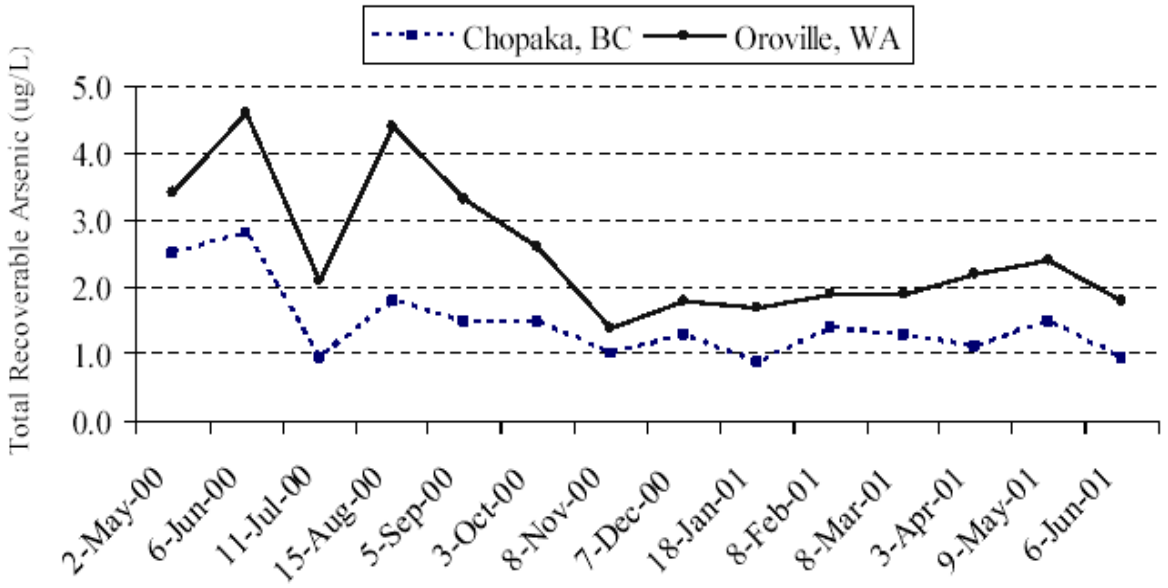

Figure 2: Total Recoverable Arsenic Concentrations Measured in Monthly Monitoring of Similkameen River from May 2000 to June 2001 (Ecology data)

The seasonal variation in the background data taken from the Similkameen River at Princeton is used to determine the seasonal targets for the TMDL. The Princeton monthly average concentrations are presented in Table 3. These averages vary little over the year, yet represent substantial differences in loading due to the higher river flows associated with the higher spring values.

Table 3: Proposed Targets for Total Recoverable Arsenic in the Similkameen River

Month	Target Concentration (µg/L)
May-June	0.6
April & July	0.5
August - March	0.4

Margin of Safety

The federal Clean Water Act requires that a margin of safety be identified to account for uncertainty when establishing a TMDL. The margin of safety can be explicit in the form of an allocation, or implicit in the use of conservative assumptions in the analysis. Several conservative assumptions and critical conditions used in the development of the Similkameen River TMDL provide an inherent margin of safety as required by the statute.

In this TMDL, a major unknown is whether there would be a natural incremental increase in arsenic concentrations downstream of Princeton and, if so, what that rate of increase would be. The numeric targets and load reductions recommended to meet them conservatively assumes no natural increase, thus constituting an implicit margin of safety.

The WLA for the Oroville WWTP has been set using a conservative approach of examining "worst case" conditions for the WWTP discharge. Setting the WLA by using the 10 µg/L arsenic standard in the federal Safe Drinking Water Act, (a value about three times higher than the available data suggests) provided additional margin of safety to the TMDL. This standard was selected due to the WWTP discharge of arsenic is controlled by the municipal water entering the WWTP. The potential contribution of arsenic from the WWTP WLA, at maximum capacity of the plant and the maximum concentration allowed by drinking water standard, has been examined and found to be insignificant at river low flow conditions that would make it susceptible to additional loading.

There is substantial uncertainty in the quantification of tributary loads within Washington. Only four samples were obtained from the major source identified, Palmer Creek, and its average flow to the river was estimated. It seems unlikely, however, that the load is seriously under or overestimated given the consistent difference observed between the arsenic concentrations at Chopaka Bridge and Oroville.

Other than Palmer Lake outlet, Washington tributaries to the Similkameen are dry most of the year. No data were collected to establish tributary loading during storm or snow melt events. There is nothing in the available data to suggest that there are large unaccounted for arsenic inputs to the river within Washington during runoff events.

