Yakima River
Pesticides and PCBs
Total Maximum Daily Load

Volume 1. Water Quality Study Findings

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Cover photo: Upper Yakima River near Thorp (Jane Creech)

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Volume 1. Water Quality Study Findings

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Waterbody Numbers

Upper Yakima River (39-1010, 39-1030, 39-1060, 39-1070) and tributaries
Lower Yakima River (37-1010, 37-1020, 37-1040) and tributaries
Naches River (38-1010, 38-1030, 38-1040) and tributaries

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Abstract

The Yakima River, along with several of its tributaries and irrigation returns, is on the federal Clean Water Act 303(d) list for not meeting Washington State water quality standards for a range of chemical contaminants. The chemicals include six legacy pesticides or breakdown products (DDT, DDE, DDD, dieldrin, chlordane, and alpha-BHC), two current use insecticides (endosulfan and chlorpyrifos), polychlorinated biphenyls (PCBs), and dioxin (2,3,7,8-TCDD). All of these chemicals have exceeded Washington State water quality criteria for protection of human health for fish consumption or criteria for protection of aquatic life. Except for endosulfan and chlorpyrifos, these legacy pollutants are no longer produced or used in the United States.

The Clean Water Act requires a Total Maximum Daily Load (TMDL) be developed for every waterbody and pollutant on the 303(d) list. A TMDL is a written, quantitative assessment of water quality problems and pollutant sources that cause the problems. The TMDL determines the amount (load) of a pollutant that can be discharged to the waterbody and allocates the load among sources.

The Washington State Department of Ecology conducted a fish tissue survey in 2006 and a water quality study in 2007-08 (present report) in the Yakima River basin to aid in developing a TMDL for the 303(d) listed chemicals. Dioxin was excluded from the water quality study due to budget constraints and because the fish tissue survey showed human health criteria were very close to being met.

The water quality study analyzed 303(d) pesticides, PCBs, suspended sediment, and turbidity in surface waters, municipal wastewater treatment plant effluents, fruit packer and vegetable processor effluents, and urban stormwater runoff. The chemical analysis was expanded to include toxaphene, an unlisted legacy pesticide detected in the fish tissue survey. This report describes how the study was conducted and analyzes the data in terms of compliance with water quality criteria, temporal and seasonal patterns, trends, pollutant loading, and the relative importance of sources.

Numeric water quality targets are described for bringing the Yakima River into compliance with water quality standards for DDT compounds, dieldrin, chlordane, chlorpyrifos, PCBs, toxaphene, and turbidity. The river's loading capacity is calculated for these pollutants.

Endosulfan, chlordane (upper Yakima River only), alpha-BHC, and dioxin (Keechelus Reservoir only) are now meeting standards and should be removed from the 303(d) list during the next listing cycle. The report concludes with additional recommendations for the TMDL, 303(d) listing, source tracing, and monitoring.

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Executive Summary

Total Maximum Daily Loads

Section 303(d) of the federal Clean Water Act requires states to prepare a list every two years of waterbodies that do not meet water quality standards. In Washington, the 303(d) list is compiled by the Washington State Department of Ecology (Ecology). The Clean Water Act requires that a Total Maximum Daily Load (TMDL) be developed for every waterbody and pollutant on the list. TMDLs must be approved by the U.S. Environmental Protection Agency (EPA).

A TMDL includes a written, quantitative assessment of water quality problems and pollutant sources that cause the problems. The TMDL determines the amount of a pollutant that can be discharged to the waterbody and still meet standards (the loading capacity) and allocates that pollutant load among the various sources. If the pollutant comes from a discrete (point) source such as a municipal or industrial facility's discharge pipe, that facility's share of the loading capacity is called a *wasteload allocation*. If the pollutant comes from a set of diffuse (nonpoint) sources such as farm runoff, the cumulative share is called a *load allocation*.

The goal of a TMDL is to achieve clean water. Ecology works with the local community to develop (1) a strategy to control the pollution and (2) a monitoring plan to assess effectiveness of the water quality improvement activities.

The water quality study described in this report was conducted to aid in developing a TMDL for 303(d) listed pesticides and PCBs in the Yakima River. Load and wasteload allocations for the chemicals of concern will be addressed in a separate TMDL Water Quality Improvement Report to EPA, to be prepared by the Ecology Water Quality Program at a later date. While this study provides information on waters throughout the watershed, the TMDL that will be derived from this report will focus on those waters of Washington State within the Yakima basin.

Watershed Description

The Yakima River flows 215 miles out of Keechelus Lake in the Cascade Mountains to the Columbia River near Richland, draining an area of 6,155 square miles (Figure ES-1). The major population centers are, in downstream order, Ellensburg (16,542), Yakima (79,480), Toppenish (9,000), Sunnyside (14,710), and West Richland (10,210).

The upper Yakima basin includes the Kittitas Valley, an area around Ellensburg devoted primarily to hay, cereal crops, and irrigated pasture. The lower Yakima basin is the region downstream of the Naches River confluence at the city of Yakima. The lower Yakima Valley produces fruit, vegetables, grapes, other specialty crops such as hops and mint, dairy products, and beef. The lower Yakima basin is one of the most intensively irrigated and agriculturally diverse areas in the United States. Irrigation delivery is primarily managed by the U.S. Bureau of Reclamation. Diversions to the irrigation canals begin in mid-March and end in mid-October, depending on the water supply available and the district.

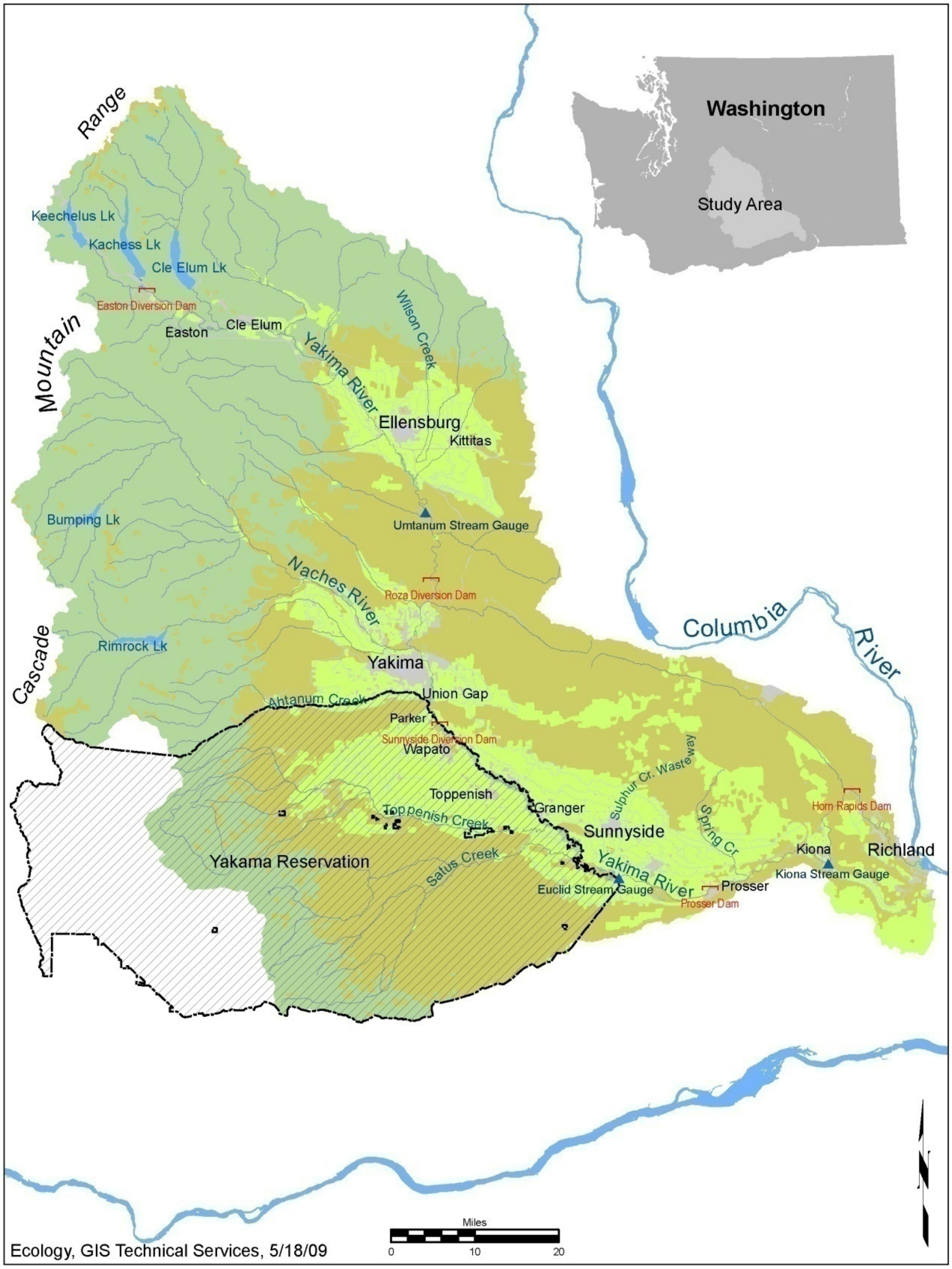

Figure ES-1. Yakima River Basin.

For many water quality parameters, the quality of irrigation return flows largely determines the quality of water in the lower Yakima River. Agricultural drains in the mid and lower valleys have been found to be significant sources of nutrients, suspended sediment, fecal coliform bacteria, and pesticides. The highest detection frequencies and concentrations of pesticides generally occur during irrigation season. Pesticides that persist in soil, such as DDT, continue to be transported in streams and drains throughout the year, especially during storm runoff or snowmelt. In 1993, the Washington State Department of Health (WDOH) issued an advisory that recommended limiting consumption of bottom fish from the lower Yakima River due to the high levels of the legacy pesticide DDT and its breakdown products DDE and DDD.

Much of the land that lies to the south of the lower Yakima River is within the Yakama Reservation. The 1.2 million acre reservation occupies about 15% of the basin. A number of the tributaries and irrigation returns that enter the lower Yakima River flow through or originate on the reservation.

Land within the Yakama Reservation is under the sovereign jurisdiction of the Yakama Nation. The Yakima River forms the reservation's boundary from Ahtanum Creek in Union Gap to the Mabton-Sunnyside Bridge. Water quality scientists, technicians, and educators from the Yakama Nation, Ecology, U.S. Geological Survey (USGS), and other agencies have maintained a cooperative partnership to monitor conditions and promote appropriate water management practices.

Yakima River 303(d) Listings

The Yakima River, along with several of its tributaries and irrigation returns, are 303(d) listed for exceeding water quality standards for a range of chemical contaminants. The include six legacy pesticides or breakdown products (DDT, DDE, DDD, dieldrin, chlordane, and alpha-BHC), two current-use insecticides (endosulfan and chlorpyrifos), polychlorinated biphenyls (PCBs), and dioxin (2,3,7,8-TCDD) (Table ES-1). Historical data collected by Ecology, USGS, and EPA have shown these pollutants exceed Washington State human health criteria for fish consumption or water quality criteria for protecting aquatic life. Washington's human health criteria are adopted from the EPA National Toxics Rule and are intended to protect the average fish consumer among the general public.

Most of these chemicals bioaccumulate in fish, wildlife, and humans. The DDT breakdown product DDE, PCBs, and dioxin, in particular, are highly bioaccumulative due to their stability and solubility in lipids (fat). Concentrations in fish tissues can be tens of thousands of times higher than in the surrounding water.

DDT, dieldrin, chlordane, alpha-BHC, and PCBs are legacy pollutants no longer produced or used in the United States. PCBs had numerous industrial applications as insulating fluids, plasticizers, in inks, and carbonless paper, and as heat transfer and hydraulic fluids. Dioxin is an unintended by-product of combustion and certain industrial processes. EPA has classed these compounds as probable human carcinogens. Endosulfan and chlorpyrifos are currently approved for use as insecticides on a variety of crops. They have adverse human health and aquatic life effects but are not carcinogens. Their bioaccumulation potential is low.

Table ES-1. 303(d) Listed Pollutants in the Yakima River Basin (2008 list).

Pollutant	Upper Yakima River (WRIA 39)	Lower Yakima River (WRIA 37)	Naches River† (WRIA 38)
Pesticides			
DDT		X	
DDE*		X	X
DDD*		X	
Dieldrin		X	
Endosulfan		X	
Chlordane	X	X	
Alpha-BHC		X	
Chlorpyrifos		X	
PCBs (polychlorinated biphenyls)	X	X	X
Dioxin (2,3,7,8-TCDD)	X	X	

*DDT breakdown product.
WRIA = Water Resources Inventory Area.
†listings are for Cowiche Creek.

In addition to the toxic chemicals shown above, the Yakima River basin also has 303(d) listings for dissolved oxygen, pH, temperature, and fecal coliform bacteria.

Existing TMDLs

Two related TMDLs are already in place for the Yakima River. The *Lower Yakima River Suspended Sediment and DDT TMDL* was established in 1998. The *Upper Yakima River Suspended Sediment and Organochlorine Pesticide TMDL* was established in 2002. These TMDLs set numeric water quality targets to be achieved for DDT compounds, dieldrin, suspended sediment, and turbidity, and schedules for meeting the targets.

The basic premise behind both TMDLs is that DDT and other pesticides attached to farm soils are being washed into the river at levels that adversely affect aquatic life and cause an increased health risk to people consuming fish. Suspended sediments – measured as total suspended solids (TSS) – also cause excessive turbidity. The combined effects of elevated TSS, turbidity, and pesticides degrade fish and wildlife habitat. Threatened and endangered salmonids are a particular concern.

The present study builds on results of these efforts. While the *Lower Yakima River TMDL* was approved by EPA for meeting aquatic life criteria, it was not approved for achieving compliance with the more restrictive human health criteria. Therefore, the lower Yakima River remains 303(d) listed for DDT compounds and dieldrin, in addition to other chemicals listed after the TMDL was completed. The *Upper Yakima River TMDL* was approved as a plan for meeting both aquatic life and human health criteria, and the listings for DDT compounds and dieldrin were subsequently moved from Category 5 (TMDL required) to Category 4 (has an approved TMDL).

2006 Fish Tissue Survey

In view of the 303(d) listings, Ecology surveyed pesticide, PCB, and dioxin levels in resident fish species throughout the Yakima River in 2006. Fifty-six composite fillet samples and 30 composite whole fish samples were analyzed from the Keechelus Lake storage reservoir to the mouth of the Yakima River, representing approximately 300 individual fish.

Findings showed that the primary human health concerns for fish consumption in the Yakima River were the DDT breakdown product DDE, PCBs, dieldrin, and toxaphene, an unlisted legacy pesticide. Except for PCBs, the concern was primarily restricted to the lower river. The DDE, PCB, dieldrin, and toxaphene results are summarized in Figures ES-2 and ES-3.

Although still not meeting water quality standards, the levels of DDT compounds and dieldrin in Yakima River fish had decreased substantially since the suspended sediment and pesticide TMDLs were first initiated. WDOH has concluded that the levels are now low enough to lift the 1993 fish consumption advisory for DDT compounds. An advisory was retained to limit consumption of lower river carp due to PCBs.

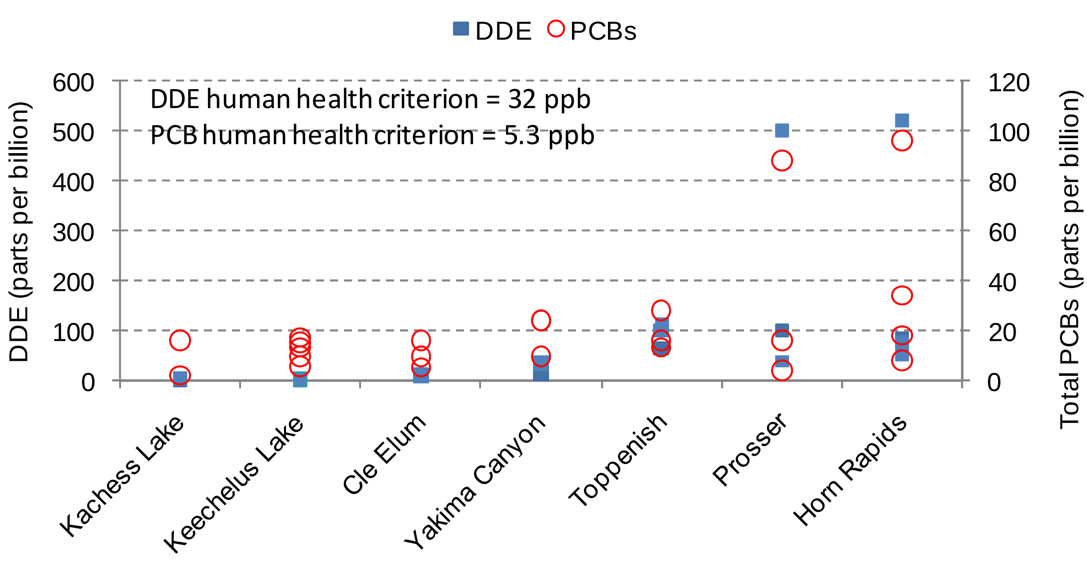

Figure ES-2. DDE and PCB Levels in Yakima River Fish Collected in 2006.