Summary Implementation Strategy

Implementation Overview

Under section 303(d) of the federal Clean Water Act, the U.S. Environmental Protection Agency requires states to identify impaired water bodies. The Similkameen River was included on Washington State's 1996 and 1998 303(d) lists for arsenic. In 1999, Ecology identified the Similkameen River as a candidate to conduct a TMDL. Ecology used existing data and conducted field work between May 2000 and February 2002 to document conditions. After review from the Okanogan Watershed Implementation Committee and the Colville Confederated Tribes, Ecology published the TMDL technical report: ***A Total Maximum Daily Load Evaluation for Arsenic in the Similkameen River*** (Appendix B). The technical report identified historic mining practices in the upper watershed as the primary source of elevated arsenic values in the Similkameen River. The technical report also recognized the existence of natural and anthropogenic factors that contribute to elevated arsenic values in the water. The Summary Implementation Strategy (SIS) summarizes a strategy to monitor the water quality to improve our understanding of this watershed, explore the legacy of arsenic contamination, and provide adaptive management strategies for long term improvement of water quality in the watershed.

An SIS is needed to meet the requirements of a TMDL submittal for approval as outlined in the 1997 Memorandum of Agreement between EPA and Ecology. It presents a clear, concise, and sequential concept of how the Similkameen River and its primary tributary, Palmer Creek, will ultimately meet the water quality standards over time. This SIS complies with the federal mandate of the Clean Water Act, Washington State laws to control point and non-point source pollution, and the 1997 Memorandum of Agreement between EPA and Ecology.

This SIS will serve as guidance for developing a Detailed Implementation Plan (DIP) during the one year period after the TMDL has been approved. The DIP will describe specific implementation activities that need to be performed to achieve the TMDL targets. The DIP will also present a thorough plan for monitoring implementation of this TMDL. It is anticipated that implementation of this TMDL will document long term reductions in the arsenic carried by the Similkameen River waters.

This is a plan to monitor and protect water quality. It is based in large measure on existing United States Federal and Washington State laws and regulations, county ordinances, and the voluntary actions of Canadian based entities. Implementation of this TMDL relies on the continued improvement of modern mining practices and continued vigilance of the water quality. The only NPDES permitted point source, the Oroville Wastewater Treatment Plant, contributes a negligible amount of arsenic to the loading in the river and does not result in a measurable increase of arsenic in the river.

The restoration timeframe for this TMDL is very uncertain. A downward (improving water quality) trend in arsenic concentrations has been noted in data collected from the Chopaka Bridge water quality sampling station 49B110 (Similkameen R. @ Chopaka Br., B. C.). The downward slope in this data from 1984 to 2000 is different from spring to fall, and the inability to determine the source of this improvement weakens any estimates of the restoration timeframe.

Examining the trend in the September data from the period of 1984 to 1999, the trend suggests that the Similkameen River at Chopaka would achieve the target around the year 2015. Exclusion of the earlier data and considering the trend in the data from 1990 to present makes the improving trend less evident. Many factors, such as natural shifting of the river channel or severe flooding, can potentially alter or reverse the improvement by re-suspending sediments that have been deposited in the river course or floodplain. Additionally, the Similkameen River has been shown to receive significant arsenic loading below the Chopaka Bridge station, probably associated with sediment deposits from up-river sources. Additional time and data are needed to address this loading. At this time, an optimistic view would be to see the TMDL goal reached at the Chopaka Bridge station within two decades, and at the Oroville water quality sampling station three decades after that. A more realistic view of the situation is to recognize that there have been more than a hundred years of mining history in the drainage and that the mining related enrichment of arsenic in the water and sediments will take many more years to be mitigated.

Implementation Activities

This TMDL is addressing water quality impairment from legacy loading and natural conditions. The technical report identifies monitoring activities for the implementation of the TMDL. A downward trend of arsenic concentrations in the Similkameen was identified in the technical report. The downward trend in arsenic concentrations may be due, in part or in whole, to changes in analytical techniques over the time monitoring has occurred. Additional monitoring will indicate if this downward trend continues and identify long term changes to this river system.

Implementation Activities to Monitor Non-Point Sources:

The TMDL technical study revealed that a reach of the Similkameen River that receives a substantial portion of the arsenic loading is a short reach of river characterized by features indicative of sediment deposition. This reach includes braided river beds and a unique interaction with Palmer Lake and the connecting stream, Palmer creek. This unique interaction is characterized by reversal of the flow of water in Palmer creek and significant rises in the Similkameen River flow. The reversal of flow reaches into Palmer Lake allowing sediments from the Similkameen River to be deposited in the lake and floodplain surrounding Palmer creek and the Similkameen River. The deposits of sediment in this area during high flows in the Similkameen appear to be a source of the arsenic in the river through the remainder of the year. Non-point sources of arsenic were not characterized sufficiently to separate natural sources from anthropogenic influenced sources. Monitoring for changes in the non-point loading will likely be done at the bridge crossing at Oroville. Additional monitoring is needed in order to determine whether re-suspension of bank sediments in Palmer Lake and Palmer Creek is increasing in-stream arsenic concentrations.

Point Sources

The Similkameen River TMDL technical report identified the Oroville Wastewater Treatment Plant (WWTP) as the only NPDES permitted point source in the watershed. Analysis of the effluent from the Oroville WWTP revealed a concentration of arsenic of 2.85 micrograms per liter. The source of the arsenic in the WWTP discharge appears to be the domestic water supply in Oroville.

The Oroville water supply complies with the federal Safe Drinking Water Act with an arsenic concentration of approximately 3 micrograms per liter, well below the 10 micrograms per liter allowed by the federal Safe Drinking Water Act. This appears to be unchanged in concentration as the water passes through the system and into the WWTP. Monitoring the arsenic discharge of the Oroville WWTP will be incorporated into the NPDES permit during the permit cycle that follows the issuance of this TMDL.

Table 4: This table presents general actions and entities responsible for implementing such actions. The information listed in the table is part of the overall strategy and may change as personnel and monetary resources are better defined during the development of the DIP.

Entity	Responsibilities to be met	1	2	3	4	5	6	7	8	9	10	Beyond 10 Years
Ecology	Periodic Monitoring of the Similkameen River, Monthly monitoring for a year repeated on every 5th year					X					X	X
Ecology, local	Monitor during high water events that would be expected to reoccur on a 10 year interval (flow of 27,030 CFS or greater).	X	X	X	X	X	X	X	X	X	X	X
City of Oroville	Monitoring arsenic in wastewater treatment plant discharge in accordance with NPDES permit requirements	X	X	X	X	X	X	X	X	X	X	X
Ecology/ Local	Dredge Sampling Project. Field data collection for effect of recreational dredges on arsenic load in the Similkameen	X										

Responsible Entities and Actions

Monitoring: The Department of Ecology is the entity currently conducting monthly water quality monitoring at the ambient water quality station on the Similkameen River (49A190 Okanogan River @ Oroville). Periodic monitoring would be preformed as part of this water quality monitoring function.

Ecology is seeking a local partner to perform high water (flood) events. Ecology would retain the responsibility for analysis of the samples, but a local entity (i.e.: Conservation District, Irrigation District or city) would be much better situated to provide the labor to sample river flows on a short notice.

Ecology is planning to conduct a field investigation of the potential impacts of recreational dredging on the arsenic loading in the water column. Ecology will be seeking a local dredge operator to voluntarily participate in this proposed study. Ecology will be investigating the protectiveness of the applicable regulations for recreational dredges.

Ecology is the responsible entity for determining compliance of interim and final targets.

Adaptive Management

These implementation activities are centered on the gathering of long term data for the evaluation of water quality. These monitoring activities will serve to better define the rate that the water quality in the basin is improving. Re-evaluation of the long-term trends with the additional data will allow the restoration timeframe to be determined with greater precision. If the water quality monitoring activities show unexpected long term rises in arsenic values in the Similkameen River, an examination of any potential new sources of arsenic should also be undertaken. Additionally, intensive surveys and watershed investigation should be sought to identify significant events in the watershed that could re-suspend sediments.

Persistent elevated values of arsenic or data that does not show the expected gradual decline of arsenic over time will trigger additional investigation under adaptive management. This should include the investigation of arsenic cycling in Palmer Lake as it relates to the flood-deposited sediments from the Similkameen River. The investigation of these flood deposits should also consider the interaction on ground water with the surface waters in the same reach of the river that received the greatest amount of sediment deposits. Further action may also include the coordination with upstream B.C. land management agencies to discuss upstream measures that would decrease flooding in the Palmer Lake /Similkameen River basin.

Potential Funding Sources

Funding sources will be more fully explored in the development of the DIP. At this time, funding for the periodic (repeating every five years) monitoring of the Similkameen River at the Oroville Station is expected be accomplished with little funding, provided that arsenic sampling can be incorporated into the routine monthly water monitoring that takes place at that location. Incorporating the arsenic monitoring into the routine monitoring will require little additional time and labor of the sampler and no additional mobilization cost. Analysis for arsenic in the river water is a relatively inexpensive analysis.