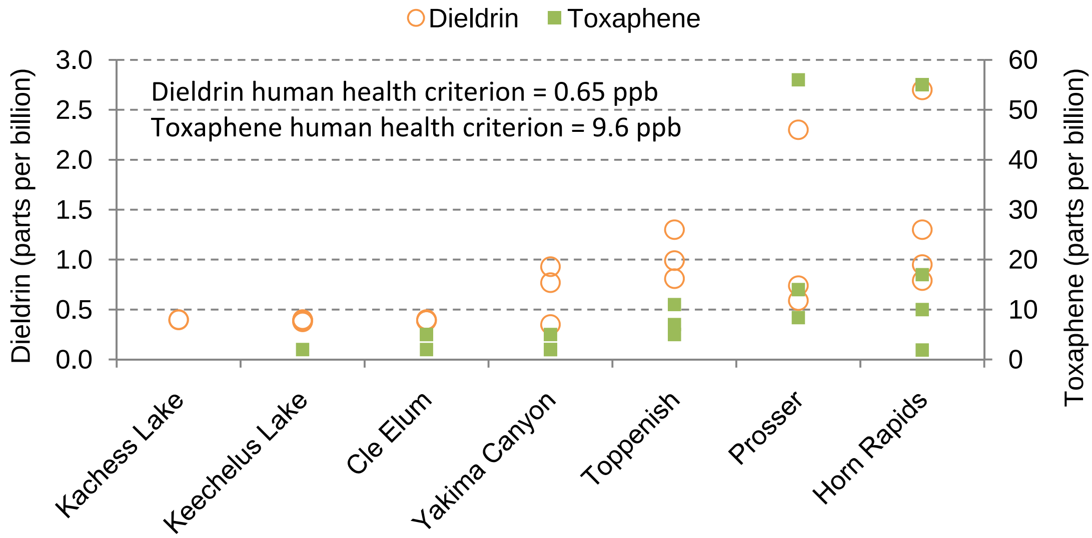

Figure ES-3. Dieldrin and Toxaphene Levels in Yakima River Fish Collected in 2006.

2007-08 Water Quality Study

Based on results of the 2006 fish survey, Ecology initiated a year-long water quality study in the Yakima River basin in 2007 to aid in developing a TMDL for the 303(d) listed pesticides, PCBs, and toxaphene. Dioxin was excluded from the study due to budget constraints and because the fish samples showed the human health criterion was met or very close to being met, depending on location.

The sampling effort was weighted toward the lower Yakima River due to the greater number of 303(d) listings and because of the existing TMDL for suspended sediment and pesticides in the upper river. The study analyzed 303(d) pesticides, PCBs, toxaphene, suspended sediment, and turbidity in surface waters, municipal wastewater treatment plant (WWTP) effluents, fruit packer and vegetable processor effluents (lower river only), and urban stormwater runoff. Chemical analysis for the upper river was limited to PCBs and toxaphene. Field work was initiated in April 2007 and completed in June 2008. Over 400 samples were analyzed.

The present report describes how the water quality study was conducted and analyzes the data in terms of compliance with water quality criteria, temporal and seasonal patterns, trends, pollutant loading, and relative importance of sources. Examples are provided of significant water quality improvements already realized due to farmers reducing soil erosion and associated pesticide inputs to surface waters to meet TMDL water quality targets.

Water Quality Study Findings

Key findings of the water quality study include the following:

- Despite significant, recent reductions in soil erosion, lower Yakima River irrigation returns continue to discharge elevated levels of suspended sediment that contribute to exceedances of turbidity and pesticide criteria and TMDL targets, particularly during the first half of the irrigation season. Figure ES-4 shows turbidity levels during the 2007 irrigation season in the lower mainstem compared to the existing TMDL target.

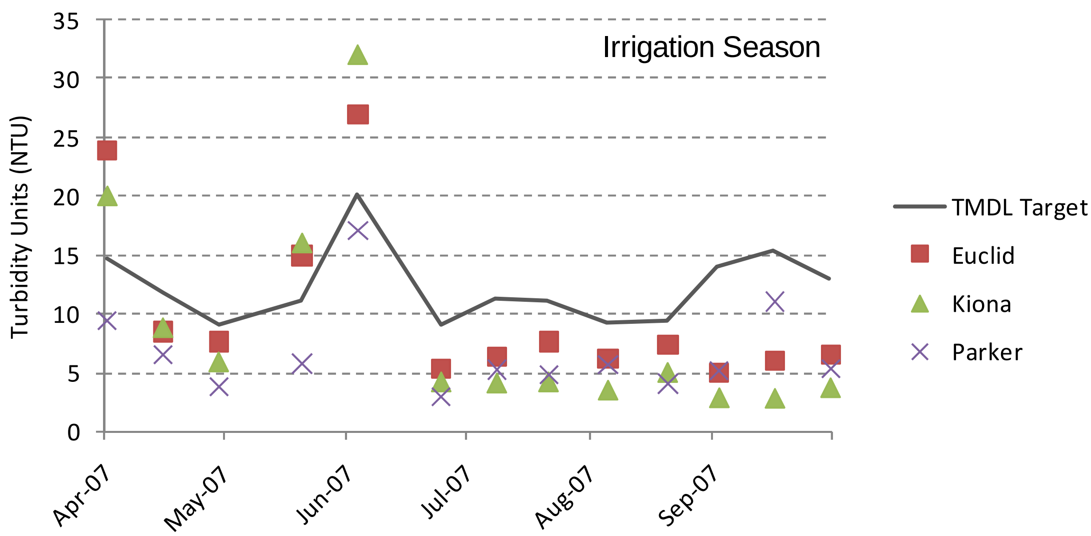

Figure ES-4. Turbidity in the Lower Mainstem Yakima River during the 2007 Irrigation Season.

- Although much reduced over historical levels, the lower Yakima River and a number of its tributaries and irrigation returns still exceed human health or aquatic life criteria for DDT, DDT breakdown products, and dieldrin (Figure ES-5).

- A first-time effort to characterize chemical contaminants in urban stormwater discharges to the Yakima River found high levels of pesticides, PCBs, TSS, and turbidity in runoff from the cities of Yakima, Union Gap, and Ellensburg (pesticides not analyzed in Ellensburg samples) (Figure ES-6).

- Several irrigation returns to the lower Yakima River exceed human health or aquatic life criteria for toxaphene and PCBs. Exceedances of the toxaphene aquatic life criteria were observed in the lower Yakima mainstem during the irrigation season.

- Peak chlorpyrifos concentrations in some of the same returns exceed aquatic life criteria during the spring and fall when this insecticide is being applied.

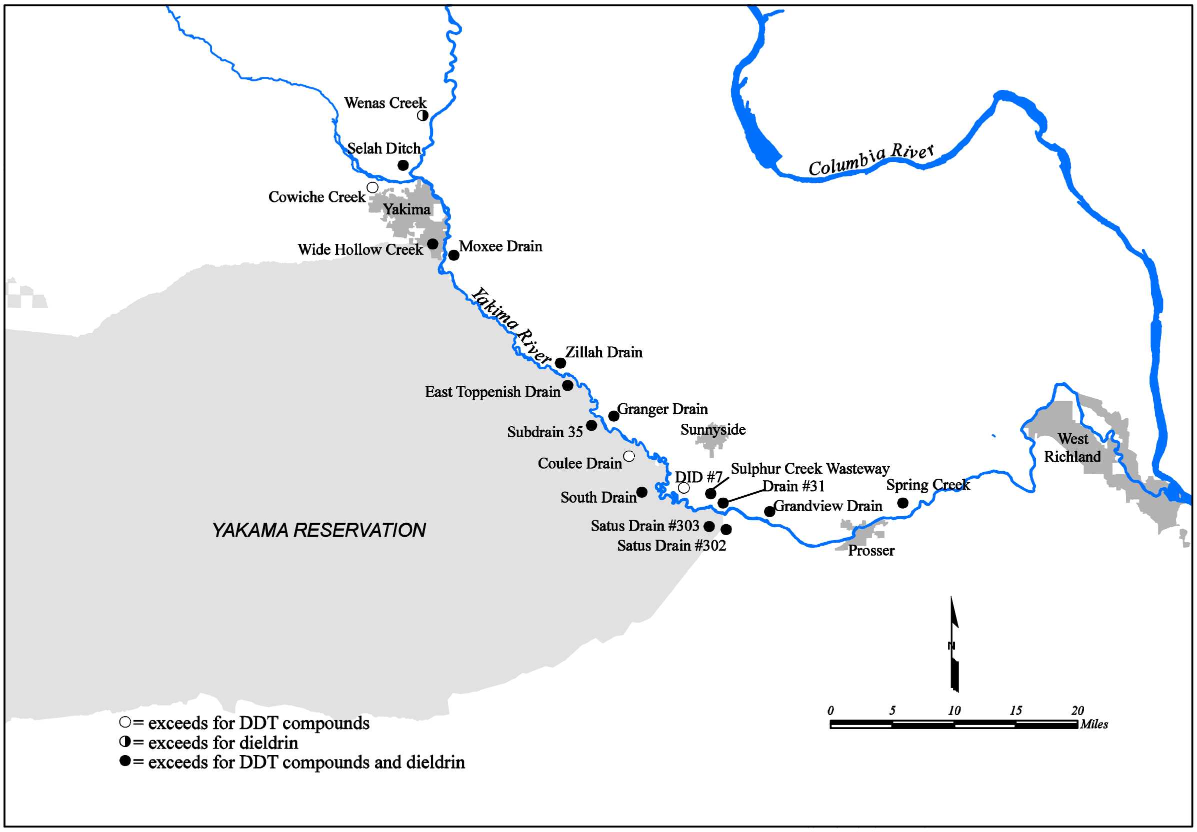

Figure ES-5. Lower Yakima River Tributaries and Irrigation Returns that Exceeded Water Quality Criteria for DDT Compounds and Dieldrin in 2007-08.

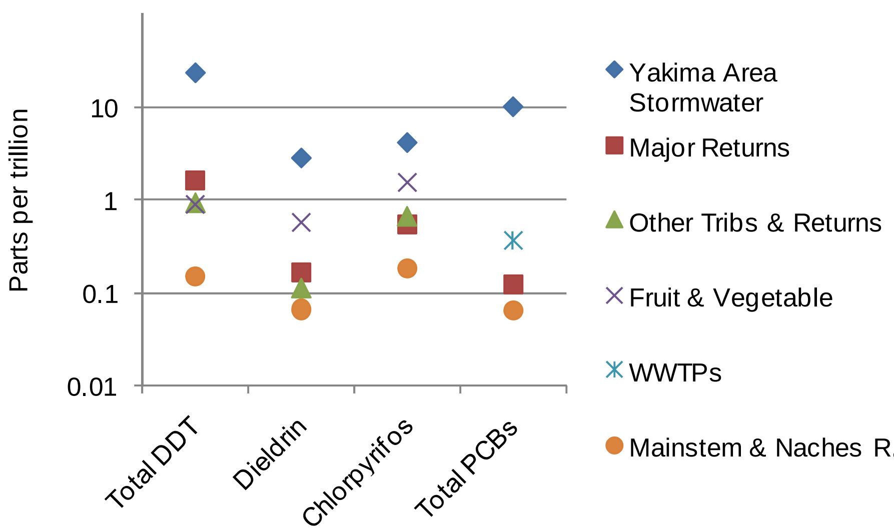

Figure ES-6. Comparison of Pesticide and PCB Levels in Surface Water and Permitted Discharges (median values, log scale).

In terms of loading, irrigation returns continue to be the predominant cause of degraded water quality in the lower Yakima River. These are the most significant sources needing control to reduce the adverse effects of elevated turbidity, pesticides, and PCBs. Urban stormwater runoff appears to be a significant source of these same pollutants and warrants additional monitoring of spatial and temporal variability to better identify and control sources.

This study found that reductions are also needed for PCBs in WWTP effluents and dieldrin in fruit packer and vegetable processor effluents, if they are to meet water quality criteria at the point of discharge. However, these are relatively low volume discharges. Due to chemical interferences, legacy pesticides could not be analyzed down to water quality criteria levels in WWTP effluent.

Pollutants for Which a TMDL or Other Pollution Control Plan is Needed

The combined results from Ecology's fish tissue and water quality studies show that DDT compounds, dieldrin, chlordane, chlorpyrifos, toxaphene, and PCBs currently exceed standards in the Yakima River basin at the locations indicated in Table ES-2. Thus, 303(d) listing continues to be warranted for these pollutants, and a TMDL or other pollution control plan should be implemented. Dioxin marginally exceeds standards and should therefore continue to be listed. The chlordane exceedance is also marginal and limited to fish near Prosser.

Table ES-2. Locations and Pollutants Where a TMDL or Other Pollution Control Plan is Needed.

Reservoirs (WRIA 39)	Upper Yakima River (WRIA 39)		Lower Yakima River (WRIA 37)		Naches River (WRIA 38)	
Keechelus Lake Kachess Lake	Mainstem	Wilson Creek	Mainstem	Tributaries & Returns	Mainstem	Cowiche Creek
PCBs	PCBs Dioxin	Toxaphene*	PCBs Toxaphene* DDE Total DDT† Dieldrin Dioxin	PCBs Toxaphene* DDE DDT Total DDT Chlorpyrifos	PCBs	PCBs DDE Total DDT

WRIA = Water Resources Inventory Area.
*new finding, not currently 303(d) listed.
†total DDT = DDT+DDE+DDD.

The low-level occurrence of PCBs is widespread in Washington rivers and lakes, and is the reason for many 303(d) listings. Targeted cleanups of PCB contaminated sites may be more effective for reducing PCB levels in the Yakima River than the traditional TMDL approach of setting load and wasteload allocations.

Because of limited Ecology resources, which extend beyond costs and include staffing levels, dioxin will not be included in this TMDL. Dioxin will remain on the 303(d) list of contaminants to be addressed in the Yakima basin in the future. Ecology plans to address dioxins on a larger scale (possibly region- or state-wide) in the future. Additionally, because dioxins are often carried via air and can pollute sizeable areas not necessarily limited to watersheds, a larger TMDL footprint will likely be more effective and efficient.

Numeric TMDL Targets and Loading Capacity

This report proposes numeric water quality targets for the TMDL. The targets identify the specific instream goals or criteria for the TMDL, which equate to attainment of water quality standards. The targets include: (1) a partial revision to the existing TMDL turbidity targets for the lower Yakima River; (2) a subset of the water quality criteria for pesticides and PCBs; and (3) equivalent human health criteria-based targets for edible fish tissue. Similar targets for pesticides and turbidity are already in effect as part of the *Upper Yakima River TMDL*.

The loading capacity (grams per day) of the Yakima River was calculated for total DDT, DDE, dieldrin, chlordane, chlorpyrifos, toxaphene, and PCBs. Reductions in the concentrations and loads of these compounds will be needed to meet the water quality targets and not exceed loading capacity.

Recommendations

The report concludes with recommendations for the TMDL, 303(d) list, source tracing, and further monitoring. These include:

- Develop TMDLs or other pollution control plans for DDT compounds, dieldrin, chlordane, chlorpyrifos, toxaphene, and PCBs for those areas indicated in Table ES-2.
- Remove the 303(d) listings for endosulfan, chlordane (upper Yakima River only), alpha-BHC, and dioxin (Keechelus Reservoir only).
- Improve current understanding of variability in concentrations and loads of pesticides, PCBs, suspended solids, and turbidity in Yakima area urban stormwater runoff, with the ultimate aim of identifying and controlling sources.
- Identify sources of toxaphene and PCBs in selected irrigation returns.
- Characterize dry weather discharge of pesticides, PCBs, suspended solids, and turbidity from Yakima area urban storm drains.
- Continue turbidity monitoring of irrigation returns and expand where appropriate.
- Periodically monitor Yakima River fish for the contaminants of concern to assess progress toward meeting human health criteria and TMDL targets.

What is a Total Maximum Daily Load (TMDL)?

Federal Clean Water Act Requirements

The Clean Water Act established a process to identify and clean up polluted waters. Under the Act, each state is required to have its own water quality standards designed to protect, restore, and preserve water quality. Water quality standards consist of designated uses for protection, such as cold water biota and drinking water supply, as well as criteria, usually numeric criteria, to achieve those uses.

Every two years, states are required to prepare a list of waterbodies – lakes, rivers, streams, or marine waters – that do not meet water quality standards. This list is called the 303(d) list. To develop the list, the Washington State Department of Ecology (Ecology) compiles its own water quality data along with data submitted by local, state, and federal governments, tribes, industries, and citizen monitoring groups. All data are reviewed to ensure that they were collected using appropriate scientific methods before being used to develop the 303(d) list. The 303(d) list is part of the larger Water Quality Assessment.