Sampling of a high water event would ideally be conducted through a local entity. This would facilitate sampling a high water event at short notice. Grant funding will be sought to fund this portion of the monitoring plan.

Detailed Implementation Plan

A Detailed Implementation Plan will be prepared within a year following approval of this document. Further public input will be sought to help prepare this plan. The plan will identify how, when, and where monitoring activities will be implemented. Ecology and other entities will provide technical assistance and seek additional funding for these monitoring activities and any restoration activities that may be identified as the body of data grows. It is the goal of this TMDL to meet the water quality arsenic standards by 2020.

Activities that Support this TMDL Monitoring Strategy

The implementation strategy for the Similkameen arsenic TMDL is designed to address a legacy loading of arsenic in the watershed by historic mining practices and the permitted discharge in the watershed. Implementation activities include 1) monitoring of the river mainstem periodically at the Oroville station, 2) monitoring potential impact of high river flows through focused monitoring when a ten-year high flow (flow of 27,030 CFS or greater) occurs, 3) monitoring the discharge of the NPDES permitted WWTP at Oroville is a requirement of the permit itself.

Supporting Regulations and Land Management Plans

Routine implementation of Washington's State Environmental Policy Act, the Okanogan County Comprehensive Plan and the Okanogan County Shoreline Master Program will assure the review of projects proposed in the vicinity of the Similkameen River for potential environmental impacts. This review process should ensure best management practices are used for new projects and that permitted activities will not impact the implementation of this TMDL.

Reasonable Assurance

During the development of the Similkameen River arsenic TMDL, available data for water quality throughout the watershed was collected and evaluated. The mass balance approach to the TMDL and the quantity of data has left questions regarding the amount of the natural arsenic contribution is in the watershed. The conservative assumptions used in the technical evaluation (Johnson 2002) burdens the anthropogenic sources with the potential natural loading below Princeton. Additional data on natural contribution could only raise the TMDL target higher than they have currently been set.

The single NPDES permitted source to discharge to the river, the Oroville WWTP, has been found to be an insignificant contributor to the arsenic loading. The conditions used to determine the potential impact of the WWTP have been incorporated in the current NPDES permit. Monitoring the discharge water will be a condition of the NPDES permit and monitoring the source of the municipal water is currently being accomplished under the drinking water system regulations administered by the Washington State Department of Health.

Each of these conservative measures will assure that the Similkameen Watershed will be monitored and protected from activities that would threaten the water quality while the legacy loading is mitigated through time and nature.

Public Participation

Public involvement is a required part of the TMDL process. The public participation activities performed to date for this TMDL are included in appendix A "Summary of Public Involvement". Additional public involvement activities will be included in preparation of the Detailed Implementation Plan.

References Cited

Hurst, Donald. 2003. Analysis of Sediment from the Similkameen River and Palmer Creek, US. Unpublished report for the Colville Confederated Tribe, Department of Environmental Trust.

Johnson, Art, November 2002. **A Total Maximum Daily Load Evaluation for Arsenic in the Similkameen River**, Washington State Department of Ecology, Olympia, Washington. http://www.ecy.wa.gov/biblio/0203044.html (This report has been included as Appendix B to this report)

Pommen, L. 2001. E-mail to Art Johnson, December 4. B.C. Ministry of Water, Land and Air Protection.

Shaw, R. and B.R. Taylor. 1994. Assessment of Federal –Provincial Water Quality Data for the Flathead and Similkameen Rivers. Prep. for Coordinating Committee of the Canada-British Columbia Water Quality Monitoring Agreement. Environmental Management Associates.

Definitions and Acronyms

CFR	Code of Federal Regulations, usually preceded by chapter number and followed by a section number (i.e. 40CFR131.36)
cfs	cubic feet per second
DIP	Detailed Implementation Plan
EPA	Unites States Environmental Protection Agency
g/day	grams per day
NPDES	National Pollutant Discharge Elimination System
NTR	National Toxics Rule (40CFR131.36)
RCW	Revised Code of Washington
SIS	Summary Implementation Plan
TMDL	Total Maximum Daily Load
WAC	Washington Administrative Code
WWTP	Waste Water Treatment Plant
µg/L	micrograms per liter
7Q10	The lowest flow averaged over a seven-day period that would be expected to occur once every ten years.