The Water Quality Assessment is a list that tells a more complete story about the condition of Washington's water. This list divides waterbodies into five categories:

Category 1 – Meets standards for parameter(s) for which it has been tested.

Category 2 – Waters of concern.

Category 3 – Waters with no data available.

Category 4 – Polluted waters that do not require a TMDL because:

- 4a. Has an approved TMDL and it is being implemented.
- 4b. Has a pollution control plan in place that should solve the problem.
- 4c. Is impaired by a non-pollutant such as low water flow, dams, culverts.

Category 5 – Polluted waters that require a TMDL – the 303(d) list.

TMDL Process Overview

The Clean Water Act requires that a TMDL be developed for each of the waterbodies on the 303(d) list. A TMDL identifies how much pollution needs to be reduced or eliminated to achieve clean water. Ecology then works with the local community to develop (1) a strategy to control the pollution and (2) a monitoring plan to assess effectiveness of the water quality improvement activities. TMDLs must be approved by EPA.

Elements Required in a 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 pollutant sources that cause the problem. The TMDL determines the amount of a given pollutant that can be discharged to the waterbody and still meet standards (the loading capacity) and allocates that load among the various sources.

Identification of a waterbody's loading capacity for a pollutant is an important step in developing a TMDL. EPA defines loading capacity as "the greatest amount of loading that a waterbody can receive without violating water quality standards" (www.epa.gov/owow/tmdl/glossary.html). The loading capacity provides a reference for calculating the amount of pollution reduction needed to bring a waterbody into compliance with standards. By definition, a TMDL is the sum of the allocations, which must not exceed the loading capacity.

The portion of the receiving water's loading capacity assigned to a particular source is a load or wasteload allocation. If the pollutant comes from a discrete (point) source such as a municipal or industrial facility's discharge pipe, that facility's share of the loading capacity is called a *wasteload allocation*. If the pollutant comes from a set of diffuse (nonpoint) sources such as farm runoff, the cumulative share is called a *load allocation*.

The TMDL must also consider seasonal variations and include a margin of safety that takes into account any lack of knowledge about the causes of the water quality problem or its loading capacity. A reserve capacity for future loads from growth pressures is sometimes included as well. The sum of the wasteload and load allocations, the margin of safety, and any reserve capacity must be equal to or less than the loading capacity.

TMDL = Loading Capacity = sum of all wasteload allocations + sum of all load allocations + margin of safety.

Why is Ecology Conducting a TMDL Study in This Watershed?

Overview

This TMDL project will incorporate and update the DDT and suspended sediments water quality improvement plans already in place in the Yakima basin, while capturing previously unaddressed water quality impairments due to other toxics pollutants. While this study provides information on waters throughout the watershed, the TMDL derived from this report will focus on those waters of Washington State within the Yakima basin.

In 1994 Ecology began to seriously address polluted runoff in the Yakima River watershed when it initiated the *Yakima River Suspended Sediment and DDT TMDL* study. That project concluded that reducing polluted runoff from irrigated agricultural activities was a priority for reducing DDT and its breakdown products. The 1997 publication of the TMDL included goals for controlling sediment runoff reaching the Yakima River through irrigation drains and a schedule for re-evaluating contaminant loading to the river.

An Ecology TMDL study in the upper Yakima River conducted in 1999 also showed that DDT, its breakdown products, and other organochlorine pesticides could be reduced if suspended sediment loading from agricultural areas were reduced.

The current study answers the TMDL requirement to check the progress of the earlier work on suspended sediments and DDT while expanding the study to capture other toxics in the watershed.

After a decade of implementation activities that reduce suspended sediment loading to the Yakima River and its tributaries, Ecology began this study to:

- Assess progress toward meeting TMDL targets for reducing DDT and dieldrin levels in Yakima River fish.
- Verify accuracy of the current 303(d) listings for chemical contaminants in Yakima River fish and water.
- Provide data to the Washington State Department of Health to update the 1993 fish consumption advisory on DDT.
- Set or adjust pollution reduction goals from a broad range of sources – stormwater, irrigated agriculture, wastewater treatment plants, and other sources – for meeting human health and aquatic life criteria for toxic compounds in the Yakima River.

Due to the size of the Yakima basin and the number and complexity of toxics issues, Ecology decided to split the TMDL into two parts: a Water Quality Study Findings Report (the present study) and a future TMDL Water Quality Improvement Report. This Water Quality Study Findings Report assesses the current status of toxics pollution problems and sources in the Yakima basin and calculates the river's loading capacity for the chemicals of concern. The

Water Quality Improvement Report will include the overall approach to control the pollution (*Implementation Strategy*) and a monitoring plan to assess the effectiveness of the water quality improvement activities undertaken (*Effectiveness Monitoring*). Load and wasteload allocations for the chemicals of concern will be addressed in the Water Quality Improvement Report, to be prepared by the Ecology Water Quality Program at a later date and submitted to EPA.

Study Area

The study area for this TMDL includes the Yakima River, its tributaries, and irrigation returns. This area extends from the headwaters of Keechelus Lake to the Yakima River confluence with the Columbia River. It includes Water Resource Inventory Areas (WRIA) 39: Upper Yakima River, WRIA 38: Naches River, and WRIA 37: Lower Yakima River (Figure 1).

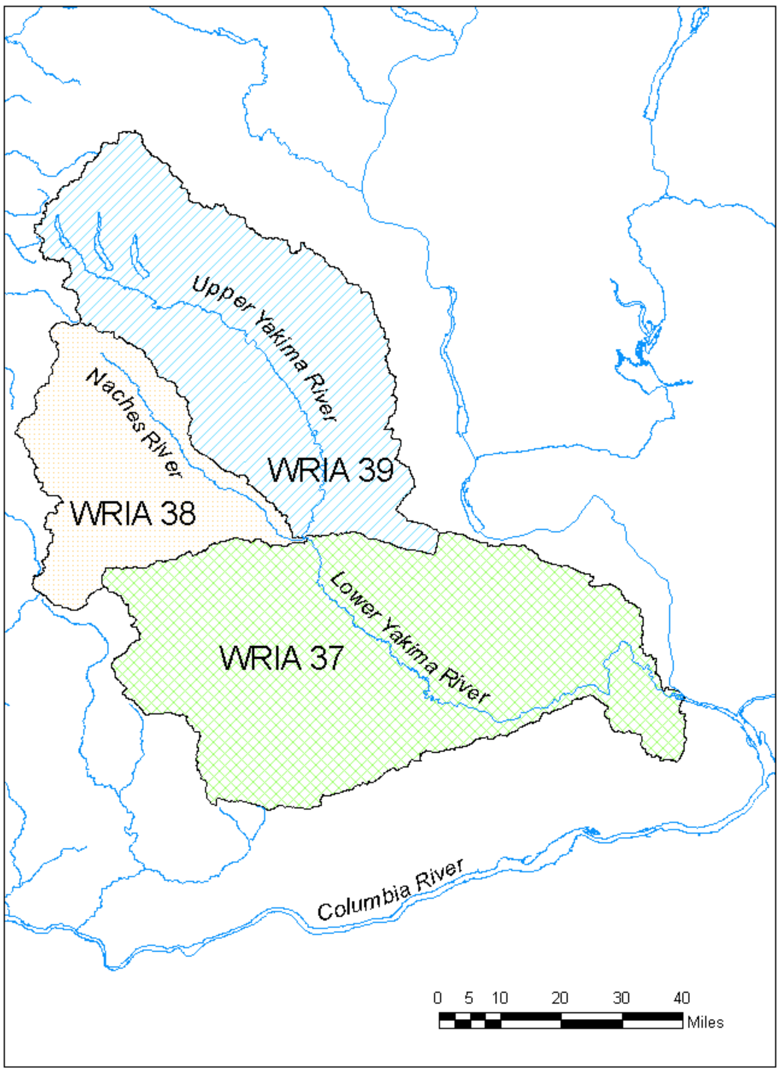

Figure 1. Water Resource Inventory Areas for Yakima River Pesticides and PCBs TMDL.

Yakima Basin Waterbodies on Ecology's 303(d) List of Impaired Waters

Washington's 2008 303(d) list includes numerous Category 5 listings in the Yakima River watershed for a range of chemical contaminants (www.ecy.wa.gov/programs/wq/303d/index.html). The include six legacy pesticides or breakdown products (DDT, DDE, DDD, dieldrin, chlordane, and alpha-BHC), two current use insecticides (endosulfan and chlorpyrifos), polychlorinated biphenyls (PCBs), and dioxin (2,3,7,8-TCDD). Waterbodies in Category 5 require a TMDL.

The individual Category 5 listings for chemicals that have failed to meet (exceeded) human health criteria in edible fish tissue samples from the Yakima River are in Appendix A. The listings for chemicals that have exceeded human health and aquatic life criteria in water samples are in Appendix B. Both sets of listings are summarized in Table 1. Ninety-five percent of the current Category 5 listings in the Yakima basin are for the lower river (89 out of 94).

Although EPA approved the *Lower Yakima River Suspended Sediment and DDT TMDL* for meeting aquatic life and turbidity criteria, it was not approved for achieving compliance with the more restrictive human health pesticide criteria. Therefore, the lower river continues to have Category 5 listings for DDT, DDE, DDD, and dieldrin. The *Upper Yakima River Suspended Sediment and Organochlorine Pesticide TMDL* was approved for meeting human health criteria, and the listings for DDT compounds and dieldrin were subsequently moved to Category 4a (waterbodies that have an approved TMDL).

The 2008 303(d) list had a number of new Yakima River listings for organochlorine compounds including PCBs, dioxin, and the pesticides endosulfan, chlorpyrifos, chlordane, and alpha-BHC. These listings were based on fish and water samples analyzed by Ecology and EPA since 1995.

Most of these chemicals bioaccumulate in fish, wildlife, and humans. DDE, PCBs, and dioxin, in particular, are highly bioaccumulative due to their stability and solubility in lipids (fat). Concentrations in fish tissues, for example, can be tens of thousands of times higher than in the surrounding water.

PCBs and most chlorinated pesticides are legacy pollutants no longer produced or used in the United States. They were banned by EPA in the 1970s and 1980s for ecological and human health concerns, but they persist in soil, lakes, rivers, and streams. Endosulfan, a chlorinated insecticide, and chlorpyrifos, an organophosphorus insecticide, are currently approved for a variety of crops. Their bioaccumulation potential is low. The 303(d) listings for endosulfan and chlorpyrifos are for exceeding aquatic life criteria in water samples.

PCBs were once widely used in industrial applications as insulating fluids, plasticizers, in inks and carbonless paper, and as heat transfer and hydraulic fluids. Dioxin is an unintended by-product of combustion and certain industrial processes. These chemicals are routinely detected in Washington rivers and streams and are the cause of many 303(d) listings.

Table 1. Summary of 303(d) Listings for Chemical Contaminants in the Yakima River Basin (2008 list).

Reach	Number of Listings	Parameter	Applies To
Upper Yakima River (WRIA 39)			
Keechelus Lake	2	PCBs, Dioxin	Fish tissue
Yakima R. Canyon	3	PCBs, Dioxin, Chlordane	Fish tissue
Naches River (WRIA 38)			
Cowiche Creek	2	PCBs, DDE	Fish tissue
Lower Yakima River (WRIA 37)			
Yakima R. near Union Gap	5	DDT, DDE, DDD, alpha-BHC, PCBs	Fish tissue
	7	DDT, DDE, DDD, Chlorpyrifos, Endosulfan	Water
Yakima R. near Zillah	3	DDT, DDD, Dieldrin	Fish tissue
Yakima R. near Granger	8	DDT, DDE, PCBs, Dioxin	Fish tissue
	2	DDT, Dieldrin	Water
Yakima R. near Grandview	1	DDE	Fish tissue
	2	DDE, DDD	Water
Yakima R. near Prosser	4	DDT, DDE, Chlordane, Dioxin	Fish tissue
	1	DDT	Water
Yakima R. near Benton City	8	DDT, DDE, DDD, alpha-BHC, PCBs	Fish tissue
	5	DDT, DDE, DDD, Dieldrin, Endosulfan	Water
Yakima R. near Horn Rapids	6	DDT, DDE, DDD, Dieldrin, alpha-BHC, PCBs	Fish tissue
	1	DDE	Water
Yakima R. near mouth	2	DDT, DDE	Fish tissue
Yakima Tributaries: Wide Hollow Creek, Moxee Drain, Marion Drain, Granger Drain, Sulphur Creek Wasteway, Snipes Creek, Spring Creek	32	DDT, DDE, DDD, Dieldrin, Endosulfan, Chlorpyrifos	Water
	44	Total Fish Tissue Listings	
	50	Total Water Column Listings	
	94	Total Listings	

*Water Resources Inventory Area.

Toxaphene, a chlorinated pesticide, is among the pollutants being addressed in this TMDL. All uses of this chemical were banned in 1990. Toxaphene is not currently 303(d) listed but was recently identified as a contaminant of potential concern in Yakima River fish (Johnson et al., 2007). The report of this finding did not come in time for the 2008 303(d) list. Toxaphene shares many of the characteristics of other bioaccumulative pesticides and PCBs.

Detailed profiles including use, regulations, environmental occurrence, and health effects of these chemicals have been prepared by the Agency for Toxic Substances & Disease Registry and are available at www.atsdr.cdc.gov/toxpro2.html.

In addition to the toxic chemicals mentioned above, the Yakima River basin has 303(d) listings for dissolved oxygen, pH, temperature, and fecal coliform bacteria.

Pollutants Addressed by This TMDL

This TMDL project addresses the pollutants listed in Table 2.

Table 2. Pollutants Being Addressed in This TMDL.

Pollutant	Upper Yakima Basin (WRIA 39)	Lower Yakima Basin (WRIA 37)	Naches River (WRIA 38)
Chlorinated Pesticides			
DDT (dichlorodiphenyltrichloroethane)		X	
DDE (dichlorodiphenyldichloroethylene)*		X	X
DDD (dichlorodiphenyldichloroethane)*		X	
Dieldrin		X	
Endosulfan		X	
Chlordane	X	X	
Alpha-BHC (benzenehexachloride)		X	
Toxaphene†	X	X	
Organophosphorus Pesticides			
Chlorpyrifos		X	
PCBs (polychlorinated biphenyls)	X	X	X

*DDT breakdown product.
†Not currently 303(d) listed.

Suspended sediment and turbidity are also a focus of this study. The previous TMDLs correlated these parameters with the occurrence of chlorinated pesticides and adverse effects on fish and other aquatic life. The TMDLs established numeric water quality targets and schedules to bring the Yakima River into compliance with the turbidity standards and certain of the pesticide criteria.

Washington State standards do not provide numeric criteria for suspended sediment. However, elevated levels of suspended sediment increase turbidity, and turbidity is addressed in the standards.

Exceedances of dioxin criteria in the Yakima River are minimal. For this reason and because of limited Ecology resources, which extend beyond costs and include staffing levels, dioxin will not be addressed in this TMDL. Dioxin will remain on the 303(d) list of contaminants to be addressed in the Yakima basin in the future. Ecology plans to address dioxins on a larger scale, possibly region- or state-wide. Because dioxins are often carried via air and can pollute sizeable areas not necessarily limited to watersheds, a larger TMDL footprint will likely be more effective and efficient.

Water Quality Standards

Designated Uses

Designated uses in Washington State include public water supply, protection for fish, shellfish, and wildlife, as well as recreational, agricultural, industrial, navigational, and aesthetic purposes. Water quality criteria are designed to protect the designated uses and are used to assess the general health of Washington surface waters and set permit limits.

Use designations for the upper Yakima River, lower Yakima River, Naches River, and their tributaries are listed in Appendix C.

Toxics

Washington State's aquatic life and human health criteria for the toxic pollutants being addressed in this TMDL are shown in Table 3.

Table 3. Washington State Water Quality Criteria for 303(d) Listed Pesticides, PCBs, and Toxaphene in the Yakima River Basin *(ng/L; parts per trillion).*

Chemical	Criteria for Protection of Aquatic Life (WAC 173-201A)		Criteria for Protection of Human Health (EPA National Toxics Rule)	
	Freshwater Chronic	Freshwater Acute	Fish Consumption	Fish & Water Consumption
DDT	- -	- -	0.59	0.59
DDE	- -	- -	0.59	0.59
DDD	- -	- -	0.84	0.83
DDT and metabolites*	1.0	1,100	- -	- -
Dieldrin	1.9	2,500	0.14	0.14
Chlordane	4.3	2,400	0.59	0.57
alpha-BHC	- -	- -	13	3.9
Endosulfan	56	220	2,000	930
Chlorpyrifos	41	83	- -	- -
Toxaphene	0.2	730	0.75	0.73
PCBs	14	2,000	0.17	0.17

*The sum of DDT and metabolites DDE and DDD (i.e., total DDT).
- - = no criteria.

Aquatic Life

The aquatic life criteria are designed to protect for both short term (acute) and long term (chronic) effects of chemical exposure. The criteria are primarily intended to avoid direct lethality to fish and other aquatic life within the specified exposure periods. The chronic criteria for PCBs and a number of the chlorinated pesticides are to protect fish-eating wildlife from adverse effects due to bioaccumulation.

The exposure periods assigned to the acute criteria are expressed as: (1) an instantaneous concentration not to be exceeded at any time, or (2) a 1-hour average concentration not to be exceeded more than once every three years on the average. The exposure periods for the chronic criteria are either: (1) a 24-hour average not to be exceeded at any time, or (2) a 4-day average concentration not to be exceeded more than once every three years on the average. For 303(d) listing purposes, measurements of instantaneous concentrations are assumed to represent the averaging periods specified in the water quality standards for both acute and chronic criteria, unless additional measurements are available to calculate averages (Ecology, 2006).

As indicated in Table 3, there are no aquatic life criteria specifically for DDT, its breakdown products DDE and DDE, or alpha-BHC. The "DDT and metabolites" criteria apply to DDT, DDE, and DDD individually or in combination. In the present report, the sum of detected concentrations of DDT, DDE, and DDD is referred to as total DDT.

Human Health

Criteria for the protection of human health are applied to the states through the EPA National Toxics Rule (NTR) (40 CFR 131.36(14). In freshwater, the criteria take into account the combined exposure of drinking the water and eating fish that live in the water. In marine waters, human health criteria only consider the effect of eating fish. The criteria protect against non-carcinogenic illness and keep the risk of developing cancer to a pre-specified level.

In Washington, the cancer risk is set such that no more than 1 in 1,000,000 people with full exposure would be likely to develop cancer in response to that exposure. Full exposure is defined by a set of assumptions on body weight, fish and water consumption, and the number of years exposed. The risk is correlated to an average-weight adult consuming 6.5 grams per day of fish (approximately 5 pounds per year), drinking 2 liters of water per day (if freshwater), and continuing this pattern for 70 years. For the chemicals of concern in the Yakima River, essentially all of the cancer risk is from fish consumption. People with higher or lower body weight and exposure patterns would face higher or lower risks. This basic exposure pattern is the same for both cancer-causing and non-cancer-causing chemicals.

EPA has classed the pollutants of concern in this TMDL as probable human carcinogens, except for endosulfan and chlorpyrifos. The human health criteria for endosulfan are based on a reference dose that is unlikely to have appreciable health risk. There are no human health criteria for chlorpyrifos.

The edible fish tissue criteria that apply to the Yakima River are shown in Table 4. These values are derived from the human health water quality criteria in Table 3 (fish and water consumption) and EPA bioconcentration factors (BCFs). BCF= C_t/C_w, where C_t is the contaminant concentration in fish tissue (wet weight) and C_w is the concentration in water. The BCFs are taken from the EPA 1980 Ambient Water Quality Criteria documents (www.epa.gov/waterscience/criteria/1980docs.htm). The BCF predicts the chemical concentration in fish tissue that would be expected to result for a given concentration in the water column. In essence, the 303(d) fish tissue criteria are the human health water quality criteria expressed in tissue form.

Table 4. Freshwater Edible Fish Tissue Criteria for 303(d) Listed Pesticides, Toxaphene, PCBs, and Dioxin in Yakima River Fish *(based on EPA National Toxics Rule; ug/Kg wet weight, parts per billion).*

Chemical	Fish Tissue Criteria
DDT	32
DDE	32
DDD	45
Dieldrin	0.65
Chlordane	8.0
alpha-BHC	0.51
Endosulfan	251
Chlorpyrifos	- -
Toxaphene	9.6
PCBs	5.3
Dioxin	0.00007

Turbidity

Turbidity is a measure of light refraction in water and can be used to estimate the amount of suspended sediment and other solids. Fish and other aquatic life are affected by suspended matter in the water column and sediments that settle out on the bottom.

The effects of suspended sediment on fish and other aquatic life can be divided into five categories:

1. Acting directly on swimming ability.
2. Causing mortality or reducing their growth rate, resistance to disease, etc.
3. Preventing the successful development of eggs and larvae.
4. Modifying natural movements and migrations.
5. Reducing the abundance of available food.

Suspended sediment may also serve to transmit attached chemical and biological contaminants to waterbodies where they can be taken up in the tissues of fish. This can affect the health of humans or wildlife that eat the fish. Turbid waters also interfere with the treatment and use of water as potable water supplies, and can interfere with the recreational use and aesthetic enjoyment of the water.

Turbidity is a focus of the existing Yakima River suspended sediment TMDLs. The criteria state that: *Turbidity shall not exceed 5 NTU*[a] *over background turbidity when the background turbidity is 50 NTU or less, or have more than a 10 % increase in turbidity when the background is more than 50 NTU.* The criteria do not set a maximum acceptable turbidity level based on beneficial use considerations, but they do limit the effect of an identified source on raising the turbidity in the receiving water. Background conditions are defined as … *the biological, chemical, and physical conditions of the water body, outside the area of influence of the discharge under consideration.* [WAC 173-201A-200; 2006 edition]

[a] nephelometric turbidity units

Watershed Description

Yakima River Basin

The Yakima River flows 215 miles out of Keechelus Lake in the Cascade Mountains to the Columbia River near Richland, draining an area of 6,155 square miles (Figure 2). The major population centers are, in downstream order, Ellensburg (16,542), Yakima (79,480), Toppenish (9,000), Sunnyside (14,710), and West Richland (10,210). Much of the land that lies to the south of the lower Yakima River is within the Yakama Nation Reservation. The reservation occupies about 15% of the basin.

Most of the Yakima basin is in the Cascade rain shadow. Mean annual precipitation ranges from 140 inches in the mountains to less than 10 inches in the eastern regions. The western part is mostly forested, while the eastern uplands are dominated by sagebrush and grass. The lowlands are farmed and intensively irrigated.

The upper basin includes the Kittitas Valley, an area around Ellensburg devoted primarily to hay, cereal crops, and irrigated pasture. The lower basin is downstream of the Naches River confluence at river mile (r.m.) 116.3 in the city of Yakima. The lower Yakima Valley produces fruit, vegetables, grapes, other specialty crops such as hops and mint, dairy products, and beef. The lower Yakima River basin is one of the most intensively irrigated and agriculturally diverse areas in the United States.

The Kittitas and Yakima Valleys are separated by the Yakima River Canyon, an arid 20-mile reach between Ellensburg and Yakima. The canyon is generally considered to be part of the upper Yakima River.

Approximately one-half million acres are irrigated in the drainage. Most of the water is managed by the U.S. Bureau of Reclamation (USBR). Snowmelt and precipitation are held in six reservoirs on the upper Yakima and Naches Rivers and delivered to growers via rivers, creeks, and man-made canals. Water distribution from canals to farms is primarily managed by irrigation districts. USBR also manages the system for flood control, power generation, and fishery management.

Irrigation is by one of three general methods: furrow, sprinkler, or drip. Of these methods, furrow typically results in the most surface runoff from agricultural lands. Excess water is collected at the lower ends of fields and flows into drains that ultimately reach the Yakima River. Over the last several decades, irrigated land has been converted to sprinkler or drip irrigation, but rill and furrow is still used by many agricultural producers.

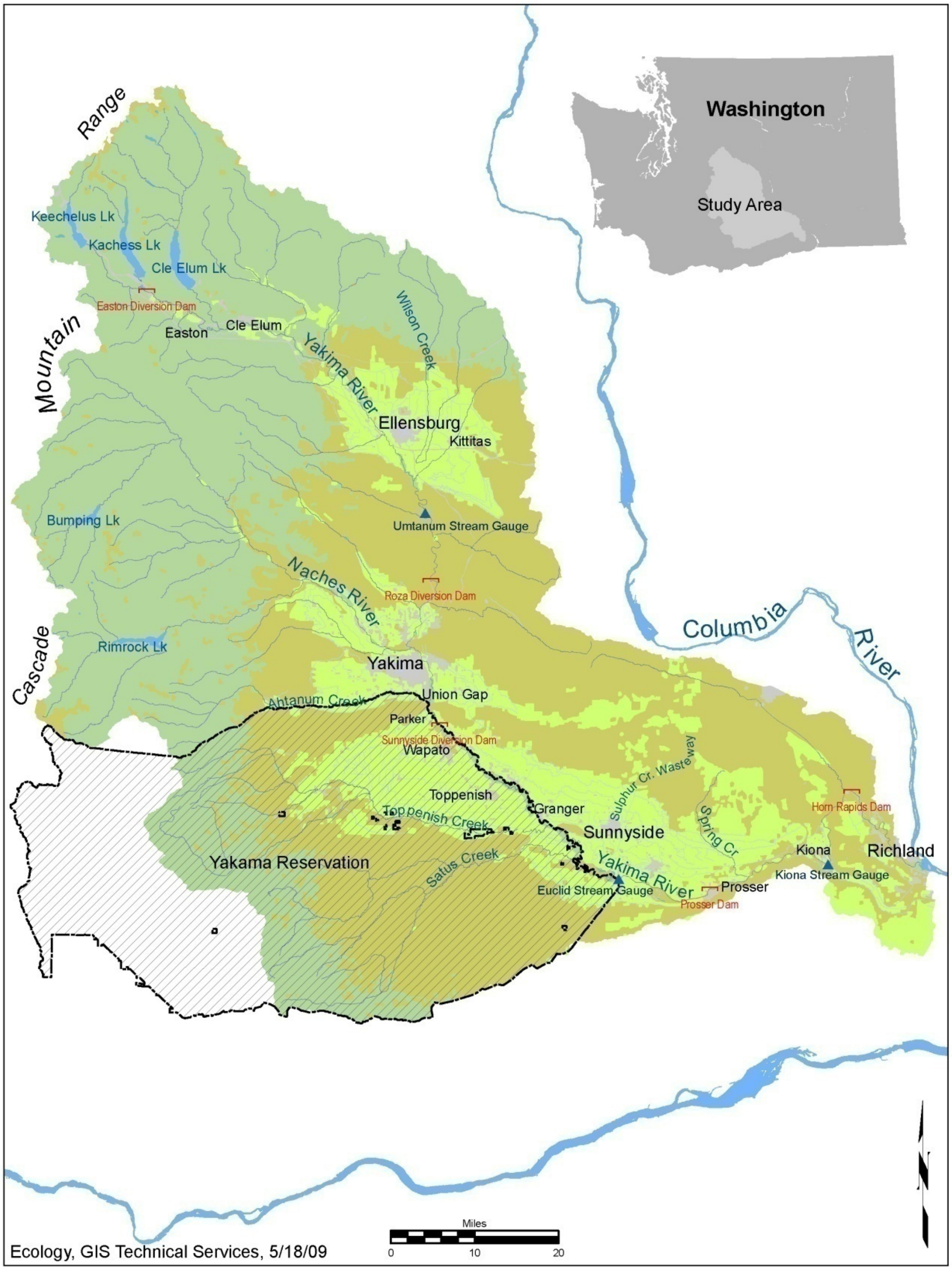

Figure 2. Yakima River Basin.

During the summer, return flows downstream from the city of Yakima account for 50 to 70% of the flow in the Yakima River (Fuhrer et al., 2004). Thus, for many water quality parameters, the quality of the irrigation returns largely determines the quality of water in the lower Yakima River. While most of the drinking water in the Yakima basin comes from wells, surface water provides drinking water for some cities such as Yakima (Naches River) and Cle Elum (upper Yakima River).

Yakama Nation

The 1.2-million-acre Yakama Reservation lies between the lower Yakima River and the Cascade Range. A number of the tributaries and irrigation returns that enter the Yakima River flow through or originate on the reservation.

Land within the Yakama Reservation is under the sovereign jurisdiction of the Yakama Nation. The Yakima River forms the reservation's northern boundary from Ahtanum Creek at r.m. 106.9 in Union Gap to the Mabton-Sunnyside Bridge at r.m. 59.8.

Since the Yakima River was on the 303(d) list of threatened or impaired waterbodies, the state acted to improve and protect water quality by developing the existing TMDLs. Water quality scientists, technicians, and educators from the Yakama Nation, Ecology, the U.S. Geological Survey (USGS), and other agencies have maintained a cooperative partnership to monitor conditions and promote appropriate water management practices. The approval and cooperation of the Yakama Nation is important to the success of continuing efforts to clean up the river.

Streamflow and the Irrigation System

Peak runoff in the Yakima River normally occurs during snowmelt in April and May (Figure 3). Diversions to the irrigation canals begin in mid-March and end in mid-October, depending on water supply. Because of diversions, flow regulation in the headwaters, and dry summers, some reaches of the Yakima have a low-flow period during summer. Most irrigation returns have their low-flow periods in the winter, while many natural tributaries have low-flow periods in the late summer or fall.

Streamflow varies from year to year depending on snowfall. The snowpack is thought of as the "sixth reservoir" and is an integral part of the total water supply. "Storage control" is a term used to define the time when natural, unregulated flow in the river has ended and water supply is controlled by releases from the reservoirs. In a year with normal snowmelt and runoff, the system goes on storage control around June 20.

There are seven divisions in the USBR Yakima Project: Storage, Kittitas, Tieton, Roza, Wapato, Sunnyside, and Kennewick. The Wapato Division is operated by the Bureau of Indian Affairs. Storage dams and reservoirs in the project are Keechelus, Kachess, and Cle Elum on the upper Yakima River, and Bumping Lake, Clear Lake, and Tieton Reservoir (Rimrock Lake) in the Naches River drainage. Other project features are five diversion dams, canals, laterals, pumping plants, drains, two power plants, and transmission lines.

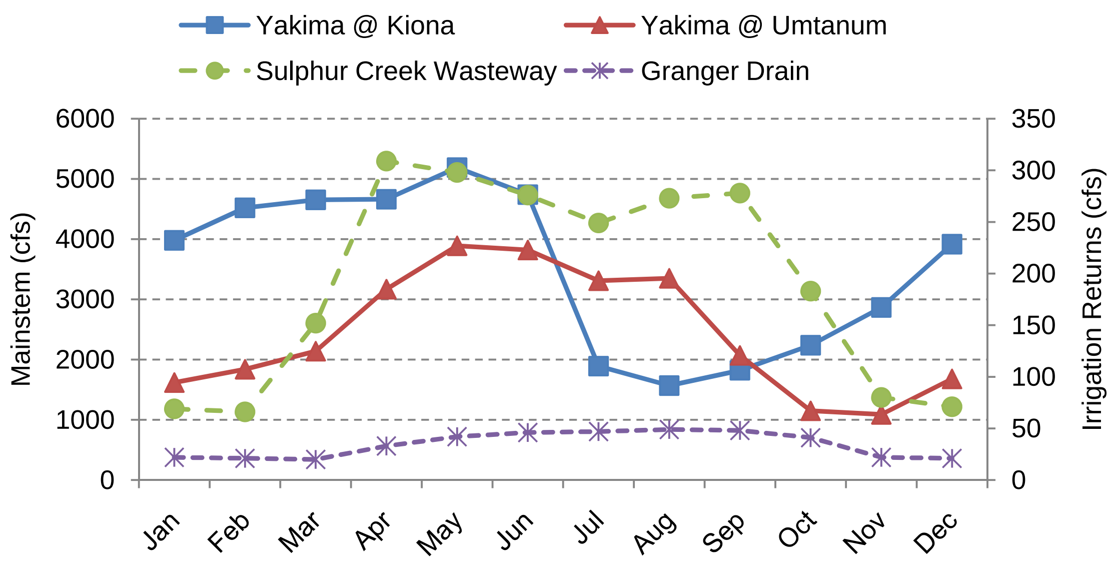

Figure 3. Monthly Average Flow in the Yakima River, Sulphur Creek Wasteway, and Granger Drain.

(USGS data: Yakima @ Umtanum 1933-1977; Yakima @ Kiona 1933-2007; Sulphur Creek 1976-90; Granger Drain 1991-2003; http://waterdata.usgs.gov/wa/nwis/sw.)

Figure 4 is a schematic of the drainage, showing the relative position of selected tributaries, diversions, return flows, and other features of interest in the present study.

Feature	Inflow or Outflow	River Mile
Keechelus Lake	→	214.5
Kachess Lake	→	203.5
Cle Elum Lake	→	185.6
Wilson Creek	→	147.0
Umtanum Stream-gaging Station	--	140.5
Roza Diversion Dam	←	127.9
Naches River	→	116.3
Roza Power Return	→	113.3
Wide Hollow Creek	→	107.4
Moxee Drain	→	107.3
Ahtanum Creek	→	106.9
Wapato Canal		106.7
Sunnyside Diversion Dam	←	103.8
Parker Stream-gaging Station	--	103.7
Marion Drain	→	83.2
Granger Drain	→	82.8
Toppenish Creek	→	80.4
Satus Creek	→	69.6
Sulphur Creek Wasteway	→	61.0
Euclid Stream-gaging Station	--	55.0
Chandler Diversion Dam @ Prosser	←	47.2
Spring Creek/Snipes Creek	→	41.8
Chandler Power Return	→	35.8
Kiona Stream-gaging Station	--	29.9
Horn Rapids Diversion Dam	←	18.0
Columbia River Confluence	--	0

Figure 4. Relative Position of Selected Tributaries, Diversions, Irrigation Returns, and Other Features on the Yakima River.