Appendix A

Summary of Public Involvement

Summary of Public Involvement

September 12, 2000	Met with the Okanogan Health District Board to present introductory information on the Okanogan DDT/PCB and Similkameen arsenic TMDLs.
November 7, 2000	Presentation on the Okanogan and Similkameen TMDLs made to the environmental science class at Wenatchee Community College class at the Omak branch campus.
September 7, 2000	Presentation to the Okanogan Conservation District Supervisor's meeting to introduce the Similkameen arsenic and Okanogan DDT/PCB TMDLs
February 22, 2001	Public meeting at Okanogan PUD to kick -off Okanogan DDT/PCB and Similkameen Arsenic TMDLs.
June 12, 2001	Presentation regarding the Okanogan at the conference "Aquatic Ecosystem Health and Fisheries in the Okanogan-Similkameen Basin" in Kelona, BC
July 26, 2001	Presentation on the Okanogan DDT/PCB and Similkameen arsenic TMDLs to the Okanogan Watershed Implementation committee.
August 9, 2001	Presentation to the Oroville-Tonasket irrigation District on the Okanogan DDT/PCB and Similkameen arsenic TMDLs.
March 5, 2002	Meeting with the Oroville City Council to discuss arsenic data needed from the Oroville wastewater treatment plant.
April 16, 2002	Meeting to discuss arsenic data results from the sampling the discharge of the Oroville wastewater Treatment plant.
September 10, 2002	Presentation to the Okanogan County Commissioners and invitation to participate in the Lower Similkameen watershed tour.
September 19, 2002	Lower Similkameen Watershed tour including representatives from Environment Canada, BC Ministry of Water air and Land Protection, BC Ministry or Energy & Mines, Okanogan Nations Alliance, Colville Confederated Tribes, US Bureau of Land Management, Okanogan County Commissioners, Okanogan Public Utility District, Okanogan Health District, City of Oroville, and the citizens of Okanogan County.
October 25, 2002	Meeting with the Okanogan Watershed Implementation Committee to discuss the Similkameen River arsenic TMDL and the Okanogan River DDT/PCB TMDL

February 24, 2003	Meeting with the Okanogan Watershed Implementation Committee to discuss the Similkameen River arsenic TMDL and the Okanogan River DDT/PCB TMDL
July 24, 2003	Meeting with the Okanogan Watershed Implementation Committee to discuss the Similkameen River arsenic TMDL and the Okanogan River DDT/PCB TMDL
September 10 to October 10, 2003	Public Comment Period for the Similkameen Arsenic TMDL Submittal report. Advertised for public comment period and meeting placed in the Okanogan Chomical and the Okanogan Valley Gazette Tribune.
October 1, 2003	Public meeting held in the evening at the Oroville City Hall. Meeting provided a forum to discuss the TMDL Submittal Report

Responses to Comments on the Similkameen Arsenic TMDL Submittal Report

Comments received from David Kliegman, Executive Director of the Okanogan Highlands Alliance, Mo McBroom, Staff Attorney for WashPIRG, and Jessica McNamara raised concerns that were similar, if not the same as, concerns raised in one other set of comments. Due to these similarities, these comments will be addressed together.

<u>The following comments were received concerning abandoned mines in the Washington's Similkameen Drainage</u>:

1. The draft plan for monitoring of arsenic TMDLs on the lower Similkameen raises concern because the plan lacks any provisions for investigating or addressing possible arsenic contamination from the many abandoned mines located in the Similkameen watershed.

According to the Department of Natural Resources' Mas/Mils database, there are 71 abandoned mines on the U.S. side of the border in the Similkameen watershed. The majority of these mines have never been inventoried or otherwise assessed for their environmental impacts.

Department of Ecology's TMDL evaluation completed in 2002 acknowledges the existence of only 11 of the Similkameen watershed's 71 mines. The 60 mines not mentioned in the report contain tens of thousands of miles of stopes, drifts, shafts and adits, as well as unknown acres of tailings and waste rock piles, any of which could be sources of arsenic to the Similkameen River and Palmer Creek.

With respect to the 11 mines that were considered in the TMDL evaluation, it appears that Ecology looked only for obvious evidence of off-site drainage, and did not test for arsenic levels, nor conduct other tests such as trace element doping to verify whether arsenic or other metals from these mines may be migrating within the watershed. Nor has Ecology taken measures to determine whether any of the 71 mines are contributing particulate arsenic to the Similkameen

River or Palmer Creek through erosion and sediment generation during spring freshets. Ecology's conclusion in the TMDL draft report that arsenic loading in the watershed occurs from sources "mostly in British Columbia" is weakened by the complete lack of information about these Washington mine sites.

Without adequate data on these potential sources of contamination to the watershed, we are concerned that Ecology cannot properly implement a plan to monitor non-point sources and ensure adequate implementation of the TMDL.