Four hydrologic points of particular importance[b] are:

1. Roza Diversion Dam (r.m. 127.9)

Located at the bottom of the Yakima River Canyon about 10 miles north of the city of Yakima, the Roza Diversion serves approximately 72,500 acres of irrigated land on the northeast side of the lower valley. About half of the water diverted to Roza Canal is used for hydropower generation and returned to the river with little change in pollutant loading at r.m. 113.3 in Yakima.

2. Naches River Confluence (r.m. 116.3)

The Naches River is a major tributary to the lower Yakima River. It meets the Yakima about 12 miles downstream of Roza Dam in Yakima. There are several major tributaries and irrigation returns in the reach between the Naches confluence and Union Gap including Wide Hollow Creek, Ahtanum Creek, and Moxee Drain.

The Naches River supplies fairly high-quality water. Since 1981, the contribution of the Naches and Yakima Rivers to the lower basin has been manipulated during the irrigation season to accommodate the needs of irrigators and fishery managers. In general, upper Yakima River reservoirs are used to meet June to August irrigation needs, while Naches River reservoirs are used for September and October. The "flip-flop" allows flow regimes in the upper Yakima River for spring chinook salmon egg survival.

3. Wapato and Sunnyside Valley District Diversions (r.m. 103.8 and 106.7)

Located near Parker (r.m. 103.7), these two irrigation districts divert half to three-fourths of the water available below the city of Yakima. The Wapato Irrigation Project diverts up to 2,000 cubic feet per second (cfs) to serve 136,000 acres of irrigated land on the Yakama Reservation. The Sunnyside Valley Irrigation District (SVID) diverts up to 1,280 cfs to serve 103,500 acres between the river and Roza Irrigation District lands.

In many past years, nearly all of the water in the Yakima River mainstem was diverted for irrigation by the time it passed the SVID diversion, leaving the reach immediately downstream dewatered and nearly dry. This became a concern among fishery and water resource managers. Instream flow limits were established in 1994, setting a minimum target of 300 cfs that would remain in the river and maintain flow through fish ladders and around irrigation diversions.

The remaining 103 miles of Yakima River in the lower basin slowly recover some of the water diverted for irrigation through surface and subsurface returns. The most numerous and largest tributaries and irrigation returns are located between Parker and the Euclid streamflow gauge near Grandview (r.m. 55.0). Major inflows to this reach are: Granger Drain, Marion Drain, Toppenish Creek, Satus Creek, and Sulphur Creek Wasteway. One additional large return, Spring Creek, is located downstream of Euclid below Prosser.

[b] This information taken from Joy and Patterson (1997), USBR Hydromet website www.usbr.gov/dataweb/html/yakima.html, Coffin et al. (2006), and Morace et al. (1999).

Chandler Diversion is a significant control point at Prosser. It creates the Prosser pool, a major change point in river morphology and hydrology. The Chandler Power Return is a large input of water between Spring Creek and Kiona.

4. Kiona (r.m. 29.9)

There is a long-term stream-gaging station at Kiona (Benton City). Upstream of this point, the majority of the large irrigation diversions and returns have occurred.

The Yakima River from Kiona to the mouth has a few additional diversions and returns, but no gaging station is located in the final 30-mile reach. The Columbia and Richland Canals are the most significant diversions. They occur at Horn Rapids (Wanawish) Dam (r.m. 18.0). The last significant irrigation return is Amon Wasteway at r.m. 2.1.

Previous Water Quality Studies

Yakima River water quality was investigated in the 1970s, with several studies evaluating sediment loading (CH2M Hill, 1975; Boucher, 1975; Soil Conservation Service, 1978; Corps of Engineers, 1978; Ecology, 1979; Nelson, 1979; Boucher and Fretwell, 1982; and Molenaar, 1985). This work showed irrigation practices directly affected suspended sediment in the river. Peak concentrations occurred in April through June when streamflows were high and freshly tilled fields were being irrigated. Suspended sediment loads began to increase rapidly below the confluence of Moxee Drain (r.m. 107), a major irrigation return in Union Gap near Yakima.

In 1986, the Yakima River basin was selected as one of four surface-water pilot studies for the USGS National Water-Quality Assessment (NAWQA) Program. Data collected from 1987-1991 provide a baseline characterization of suspended sediment, pesticides, nutrients, trace elements, and aquatic life in Yakima River streams. A special NAWQA study was conducted in the Yakima during 1999-2000 to monitor water quality trends and evaluate transport of agricultural chemicals and their effects on stream ecosystems. NAWQA results are reported by McKenzie and Curtiss (1989), Rinella et al. (1999), Morace et al. (1999), Ebbert and Embrey (2002), Ebbert et al. (2002), Fuhrer et al. (2004), and others.

USGS concluded that “agricultural drains in the mid and lower valleys were found to be significant sources of nutrients, suspended sediment, pesticides, and fecal indicator bacteria.” NAWQA showed the highest detection frequencies and concentrations of pesticides generally occur during irrigation season. Their findings indicated pesticides that persist in soil, such as DDT, continue to be transported in streams and drains throughout the year, especially during storm runoff or snowmelt.

Groundwater inputs are also potential pesticide sources, including chlorinated pesticides normally associated with suspended sediment. DDT compounds, for example, have been detected in wells in the Toppenish and Sulphur subbasins of the lower Yakima River (Rinella et al., 1999). A recent Ecology study found the highest dieldrin levels in Wide Hollow Creek near Union Gap occurred after the irrigation season. Dieldrin was inversely correlated with discharge and positively correlated with conductivity, suggesting subsurface flow is a source in this area (Johnson and Burke, 2006).

The U.S. Fish and Wildlife Service began routine monitoring of organochlorine compounds in Yakima River fish in the 1970s (see Schmitt et al., 1990). They found high concentrations of several chlorinated pesticides including DDT and dieldrin. PCBs were also detected. Ecology followed up on the pesticide findings in 1985 (Johnson et al., 1986, 1988). A number of creeks and irrigation returns were identified as pesticide sources. These include Wilson Creek in the upper Yakima basin and Moxee Drain, Granger Drain, Sulphur Creek Wasteway, and Spring Creek in the lower Yakima basin.

NAWQA confirmed continued high concentrations of total DDT in resident lower Yakima River fish (Rinella et al., 1993). Fish communities were characterized as being severely impaired "associated with high levels of pesticides in fish tissues and the presence of external anomalies on fish."

In 1993 the Washington State Department of Health (WDOH) issued an advisory that recommended limiting consumption of bottom fish from the lower Yakima River due to the high levels of total DDT (WDOH, 1993; www.doh.wa.gov/ehp/oehas/fish). Because of the NAWQA studies and WDOH advisory, Ecology prioritized suspended sediment TMDLs to reduce DDT and other pesticide loading to the Yakima River.

Existing Yakima River TMDLs

A number of TMDLs have been approved or are underway in the Yakima River basin including TMDLs for fecal coliform bacteria, temperature, ammonia, chlorine, suspended sediment, and chlorinated pesticides (www.ecy.wa.gov/programs/wq/tmdl/watershed/index.html). The present 2007-08 study builds on results achieved through the two suspended sediment and chlorinated pesticide TMDLs, described below.

Lower Yakima River Suspended Sediment and DDT TMDL

In 1998, a TMDL was established for suspended sediment in the lower Yakima River to bring it into compliance with water quality criteria for turbidity and DDT. The basic premise behind this TMDL was that suspended sediment from erosion of farm soils was the primary source of DDT and other chlorinated pesticides introduced to the river at levels that adversely affected aquatic life and cause an increased health risk to people consuming fish. Suspended sediments – measured as total suspended solids (TSS) – also cause excessive turbidity in the Yakima River, its tributaries, and irrigation returns.

The combined effects of high TSS, turbidity, and pesticides degrade fish and wildlife habitat. Threatened and endangered salmonids are a particular concern.

The field study for the *Lower Yakima River Suspended Sediment and DDT TMDL* was conducted by Ecology during 1994-1995 (Joy and Patterson, 1997). The schedule adopted for meeting water quality targets developed through the TMDL is shown in Table 5.

Table 5. Summary of Lower Yakima River TMDL Schedule.

Year	Target	Applies To
2002	≤ 5 NTU* increase above background	Mainstem
	25 NTU	Mouths of all tributaries and drains
2007	25 NTU	All points within tributaries and drains
	Develop strategy to meet DDT human health criteria	All tributaries, drains, and the mainstem
2012†	7 mg/L TSS (to meet chronic aquatic life criterion)	
2015	DDT human health criteria to be met in fish and water	

*nephelometric turbidity units.
†target to be re-evaluated in 2007.

According to the schedule, the lower Yakima River mainstem was to be in compliance with the Washington State turbidity standard by 2002. Tributaries and irrigation returns to the lower river were expected to meet a turbidity target of 25 NTU by 2007. A strategy to further reduce DDT levels in the river and meet human health criteria was to be developed the same year. By 2012, the mainstem and tributaries are to comply with a 7 mg/L target for TSS, which correlated with meeting the chronic aquatic life criterion for total DDT, 1 ng/L. This target was scheduled to be re-evaluated in 2007. By 2015 the human health criteria for DDT compounds are to be achieved in fish and water.

Upper Yakima River Suspended Sediment and Organochlorine Pesticide TMDL

Ecology conducted a similar TMDL addressing suspended sediment and organochlorine pesticides in the upper Yakima River in 1999 (Joy, 2002; Creech and Joy, 2002). In this context, the upper river is the reach from the headwaters to r.m. 121.7, just above the confluence with the Naches River.

The major water quality impacts to the upper Yakima River are from Wilson Creek, which drains the Kittitas Valley. The TMDL schedule for the upper Yakima set goals for meeting DDT, dieldrin, and turbidity criteria in 2006 and 2011 (Table 6).

Table 6. Summary of Upper Yakima River TMDL Schedule.

Year	Target	Applies To
2006	DDT compounds and dieldrin to meet aquatic life criteria	Cherry Creek and Wipple Wasteway
	DDT compounds to meet human health criteria in fish fillets	Mainstem
	Monitor dieldrin in fish fillets to gauge progress toward meeting human health criteria	Mainstem
	90^{th} percentile turbidity ≤ 10 NTU over background	Mainstem (r.m. 121.7 – 139.8) and mouths of selected tributaries
2011	DDT compounds and dieldrin to meet human health criteria in water	Mouths of Cherry Creek and Wipple Wasteway
	Substantial progress made toward meeting human health target for dieldrin in fish fillets	Upper Yakima Basin
	90^{th} percentile turbidity ≤ 5 NTU over background	Mainstem (r.m. 121.7 – 139.8) and mouths of selected tributaries

2006 Yakima River Fish Tissue Survey

In view of the existing TMDL schedules and 2004 303(d) listings, Ecology surveyed chlorinated pesticide, PCB, and dioxin levels in resident fish species throughout the Yakima River in 2006 (Johnson et al., 2007). The objectives were to verify that human health criteria were not met (exceeded), assess progress toward the TMDL fish tissue targets, and help determine how to address the 303(d) listings. Fifty-six composite fillet samples and 30 composite whole fish samples were analyzed, representing approximately 300 individual fish.

Results for the chemicals of primary concern in the fish fillets are summarized in Table 7 and compared to the human health criteria for fish consumption used for 303(d) listing (from the EPA National Toxics Rule). Concentrations that exceeded criteria are highlighted in bold font. DDT, DDD, and endosulfan concentrations were low and did not approach criteria (data not shown). Most of the DDT residues have broken down to DDE. Chlorpyrifos was not analyzed due to limited potential for bioaccumulation. The complete edible tissue data from the fish tissue survey are in Appendix D.

There was a strong downstream trend in increasing concentrations of DDE, which is illustrated in Figure 5. Total PCB concentrations also increased going downstream, but the trend appeared less pronounced than seen for DDE (Figure 6). High concentrations of both DDE and PCBs were found in lower river carp, a species not encountered in the upper river. Dieldrin and toxaphene were primarily or exclusively detected in the lower river. Chlordane, alpha-BHC, and dioxin concentrations were low to undetectable in all areas.

Table 7. Mean Concentrations of Selected 303(d) Listed Compounds and Toxaphene in Composite Fillet Samples* from Yakima River Fish Collected in 2006 *(ug/Kg wet weight, parts per billion; except ng/Kg, parts per trillion, for dioxin).*

Reach	Species	N =	DDE	Dieldrin	Chlordane	Alpha-BHC	Total PCBs	Toxaphene	Dioxin†
Upper Yakima River									
Kachess Lake	Sucker	3	0.83	0.40 U	0.40 U	0.40 U	2.0 U	NA	0.030 UJ
	Pike Minnow	3	3.7	0.40 U	0.40 U	0.40 U	**16** J	NA	0.030 UJ
Keechelus Lake	Sucker	3	2.2	0.38 U	0.38 U	0.40 U	**13** J	NA	0.030
	Pike Minnow	2	2.6	0.40 U	0.40 U	0.40 U	**17** J	NA	0.030 UJ
	Kokanee	3	2.2	0.40 UJ	0.70 J	0.40 U	**15** J	NA	0.030 UJ
	Cutthroat	3	0.61	0.39 U	0.23 J	0.40 U	**5.6** J	2.0 U	0.030 UJ
	Whitefish	2	0.73	0.39 U	0.39 U	0.40 U	**9.6** J	NA	0.030 UJ
Cle Elum	Sucker	2	7.1	0.39 U	0.41 J	0.40 U	**9.5** J	5.0 U	0.030 UJ
	Pike Minnow	3	11	0.39 U	0.57 J	0.40 U	4.9 J	5.0 U	0.030 UJ
	Whitefish	3	10	0.40 UJ	2.0 J	0.40 U	**16**	2.0 U	**0.15**
Yakima Canyon	Sucker	3	12	**0.93**	1.1 J	0.40 U	**9.4** J	5.0 U	0.030 UJ
	Pike Minnow	3	31	**0.77**	2.3 J	0.40 U	**24**	2.0 U	0.030 UJ
	Whitefish	3	**34**	0.35 J	2.9 J	0.40 U	**24**	2.0 U	0.030 UJ
Lower Yakima River									
Toppenish	Sucker	3	**63**	**0.99** J	0.59 J	0.40 U	**13**	5.0 U	0.03 UJ
	Pike Minnow	3	**113**	**0.81**	0.74 J	0.40 U	**16**	7.0	0.03 UJ
	Whitefish	3	**100**	**1.3** J	2.0 J	0.40 U	**28**	**11**	**0.24**
Prosser	Sucker	3	**100**	**2.3** J	0.68 J	0.39 U	**16** J	**14** J	0.03 J
	Smallmouth Bass	2	**38**	**0.74** J	0.39 U	0.39 U	4.0 J	8.4 J	0.03 UJ
	Carp	3	**500**	0.59 J	**10**	0.39 U	**88**	**56** J	0.03 UJ
Horn Rapids	Sucker	3	**82**	**0.95**	1.8 J	0.40 U	**34**	**10** J	0.03 UJ
	Pike Minnow	3	**78**	**2.7** J	0.56 U	0.40 U	**7.9** J	**17** J	**0.10** J
	Smallmouth Bass	3	**54**	**0.79**	0.99 U	0.39 U	**18**	1.9 U	0.03 UJ
	Carp	3	**520**	**1.3** J	5.3 J	0.40 U	**96**	**55** J	0.03 UJ
303(d) Human Health Criteria			32	0.65	8.0	0.51	5.3	9.6	0.07

Bold values exceed human health criteria. U = not detected. J = estimated value. UJ = not detected; detection limit is an estimate. NA = not analyzed.
*4-5 fish per composite, except 8-15 for dioxin. †Dioxin analyzed in one composite per species per location.