Federal law requires Washington State to identify sources of pollution in waters that fail to meet state water quality standards, and to develop water cleanup plans to address those pollutants. Despite this mandate, the TMDL process for the Similkameen River currently lacks substantive information that could be used to confirm whether or not the 71 abandoned mines in the Similkameen watershed are sources of arsenic to the river.

For this reason, we request that you revise the TMDL to include an assessment of the potential for arsenic contribution into the Similkameen River from each of these 71 mine sites. We understand that the Department of Natural Resource (DNR) has a program for the inventory of the state's abandoned mines and we respectfully suggest that Ecology might work with DNR to procure the necessary information on the mines in the Similkameen watershed.

> **Response:** Ecology's approach to the investigation of Arsenic in the Similkameen River in this TMDL has been to first examine the arsenic concentrations in the Similkameen River reach by reach, and then identify potential arsenic sources associated with elevated reach concentrations. By starting the investigation at the known points of water quality impairment and working into more detailed divisions of the river to determine where significant loading to the river occurs, Ecology is identifying those sources that have the most significant impact on water quality. Ecology's TMDL investigation did show a significant contribution to the Similkameen's arsenic load from Palmer creek and the Reach of River from river mile 19.2 to 23.8. This reach is dominated by the accumulation of sediments deposited by high flows in the Similkameen River. These sediment deposits, whose source is higher in the Similkameen Watershed, appear to be the source of arsenic producing elevations of dissolved arsenic in the river most of the year.
>
> The Similkameen Arsenic TMDL examined potential surface water connections and influence of the larger mines in Washington's Similkameen River drainage. The TMDL investigation did not find direct links between the hard rock metals mines in Washington and the arsenic loading in the Similkameen River. The November 1990 Washington State Department of Natural Resources report "Metal Mines of Washington- Preliminary Report" shows that each of the largest mines in the region have less than a mile of underground workings. Sixty mines could not possibly account for "tens of thousands of miles of stopes, drifts, shafts and adits, as well as unknown acres of tailings and waste rock piles".
>
> Ecology is participating with Washington Department of Natural Resources in the assessment of abandoned mines in Washington. Much of the assessment project is a joint

effort between Ecology Staff and DNR staff. Ecology has published the first part of the assessment project's findings as the report titled: **Screening Level Investigation of Water and Sediment Quality of Creeks in Ten Eastern Washington Mining Districts, with Emphasis on Metals.** This publication is number 00-03-004 and is available from Ecology's publication office or it can be viewed on line at http://www.ecy.wa.gov/pubs/0003004.pdf .

2. The proposed schedule for periodic monitoring only every five years, and monitoring only during ten-year high water events, is inadequate to provide the information necessary for compliance with the Clean Water Act. Even though the DOE may not anticipate new sources of arsenic, there are several reasons why an annual, or at least semi-annual, monitoring should continue, at least for a few more years.

Response: Ecology doesn't expect changes to become evident in the space of a single year, and we believe that our current data base gives us adequate insight into variability on shorter time scales.

3. The data from monthly monitoring from May 2000 to June 2001 occurred over a period of low precipitation and spring run-off. This does not reflect the years when above normal flows and flood events occurred, so a true picture does not emerge. In addition, the report asserts, "the downward trend in arsenic concentrations may be due in part or in whole to changes in analytical techniques over the time monitoring has occurred". It seems then that the results obtained, i.e., improved lower levels of arsenic, are open to question. Waiting another five years to establish new measurements to corroborate whether this improvement has really occurred is questionable.

Response: The arsenic contamination in the Similkameen River is from natural sources combined with the legacy of a hundred years of mining history in the region. The long term monitoring program is appropriate for this situation and will account for variations in weather over time.

4. There is no consideration given to the fact that mining IS currently occurring in portions of the Similkameen both above and below Enloe Dam. Though this is considered "recreational mining" (i.e., gold dredging), there has been very little research done as to the extent and effects. Currently the DNR has permit applications for 25 dredges in the river, some of these possibly commercial, which they neither may nor may not have yet approved. In addition, the Dredge Earth First rally is now planned as an annual event which could bring several thousand people into the area every August, many of whom will be dredging both during and possibly after the rally. Without a continuing monitoring program there will be no way of knowing what effects this amount of dredging will have on TMDLs and what precautions may need to occur.

Response: To address concerns relating to the affect of recreational dredge mining on the arsenic values of the Similkameen River, a field investigation of the effects of dredge mining on arsenic loading in the Similkameen River has now been added to the implementation strategy. The planned investigation will be undertaken to determine the applicability of the dredge simulation study conducted by Ecology in 1999 to the arsenic

TMDL. Ecology will use an in-river study to better determine the water quality impacts of recreational dredging conducted according to the rules and regulations for mineral prospecting and placer mining in Washington State as administered by the Washington State Department of Fish and Game. This study should provide information that can be applied to the individuals or organized groups operating within the Similkameen River.

Those concerned about the regulation of recreational dredging should be aware of the upcoming revision of the WDFW's rules and regulations for mineral prospecting and placer mining in Washington Sate. Opportunities for public involvement could begin as early as the spring of 2004.

In response to comments received by Ecology, an inquiry was made to Washington Department of Natural Resources (DNR) on the status of pending dredge applications in the Similkameen River. The response from DNR was that the six outstanding applications for dredge mining have recently been denied and there are no outstanding applications at this time. (Personal communication with Mike Rechner, DNR aquatic lands, December 2003).

5. The high arsenic levels at Palmer Lake/Creek may be strictly a result of the washing out of the sediments from Palmer Creek into the Similkameen during the high spring flows, but more consideration and study need to be done on the role of Sinlahekin Creek in adding several hundred thousand tons of sediment to Palmer Lake annually. This sediment, both that which remains in the lake and that which flows into the Similkameen, may also be contributing to arsenic totals. As yet, there are no conclusions as to the amount of sediment, where and why it is occurring, or the improved management practices necessary to moderate it. Several large landslides, caused by poor logging and roading practices, have occurred in the past 20 years. If Sinlahekin Creek is a factor in increased arsenic levels in Palmer Lake and the Similkameen, then there is a need to analyze and correct this, since it is within the U.S. boundaries.

Response: Sediment transport by Sinlahekin Creek has not been specifically addressed in the information included in the Similkameen arsenic assessment report. The Okanogan Conservation District has monitored Sinlahekin Creek as part of the Okanogan Watershed Water Quality Management Plan and measured the total suspended solids in the creek between 1 and 10 milligrams per liter and flows from 12 to 83 cubic feet per second. The highest values of suspended solids did occur during the highest measured flow, but even if this high flow were maintained year around the sediment transport into Palmer Lake would not approach hundreds of thousands of tons. Please consider providing the information you have regarding sediment transport by Sinlahekin Creek so that Ecology can evaluate it during development of the detailed implementation plan.

Comments Received from the Colville Confederated Tribes:

CCT 1. As acknowledged by the author, historical data used to support the conclusion that Similkameen River water quality is improving is incomparable, contradicted seasonally, and may in fact demonstrate a decline in water quality over time. Yet the specious trend is used to justify DOE's strategy to rely solely on water monitoring as a method to achieve compliance with water quality standards.

> **Response:** The monitoring strategy presented in the Summary Implementation Strategy is intended to examine the long term trend in the arsenic loading of the Similkameen River. Ecology acknowledged that the data set developed for this TMDL is limited by the climatic conditions occurring during the study year. Long term monitoring is needed to truly determine the condition of the river with differing climatic conditions. Additionally, the long term monitoring plans will incorporate the review of any additional data available from non-Ecology sources prior to the monitoring cycle. This will include any additional data available from Canadian sources as indicated in the actions recommended at the conclusion of the TMDL technical report. Should the long - term monitoring set out in the submittal report show a rising trend in the arsenic concentrations, then additional investigations and actions included in the adaptive management section of the report will be undertaken.

CCT 2. The long term monitoring plan is pared down significantly from recommendations contained in the *TMDL Evaluation for Arsenic in the Similkameen River*. No new data was reported in the SIS that warrants a less rigorous sampling plan. Logic for the diminished monitoring plan appears to be a concession to the legacy of mining and is inconsistent with goals and objectives of the Clean Water Act.

> **Response:** Most of the recommended actions in the technical report will be incorporated into the long term monitoring plan included in the SIS. Periodic review of Canadian data will be incorporated into the five-year sampling cycle included in the SIS. Coring of sediments was considered by the Okanogan Water Quality Management Plan's Implementation Committee, but was not included in the SIS as is was not expected to change the options or actions available to address arsenic in the Similkameen River.
>
> The analysis of fish tissue, as suggested in the technical report, was not seen as an action that would contribute to the reduction of arsenic in the Similkameen river system, but should be conducted outside the construct of the TMDL process. The Washington State Department of Ecology partners with the Washington State Department of Health to address health concerns relating to fish consumption. A sampling of fish tissue for arsenic was included in the Ecology study titled "**Investigation of Background Inorganic and Organic Arsenic in Four Washington Lakes."** Conner's Lake in the Similkameen-Sinlahekin watershed was included in this study. The results of this study support the need for a fish tissue study in Palmer Lake. Ecology will consider conducting a fish tissue study for Palmer Lake and the priority of the project relative to other water quality projects proposals.