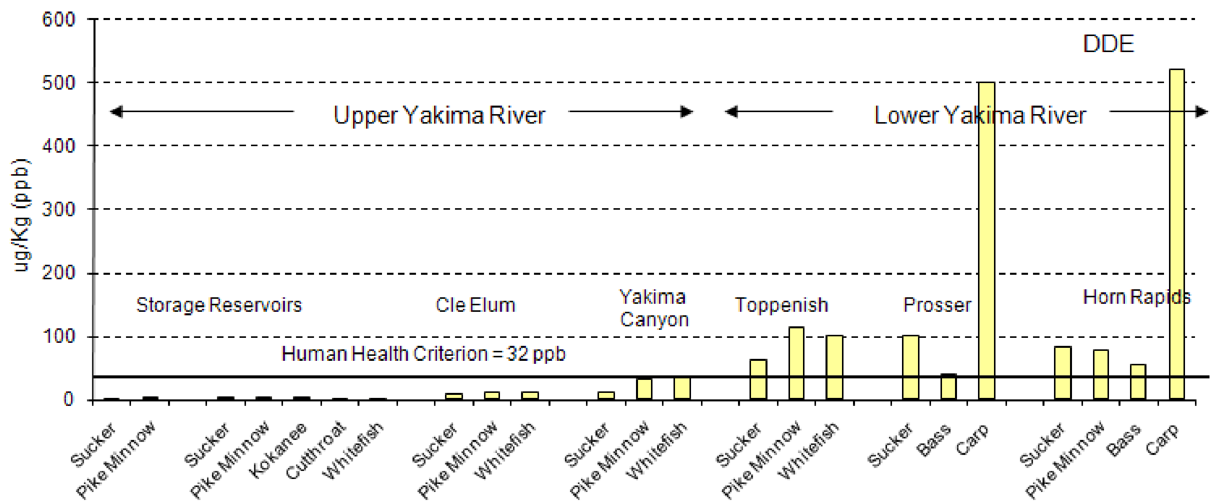

Figure 5. Mean DDE Concentrations in Yakima River Fish Fillets Collected in 2006 *(parts per billion, wet weight).*

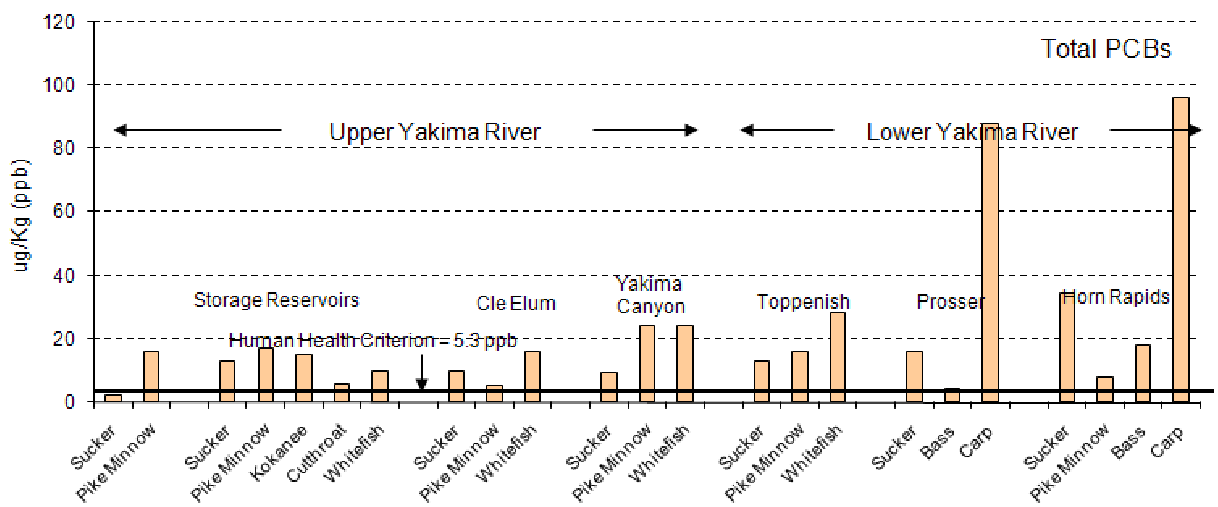

Figure 6. Mean Total PCB Concentrations in Yakima River Fish Fillets Collected in 2006 *(parts per billion, wet weight).*

Overall, results of the 2006 fish tissue survey demonstrated the following:

- Upper Yakima River fish are meeting or very close to meeting human health criteria for DDT, DDE, DDD, dieldrin, chlordane, alpha-BHC, endosulfan, toxaphene, and dioxin.
- PCBs exceed human health criteria in the Keechelus and Kachess storage reservoirs and throughout the Yakima River, with slightly to substantially higher levels in the lower river, depending on species and location.
- Most lower Yakima River fish species exceed human health criteria by factors of 2 to 4 for DDE and dieldrin, and factors of 2 to 6 for PCBs. Carp are more contaminated than other lower river species. This is likely due to their greater fat content and age of the fish analyzed.
- Chlordane, alpha-BHC, and endosulfan are meeting human health criteria in lower river fish, except for carp which marginally exceed the chlordane criterion in the Prosser area.
- Dioxin levels are low throughout the river, slightly exceeding human health criteria in a few cases.
- Some lower river fish species exceed human health criteria for toxaphene. Toxaphene, a legacy chlorinated pesticide, is difficult to analyze and has probably been under-reported in the past.

Based on these findings, Ecology concluded that the TMDL effort to address the current Yakima River 303(d) listings should focus on pesticides and PCBs in the lower Yakima River, but include some PCB and toxaphene work in the upper river as well. A one-year field study was initiated in 2007 to obtain water quality data on these chemicals.

In view of the low dioxin concentrations in Yakima River fish and due to budget constraints, dioxin was not analyzed in the water quality study. Ecology plans to address dioxins on a larger scale (possibly region- or state-wide) in the future. Additionally, because dioxins are often carried via air and can pollute sizeable areas not necessarily limited to watersheds, a larger TMDL footprint will likely be more effective and efficient.

Goals and Objectives of the 2007-08 Water Quality Study

Goals

The water quality study was conducted to aid in developing a *Pesticides and PCBs TMDL* for the Yakima River. The goals of the study were to:

1. Identify current sources and quantify loadings of 303(d) listed pesticides, PCBs, toxaphene, suspended sediment, and turbidity to the Yakima River.
2. Recommend numeric water quality targets that will result in the Yakima River and its tributaries and irrigation returns meeting Washington State water quality standards for the pollutants of concern.
3. Determine the Yakima River's loading capacity for these pollutants.
4. Compare existing water quality conditions to targets set by the *Upper Yakima River Suspended Sediment and Organochlorine Pesticide TMDL* and the *Lower Yakima River Suspended Sediment and DDT TMDL*.

Objectives

Specific objectives of the water quality study were to:

1. Monitor 303(d) listed pesticides, suspended sediment, and turbidity in the lower Yakima River, Naches River, and major lower river irrigation returns.
2. Obtain screening-level data on 303(d) listed pesticides, suspended sediment, and turbidity in other lower Yakima River tributaries and returns.
3. Estimate background concentrations of PCBs and toxaphene in the upper and lower Yakima River and identify source areas.
4. Investigate municipal wastewater treatment plant effluent as a potential source of 303(d) listed pesticides and PCBs.
5. Determine if wastewater from fruit packers and vegetable processors is a source of 303(d) listed pesticides.
6. Characterize 303(d) listed pesticide, PCB, suspended sediment, and turbidity levels in urban stormwater runoff.

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Study Design

The water quality study area included the Yakima River and selected tributaries and irrigation returns from Easton (r.m. 202.5) to the Columbia River confluence. Most of the effort was concentrated in the lower Yakima River due to the greater number of 303(d) listings and because a TMDL for suspended sediment and chlorinated pesticides had already been approved for the upper Yakima River. Table 8 gives an overview of the sampling design, showing the types of samples collected, general locations, sampling frequency, and how the samples were analyzed.

Field work was initiated in April 2007 and completed in June 2008. Over 400 surface water and wastewater samples were collected. The samples were analyzed for all chlorinated pesticides and PCBs that have been reported in water, fish, or sediment samples from the Yakima River drainage. The chlorinated pesticide analysis was expanded to include chlorpyrifos, an organophosphorus insecticide. Suspended sediment (measured as total suspended solids) and turbidity were analyzed in all samples.

The study was conducted by the Ecology Environmental Assessment Program and Central Regional Office (CRO) Yakima River TMDL Team. Samples were analyzed by the Ecology Manchester Environmental Laboratory or an accredited laboratory selected by Manchester. The study followed a Quality Assurance Project Plan (Johnson, 2007a) prepared according to the Ecology guidance in Lombard and Kirchmer (2004).

Table 8. Summary of Sampling Design for the 2007-08 Water Quality Study.

Task	Lower River	Upper River	Location (Number of Sites)	Frequency	Pesticides	PCBs	Susp. Sediment	Turbidity	Conductivity	Organic Carbon
Surface Water										
Routine Monitoring	x		Mainstem (4) Naches R. (1) Returns (4)	1-2 per Month	✓		✓	✓	✓	
Screening Survey	x		Other Tributaries and Returns (23)	Quarterly	✓		✓	✓	✓	
SPMD Deployments†	x	x	Mainstem (6) Naches R. (1) Returns (5)	Twice	✓	✓	✓	✓	✓	✓
Permitted Discharges										
Wastewater Treatment Plants	x	x	Cle Elum to West Richland (18)	Quarterly	✓*	✓	✓	✓	✓	
Fruit & Vegetable Processors	x		Selah, Yakima, Sunnyside, Prosser (6)	Quarterly	✓		✓	✓	✓	
Urban Stormwater Runoff	x	x	Yakima (5) Ellensburg (4)	4-6 Storms	✓*	✓	✓	✓	✓	

* Pesticides not analyzed for upper river effluent or stormwater samples.
†Semipermeable Membrane Device: a passive sampler used in this study for detecting PCBs and toxaphene.

Surface Water

Pesticides, Suspended Sediment, and Turbidity

A two-tiered approach was used for measuring 303(d) pesticides, suspended sediment, and turbidity levels in surface waters of the lower Yakima River. Routine monitoring was conducted at mainstem stations, tributaries, and irrigation returns that were the focus of monitoring efforts for the earlier *Suspended Sediment and DDT TMDL*. A more limited screening survey was conducted for other tributaries and returns deemed to have potential for contamination. Due to the high cost of detecting PCBs and toxaphene in whole water samples, these compounds were addressed in a separate effort (see *PCBs and Toxaphene*, page 36).

Routine Monitoring

Four mainstem stations, the Naches River, and four major irrigation returns to the lower Yakima River were monitored intensively, twice a month during the irrigation season (April – October 2007 samples) and monthly during the winter (November 2007 – March 2008 samples). Table 9 lists the monitoring sites. Sampling locations are shown in Figure 7.

Table 9. Routine Monitoring Stations in the Lower Yakima River Drainage during 2007-08.

Name and Location	River Mile	Bank*
Yakima River at Harrison Bridge	121.7	- -
Naches River at mouth	116.3	RB
Moxee Drain at Birchfield Road	107.3	LB
Yakima River at Parker Bridge	104.6	- -
Granger Drain at sheep barns in Granger	82.8	LB
Sulphur Creek Wasteway at Holaday Road	61.0	LB
Yakima River at Euclid Bridge	55.0	--
Spring Creek near mouth	41.8	LB
Yakima River at Kiona-Benton City Bridge	29.8	--

*signifies a right or left bank tributary, as seen facing downstream.

The Yakima River at Harrison Bridge and the Naches River represent background water quality conditions for the lower Yakima. The Naches River supplies fairly high-quality water to the irrigation system and has relatively few point sources. The Naches is the larger source of water to the lower Yakima River during the September - October *flip-flop* when flows in the upper Yakima are reduced to prevent de-watering of salmon redds (nests). The mainstem Yakima River stations at Harrison, Parker, Euclid, and Kiona bracket the major irrigation returns and urban centers.

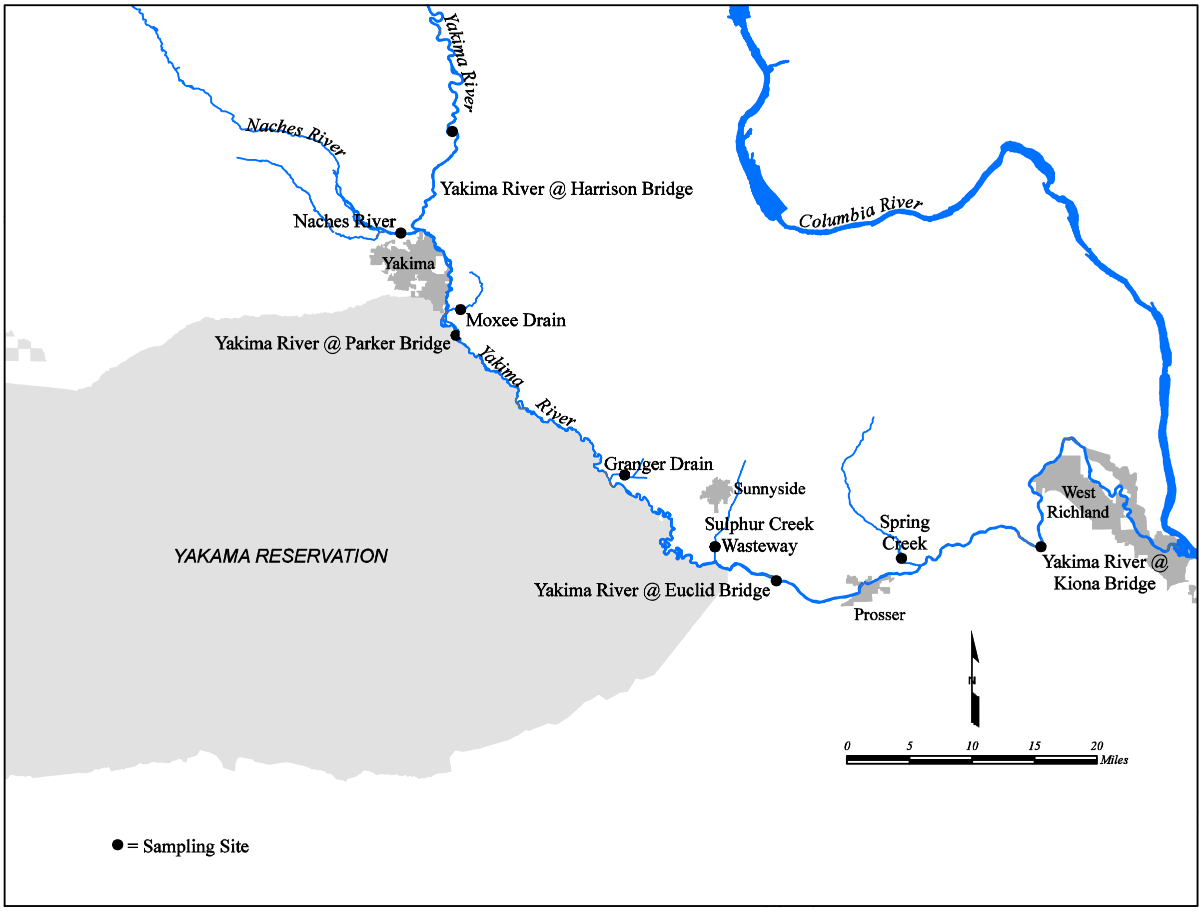

Figure 7. Routine Monitoring Stations in the Lower Yakima River for 2007-08.

The four irrigation returns monitored – Moxee Drain, Granger Drain, Sulphur Creek Wasteway, and Spring Creek – were selected in the previous TMDL as representative of irrigation return water that enters the lower Yakima River. They are specifically identified as priority returns in the TMDL five-year targets. Snipes Creek, also on the 303(d) list, is a tributary to Spring Creek.

The routine monitoring effort provided 14 sets of results for the irrigation season and five sets of results for the non-irrigation season. Extra weight was given to the irrigation season because pesticides are most frequently detected during this period. The previous TMDLs had concluded that the irrigation season was the "critical period." An extra set of samples was collected from the four returns in late March at the start of the 2008 irrigation season.

Screening Survey

Numerous other tributaries and irrigation returns enter the lower Yakima River but have either never been sampled for pesticides or the samples have not been analyzed down to human health criteria levels. Twenty-three of these discharges were sampled on a quarterly basis for the present study, starting in May 2007 and ending in February 2008 (Table 10). Figure 8 shows their locations. This screening survey provided two sets of results each for the irrigation and non-irrigation seasons.

Table 10. Lower Yakima River Tributaries and Irrigation Returns Screened for Pesticides during 2007-08.

Name and Location	River Mile	Bank*
Selah Creek at Canyon Road	123.7	LB
Wenas Creek at Wenas Road	122.4	RB
Selah Ditch at confluence with Taylor Ditch	117.1	RB
Taylor Ditch at confluence with Selah Ditch	117.1	RB
Cowiche Creek (Naches tributary) at Powerhouse Road	- -	- -
Wide Hollow Creek at Main Street	107.4	RB
Ahtanum Creek at Fullbright Park†	106.9	RB
Zillah Drain at 1st Street, Zillah (Joint Drain 14.6)	~89	LB
East Toppenish Drain at Annahat & Blue Heron Road†	86.0	RB
Subdrain 35 at Connie Road†	83.2	RB
Marion Drain at Indian Church Road†	82.6	RB
Toppenish Creek at Indian Church Road†	80.4	RB
Coulee Drain at Satus Longhouse Road†	77.0	RB
Satus Creek at Satus Longhouse Road†	60.2	RB
South Drain at Highway 22†	69.3	RB
DID #7 at Green Valley Road	65.1	LB
Satus Drain #302 at Highway 22†	60.2	RB
Satus Drain #303 at Highway 22†	~60	RB
Drain #31 at Sunnyside-Mabton Highway	58.0	LB
Grandview Drain at Chase Road	55.8	LB
Wauna Ditch (Drain 52.8) at Wamba Road	47.2	LB
Corral Canyon Creek at Old Inland Empire Highway	33.5	LB
Amon Creek Wasteway near mouth	2.1	RB

*signifies a right or left bank tributary, as seen facing downstream.
†Yakama Reservation.