CCT 3. True, active point sources upon which to focus remedial measures are problematical on the Similkameen River in the US. Instead, most of the ongoing releases of arsenic appear to derive through recycling of contaminated sediments by re-suspension of fine- grained bank materials. The sediment source is near surface and as wide as the floodplain. The SIS must summarize in the SIS for more careful development in the DIP those practically available remedial measures capable of increasing bank stability and decreasing flood-driven re-suspension of sediments. These include Best Management Practices for livestock grazing. The potential for sediment stabilization through bank revegetation programs should be included in the SIS. Institutional controls should also be explored.

> **Response:** Ongoing release of arsenic takes two forms in the Similkameen River. Release through re-suspension of sediment occurs during the high water/high flow events and release of dissolved arsenic occurs as a result of the long term contact of arsenic-enriched material with the waters in the Similkameen river system.
>
> Re-suspension of the sediments from the Similkameen River is a function of river dynamics in this area. The Similkameen River in the reach between the international border and the entrance to the Similkameen River Canyon, at river mile 19.5, is characterized by multiple channels and a wide and active floodplain. The sediments it transports are from both the current stream bed and the adjacent banks, where the banks are unstable. Stream bank erosion in this type of system is typified by infrequent avulsions of the stream channels as increasing sediment deposits force channel changes. When channel avulsion occurs, the new channel transports sediment from an area that may have higher or lower arsenic concentration than the previous channel.
>
> Dissolved arsenic is the result of the contact between river water and river sediments that are elevated in arsenic. These releases of dissolved arsenic, primarily in the vicinity of the Palmer Creek confluence, create the rise in arsenic loading to the river that is seen between the international boundary and the city of Oroville. The dissolved arsenic loading is the primary concern during most of the year, while arsenic-enriched sediment transport is dominant during the relatively short high water portion of the annual cycle.
>
> Reducing or eliminating the sources of arsenic-rich sediments that are deposited in this river reach would address both loading concerns for suspended sediments and dissolved arsenic. However, significant localized sources of arsenic-rich materials contributing to the sediments in the Similkameen River were not identified in the segment of river addressed by this TMDL. Further monitoring would be required in order to determine whether re-suspension of bank sediments in Palmer Lake and Palmer Creek is increasing in-stream arsenic concentrations.

CCT 4. …recreational dredging should be discouraged because it aggressively re-entrains arsenic contaminated bed sediment. The potential adverse effect of recreational dredging in arsenic contaminated sediments is further reason to discourage the practice on the Similkameen.

> **Response:** Addressed with the dredge mining comments above by WASHPIRG, Okanogan Highlands Alliance and J. McNamara.

CCT 5. Available measures to help minimize flooding in the United States should be summarized in the SIS. The Similkameen River valley is highly channelized in the Canadian (upstream) reach of the river. DOE should coordinate with upstream B.C. land management agencies to reduce flooding in the Palmer Lake/Similkameen River basin by removing upstream levees and riprap where feasible and avoiding further construction of channeling structures.

> **Response:** The scope of this TMDL is limited to that portion of the Similkameen River that flows through Washington State. However, the Similkameen River that flows through Washington is greatly influenced by the conditions in Canada. The Okanogan Conservation District and the National Resources Conservation Service have considered and rejected stream bank stabilization in the Washington Reach of the Similkameen because it would need to be on the same scale as the Canadian river channel controls to have a chance of resisting the river forces associated with the release of water from the diked river channel in Canada. It also needs to be acknowledged that this scale of stream stabilization would eliminate the function of the floodplain that still exists in Washington and push erosion and sediment related problems to the next river segment downstream. If however, it is determined that re-suspension of bank sediment in Palmer Lake and Palmer Creek is increasing in-stream arsenic concentrations, it would be appropriate to coordinate with upstream B.C. land management agencies to discuss upstream measures that would decrease flooding in the Palmer Lake / Similkameen River basin.

CCT 6. Based on the above, and on the fact that if the DOE is hoping to work with Canada on lowering arsenic levels on their section of the river, it seems necessary to continue a more thorough and reliable arsenic monitoring program than the one currently recommended in the draft report.

> **Response:** We believe the proposed monitoring program is appropriate for these purposes. The use of adaptive management discussed in the report provides the ability to respond through the TMDL to additional data as it becomes available.

Appendix B

Technical Report

A Total Maximum Daily Load Evaluation for Arsenic in the Similkameen River

November 2002

Ecology Publication Number 02-03-044

This publication may be viewed at the following website:
http://www.ecy.wa.gov/biblio/0203044.html

Paper copy may be obtained upon request.