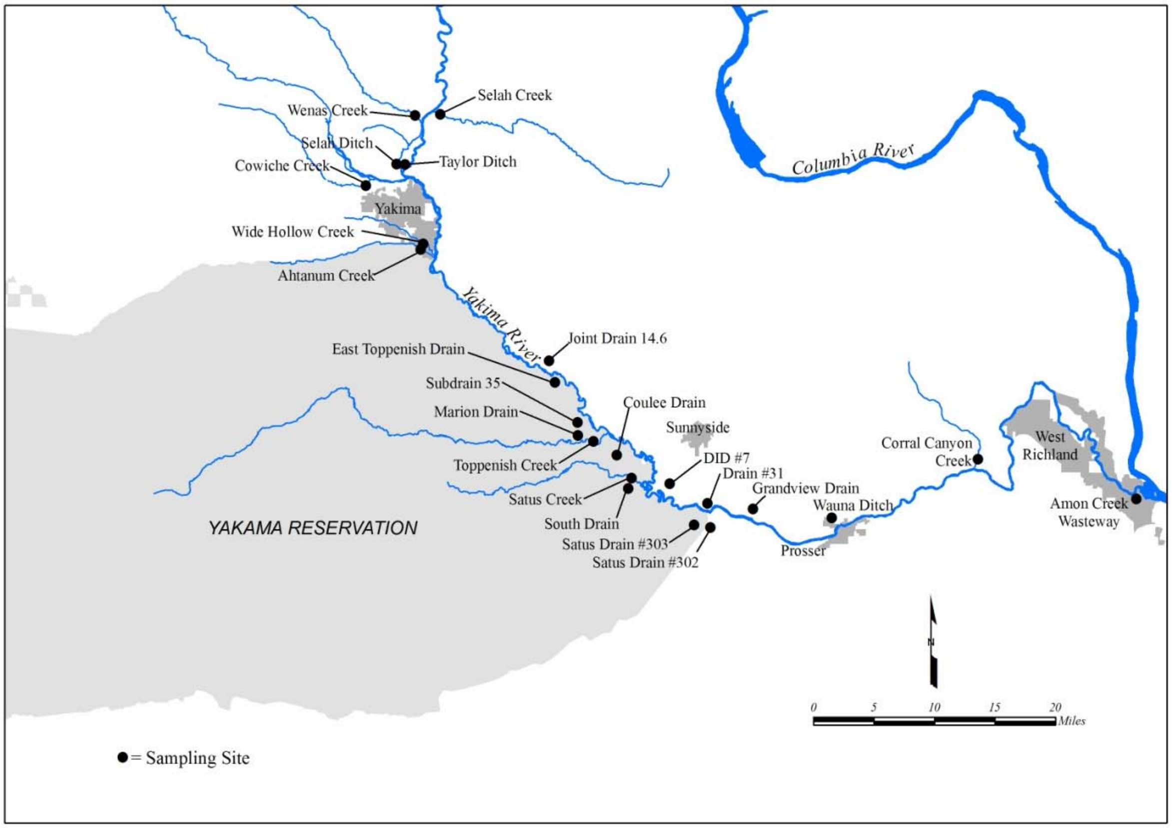

Figure 8. Lower Yakima River Tributaries and Irrigation Returns Screened for Pesticides during 2007-08.

A large number of tributaries and returns were screened to avoid overlooking significant sources of contamination. The sites selected for sampling were recommended by Joe Joy, Ecology's lead investigator for the previous TMDL; the CRO Yakima River TMDL Team; and Marie Zuroske of the South Yakima Conservation District. Two of the creeks – Cowiche and Wide Hollow – are currently 303(d) listed for several pesticides. The same parameters were analyzed in the screening survey as in the routine monitoring effort. Ecology obtained permission to collect samples from tributaries and returns on the Yakama Reservation.

Sample Collection and Analysis

Routine monitoring and screening survey samples were analyzed for pesticides at detection limits of sub-parts per trillion, much lower than in previous Yakima River studies. The depth-integrating samplers often used in the past are not designed for low-level analyses. They are difficult to clean adequately and have an increased chance of introducing contamination in an agricultural setting. The surface water pesticide samples for the present study were composites from quarter-point transects collected directly into appropriately cleaned glass bottles.

The bottles were raised and lowered through the water column to approximate the width-depth integrated method, either by hand or by placing a sample bottle in a weighted holder. This same technique is being used by Ecology to monitor current-use pesticides in lower Yakima River irrigation returns (Burke et al., 2006). Suspended sediment and turbidity samples were collected using these same procedures, except for routine monitoring samples during the irrigation season (see Effectiveness Monitoring below).

Studies conducted in the Yakima River have shown that both sampling techniques produce similar results. Hallock (2005) compared TSS, turbidity, and other water quality data obtained for the Yakima River at Kiona using Ecology collected single-point surface grabs vs. USGS collected width-depth integrated samples. Only sediment measures were significantly different overall, and even for this constituent the difference was small. Hallock pointed out that some of the difference in sediment results was attributable to the analytical method. The SSC analysis method used by USGS yields significantly higher results than the TSS method used by Ecology, even when collection methods are the same.

A similar comparison was conducted for a range of sites sampled during the *Lower Yakima River Suspended Sediment and DDT TMDL.* There were no significant differences between TSS or other results from simple grabs and integrated samples (Joy and Patterson, 1997).

The routine and screening survey samples from 2007-08 were analyzed for 303(d) pesticides, TSS, turbidity, and conductivity. To differentiate between suspended matter derived from plant material vs. other sources, a total non-volatile suspended solids (TNVSS) analysis was included.

Pesticides analysis was by gas chromatography/electron capture detection (GC/ECD). A large volume injection (LVI) technique was used to achieve low detection limits for comparison with human health criteria. Target compounds for pesticide analysis of surface water are listed in Appendix E.

Effectiveness Monitoring

The routine monitoring task also provided data for effectiveness monitoring that was required in 2007 by the current TMDLs. The objective of effectiveness monitoring is to determine if Best Management Practices (BMPs) implemented in response to the TMDL are achieving the required water quality improvements. Effectiveness monitoring for the *Lower Yakima River Suspended Sediment and DDT TMDL* was first conducted in 2003 and consisted of twice-a-month samples for TSS and turbidity throughout the irrigation season in the mainstem and priority irrigation returns (Coffin et al., 2006). A similar set of samples was collected in 2007. A depth-integrating sampler was used to be consistent with 2003 procedures.

The schedule for the *Upper Yakima River Suspended Sediment and Organochlorine Pesticide TMDL* called for effectiveness monitoring during the 2006 irrigation season. Suspended sediment and chlorinated pesticide inputs from the Wilson Creek drainage are the focus of that effort. The Kittitas County Water Purveyors, Kittitas County Conservation District, and Ecology conducted the required suspended sediment and turbidity monitoring in 2006 (Anderson, 2008), but postponed pesticide monitoring to 2007. These pesticide samples were collected during field work for the present study and employed the same methods as in the lower river (Coffin and Johnson, 2007).

Ecology's Freshwater Monitoring Unit (FMU) conducted the 2007 effectiveness monitoring while assisting with the routine monitoring task. All of the data from the 2007 irrigation season that apply to effectiveness monitoring can be found in Appendix J. Reports evaluating the effectiveness of the existing TMDLs will be prepared separately by Ecology's EAP Eastern Operations Section and CRO Yakima River TMDL Team.

PCBs and Toxaphene

PCBs and toxaphene are complex mixtures of hundreds of individual compounds which are difficult and expensive to analyze at low levels. The project budget did not allow enough water samples to be analyzed to give representative results for surface water. Although toxaphene was analyzed in the routine monitoring and screening survey samples, detection limits were high. Therefore, a passive sampling technique using a semipermeable membrane device (SPMD) was employed to provide estimates of PCB and toxaphene concentrations in surface water.

A SPMD is composed of a thin-walled, layflat polyethylene tube filled with triolein, a neutral lipid material (Figure 9). When placed in water, dissolved lipophilic (fat soluble) compounds like PCBs and toxaphene diffuse through the membrane and are concentrated over time. The large chemical residues accumulated in a SPMD translate into detection limits down to parts per quadrillion in water. Because SPMDs measure the long-term average concentration of a chemical, random fluctuations are smoothed and representativeness of the data improved. Studies have shown that chemical concentrations derived from SPMDs are comparable to other more complex low-level sampling methods such as solid-phase and liquid-liquid extraction, generally agreeing within a factor of 2 (Ellis et al., 1995; Rantalainen et al., 1998; Hyne et al., 2004).

Figure 9. SPMD Membrane Mounted on a Spider Carrier.

SPMDs were developed by the USGS Columbia Environmental Research Center, Columbia, Missouri and are now of standardized design, patented, and commercially available through Environmental Sampling Technologies (EST), St. Joseph, Missouri, (www.est-lab.com/index.php). Details of SPMD theory, construction, and applications can be found at wwwaux.cerc.cr.usgs.gov/spmd/index.htm and in Huckins et al. (2006).

Locations where SPMDs were used in the Yakima River are shown in Table 11. The samplers were deployed in both the upper and lower river because PCBs exceeded human health criteria in both areas.

Table 11. Sites Where SPMDs Were Deployed in the Yakima River Drainage during 2007.

Name and Location	River Mile	Bank*
Yakima River at Easton Diversion Dam	202.5	- -
Yakima River above Ellensburg†	160.6	- -
Wilson Creek near mouth	147.0	LB
Yakima River at Roza Dam	127.9	- -
Naches River at mouth	116.3	RB
Moxee Drain at Birchfield Road	107.3	LB
Yakima River at Sunnyside Diversion Dam	103.8	- -
Granger Drain at sheep barns in Granger	82.8	LB
Sulphur Creek Wasteway at Holaday Road	61.0	LB
Yakima River at Prosser Diversion Dam	47.2	--
Spring Creek near mouth	41.8	LB
Yakima River at Horn Rapids Diversion Dam	18.0	--

*signifies a right or left bank tributary, as seen facing downstream.
†Ellensburg Water Company Diversion

SPMDs were placed at three upper river sites (Figure 10). The Easton Diversion Dam site below Keechelus Lake and Kachess Lake was intended to provide an estimate of the PCB and toxaphene background in the upper mainstem. The other two upper river SPMDs were placed in a mainstem diversion above Ellensburg (Ellensburg Water Company diversion) and at the mouth of Wilson Creek. Wilson Creek drains the Ellensburg area and Kittitas Valley. This is the most developed urban/agricultural area in the upper river and, thus, has the greatest potential to be a source of contamination.

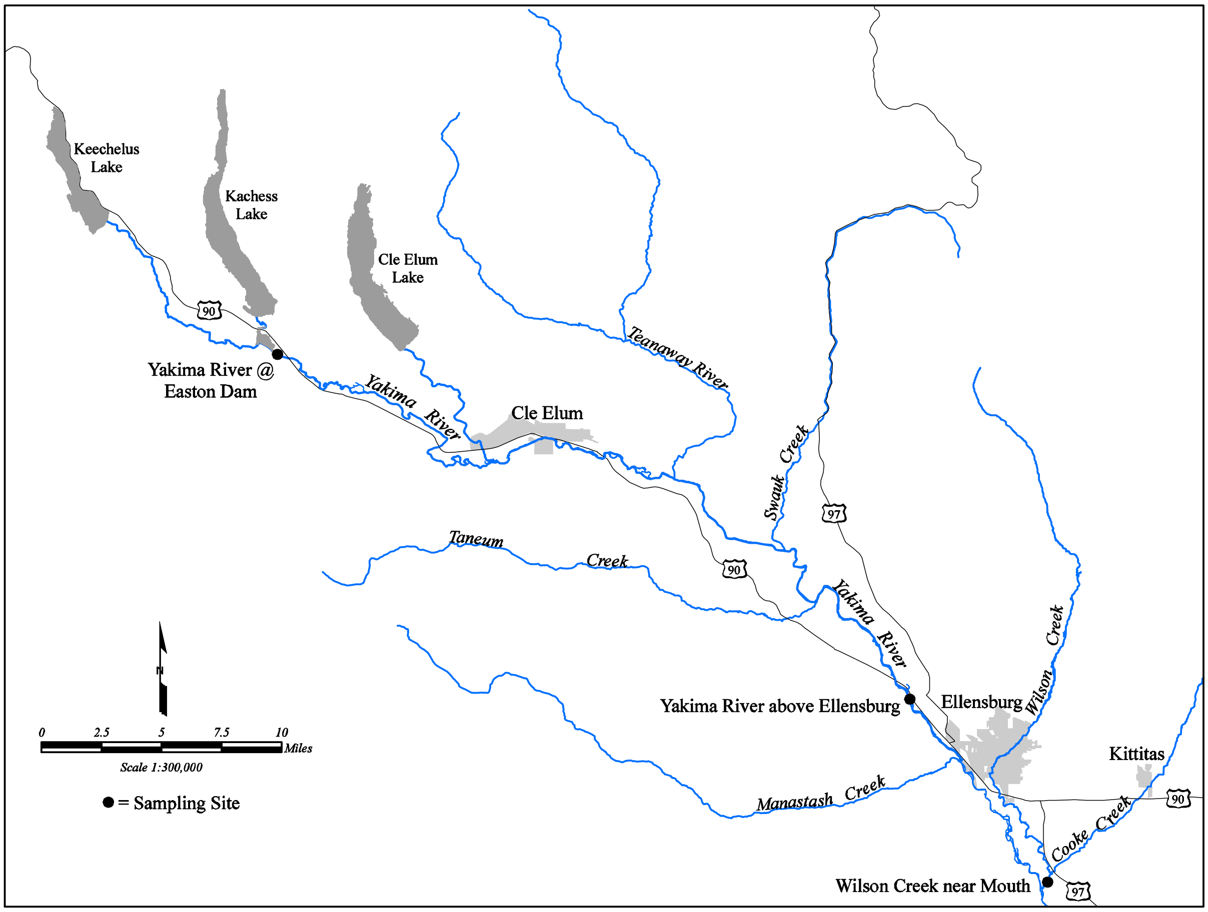

Figure 10. Sites Where SPMDs Were Deployed in the Upper Yakima River during 2007.

The lower river SPMD sites were the same as or close to the routine monitoring stations (Figure 11). SPMDs were deployed at the Roza, Sunnyside, Prosser, and Horn Rapids diversion dams rather than the Harrison, Parker, Euclid, and Kiona bridges, because these were not secure locations to leave the samplers. In all cases, the SPMDs were placed above the dams.

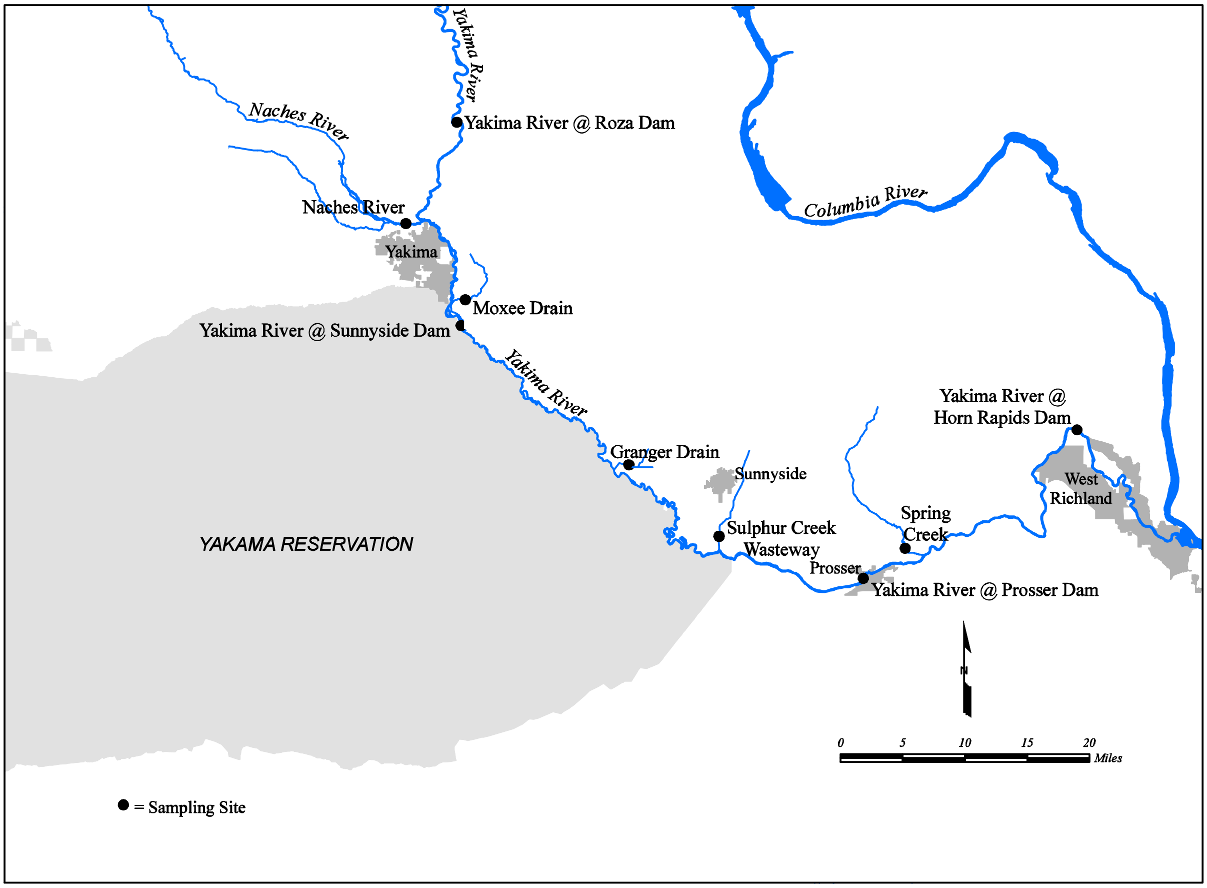

Figure 11. Sites Where SPMDs Were Deployed in the Lower Yakima River during 2007.

SPMDs were deployed during the first part of the 2007 irrigation season (approximately May 8 – June 5) and again after the end of the irrigation season (approximately October 30 – November 26). Figure 12 shows the flow regime during these periods. The May-June deployment occurred while flows were decreasing in the Yakima River and increasing or near maximum in the tributaries and returns. The reverse was true during October-November after irrigation water had been turned off.

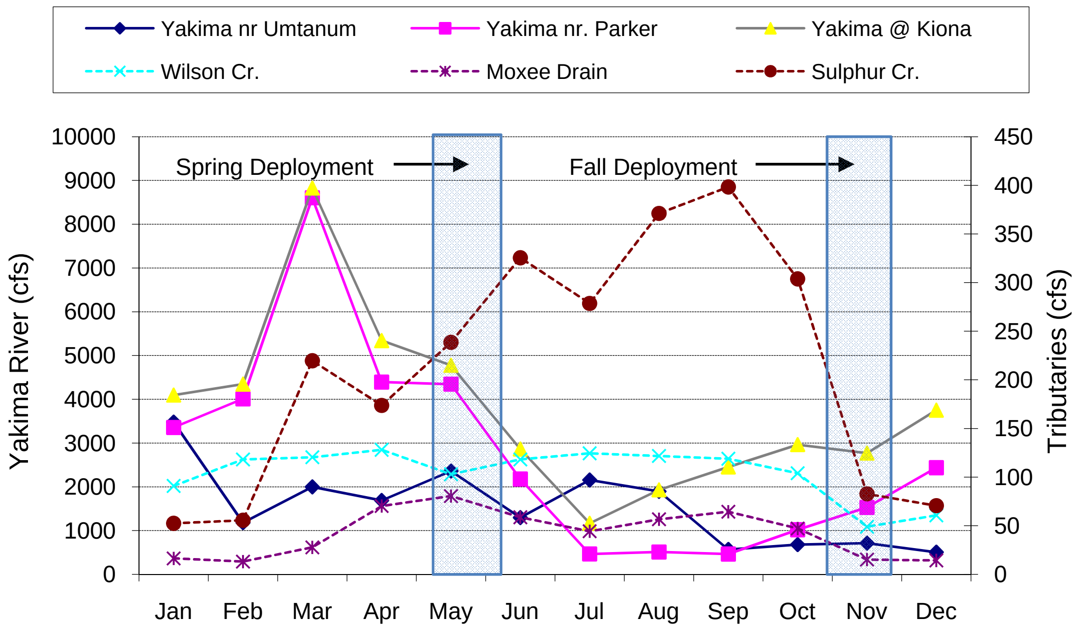

Figure 12. Monthly Average Flow near Selected SPMD Sites during 2007.
(USBR Yakima Hydromet data www.usbr.gov/pn/hydromet/yakima*)*

Each deployment lasted approximately one month. Water samples were taken at the beginning, middle, and end of each deployment and analyzed for total and dissolved organic carbon (TOC and DOC). The organic carbon data were used to calculate total water column concentrations for the chemicals of interest. Start and end dates for each site are in Appendix F. The ancillary water quality data are in Appendix G.

The Wilson Creek SPMD extract for PCB analysis from May-June 2007 was lost in a laboratory accident and re-deployed in 2008 during the same time period. Toxaphene analysis was not affected. A review of water quality data for Wilson Creek, provided by the Kittitas County Water Purveyors, showed slightly higher turbidity during the 2008 deployment, averaging 21 NTU vs. 15 NTU in 2007 (N= 4-5; Kathleen Satnik personal communication). Discharge compared closely between the two periods, averaging 545 vs. 556 cfs.

The SPMDs extracts were analyzed for PCBs using high resolution gas chromatography/mass spectrometry (HRGC/MS) to achieve low detection limits. Toxaphene was analyzed by GC/ECD. The methods used to derive water column concentrations from the PCB and toxaphene residues accumulated in the SPMDs are described in Appendix H.

Permitted Discharges

One of the mechanisms for achieving goals of the Clean Water Act is the National Pollutant Discharge Elimination System (NPDES). EPA has authorized Washington State to administer the NPDES permit program in Washington. Chapter 90.48 RCW defines Ecology's authority and obligations in issuing wastewater discharge permits. An NPDES permit must be issued before discharge of wastewater to waters of the state is allowed. The permits establish effluent limits, monitoring schedules, and other requirements.

Three types of municipal/industrial wastewater discharges that come under NPDES are potential sources of pesticides and PCBs to the Yakima River: municipal wastewater treatment plants, fruit packers and vegetable processors, and urban stormwater runoff.

Municipal Wastewater Treatment Plants

Wastewater treatment plant (WWTP) effluent is not often analyzed for pesticides or PCBs at levels approaching human health criteria. In the several instances where this has been done in other parts of Eastern Washington, results have shown water quality criteria are often not met (exceeded) for PCBs, but infrequently or not substantially exceeded for pesticides (e.g., Lubliner, 2009; Johnson et al., 2004; Serdar, 2003).

In August 1999, USGS analyzed pesticides and PCBs in seven municipal WWTPs that discharge to the Yakima River between Cle Elum and Prosser (Ebbert and Embrey, 2002). Except for trace amounts of lindane, chlorinated pesticides were not found at detection limits down to 1-4 ng/L (parts per trillion). PCBs were not detected at or above 100 ng/L. The human health criteria are considerably lower than the levels analyzed: <1 ng/L for most pesticides and 0.17 ng/L for PCBs.

Twenty-one[c] municipal WWTPs currently discharge to the Yakima River or its tributaries (Table 12, Figure 13). Final effluents from 18 of these facilities were monitored on a quarterly basis for the 2007-08 water quality study. The three remaining WWTPs — Wapato, Harrah, and Toppenish — are on the Yakama Reservation and under EPA jurisdiction. These facilities were not sampled.

The effluent samples were collected as composites taken over a two-day period. Effluent data obtained by Ecology at other WWTPs have shown little variation in PCB concentrations over two days (Golding, 2002). Each composite consisted of four grabs: two in the morning and two in the afternoon. Effluent flow is greater in the morning, but the effluent is more concentrated in the afternoon. The grabs were hand collected to avoid contamination that could occur with an automatic sampler.

[c] Moxee WWTP ceased operating on June 26, 2008; the wastewater now goes to the Yakima WWTP.

Table 12. Wastewater Treatment Plants in the Yakima Basin.

Permit No.	Facility Name	NPDES Permit Expires	Receiving Water	Average Flow Maximum Month (MGD)
Upper Yakima River				
WA002193-8	Cle Elum	31-Aug-11	Yakima River at ~ r.m. 183	3.6
WA-002125-3	Kittitas	29-Feb-12	Cooke Creek to Wilson Creek	0.45
WA-002434-1	Ellensburg	30-Nov-10	Yakima River at r.m. 151.6	8.0
Lower Yakima River				
WA0021032C	Selah	29-Feb-12	Selah Ditch to Yakima R. at r.m. 117.1	2.0
WA0022586C	Naches	30-Nov-12	Naches River	0.17
WA0052396A	Cowiche	31-Mar-13	North Fork Cowiche Creek	0.44
WA0024023C	Yakima	30-Jun-11	Yakima River at r.m. 110.1	21.5
WA0022501C	Moxee†	31-Oct-07	DID #11 to Moxee Drain	0.15
WA0050229	Wapato*	31-Mar-10	Drainage Way #2 to Yakima River	NA
WA0052132C	Buena	31-Aug-11	Unnamed trib to Yakima R. at r.m. 91.7	0.12
WA0022705	Harrah*	30-Sep-11	Harah Drain to Yakima River	0.055
WA0020168C	Zillah	31-Oct-11	Yakima River at r.m. 89.5	0.49
WA0026123	Toppenish*	25-Nov-08	Toppenish Drain to Yakima River	1.9
WA0022691C	Granger	31-Oct-13	Yakima River at r.m. 82.8	0.32
WA0020991C	Sunnyside	30-Sep-13	Sulphur Cr. via Tributary	3.0
WA0052426A	Port of Sunnyside**	28-Feb-10	Joint Control Drain 33.4 to Sulphur Cr.	0.55
WA0020648C	Mabton	30-Apr-12	Yakima River at r.m. 59.7	0.19
WA0052205B	Grandview	30-Nov-08	Yakima River at r.m. 55.2	5.0
WA0020800D	Prosser	31-Oct-11	Yakima River at r.m. 46.5	1.8
WA0051349C	Benton City††	30-Nov-13	Yakima River ~r.m. 19	0.32
WA0051063C	West Richland	31-Oct-12	Yakima River ~r.m. 9	0.75

*Yakama Indian Reservation; not sampled for present study.
†ceased operating in June 2008.
**can land apply February through October.
††discharges to Yakima River only during cold weather months.

MGD = million gallons per day.
NA = not available.

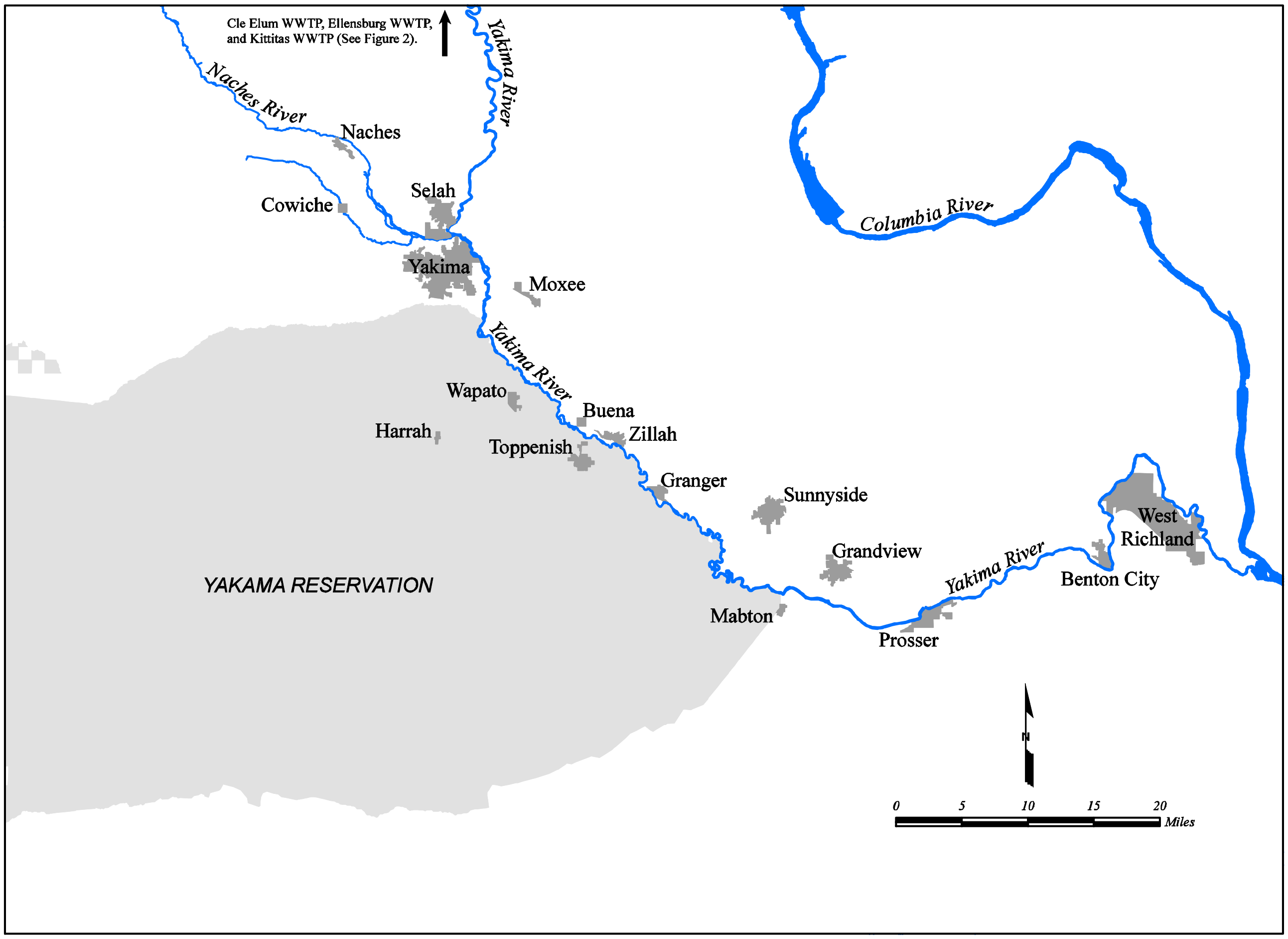

Figure 13. Wastewater Treatment Plants in the Lower Yakima River Basin.

The LVI procedure used for pesticides in surface water works poorly on WWTP effluent due to the presence of numerous interfering substances. Therefore, pesticides were analyzed in the effluent samples using solid phase extraction (SPE), a less sensitive technique. Reporting limits were approximately 2-5 ng/L for 303(d) pesticides and approximately 25 ng/L for toxaphene, higher than some of the water quality criteria. As a result, this effort constitutes a screening-level assessment of 303(d) pesticides and toxaphene in WWTP discharges to the Yakima River.

Because data from other WWTPs suggest PCBs are a greater concern than pesticides, PCBs were analyzed by HRGC/MS to achieve detection limits consistent with the human health criteria. Effluent samples from the Cle Elum, Ellensburg, and Kittitas WWTPs were not analyzed for pesticides, since a TMDL has already been established for these compounds in the upper Yakima River,

Target compounds for WWTP effluent are listed in Appendix I. Ancillary parameters included TSS, turbidity, and conductivity. Flow data were obtained from WWTP records.

Fruit Packers and Vegetable Processors

Process water discharged from fruit packers and vegetable processors is a potential link between agricultural land that harbors pesticide residues and the Yakima River. Dust and soils that may contain pesticides are washed or otherwise removed from fruits, vegetables, and transport containers during processing and washed into wastewater systems. DDT, for example, has been detected in process water at fruit packing facilities in the Okanogan area (Gary Struthers Associates, 2005)

Of the many fruit packers and vegetable processors in the lower Yakima Valley, only six discharge directly to surface waters (Table 13, Figure 14). This excludes those which discharge non-contact cooling water. All other facilities route their effluent to WWTPs or land apply.

Process water from the six facilities listed below was collected quarterly using the same techniques as for the WWTPs. The samples were analyzed for pesticides (Appendix E), TSS, turbidity, and conductivity. Because of the increased potential for pesticides being present in these effluents, the samples were analyzed by LVI to achieve low detection limits. These types of facilities are not known to be PCB sources. Therefore, PCBs were not analyzed. Flow data were obtained from each facility.

Table 13. Fruit Packers and Vegetable Processors Monitored during 2007-08.

Permit No.	Company / Facility Name	Location	Receiving Water
WAG 43-5126	Zirkle Fruit / Harrison Plant	Selah	Ditch to Taylor Ditch to Yakima River
WAG 43-5160	Apple King LLC / Apple King Facility		Gleed Ditch to Naches River
WAG 43-5074	Gilbert Orchards	Yakima	Ditch to Stock Watering Pond
WA-000056-6	Snokist Growers / Terrace Heights Cannery		Yakima River at r.m. 113.0
WAG 43-5054	Andrus & Roberts Produce	Sunnyside	SVID Ditch to Yakima River
WA-002175-0	ConAgra Foods – Lamb Weston*	Prosser	Yakima River at r.m. 47.0

*Scheduled to close in May 2010; formerly Twin City Foods.

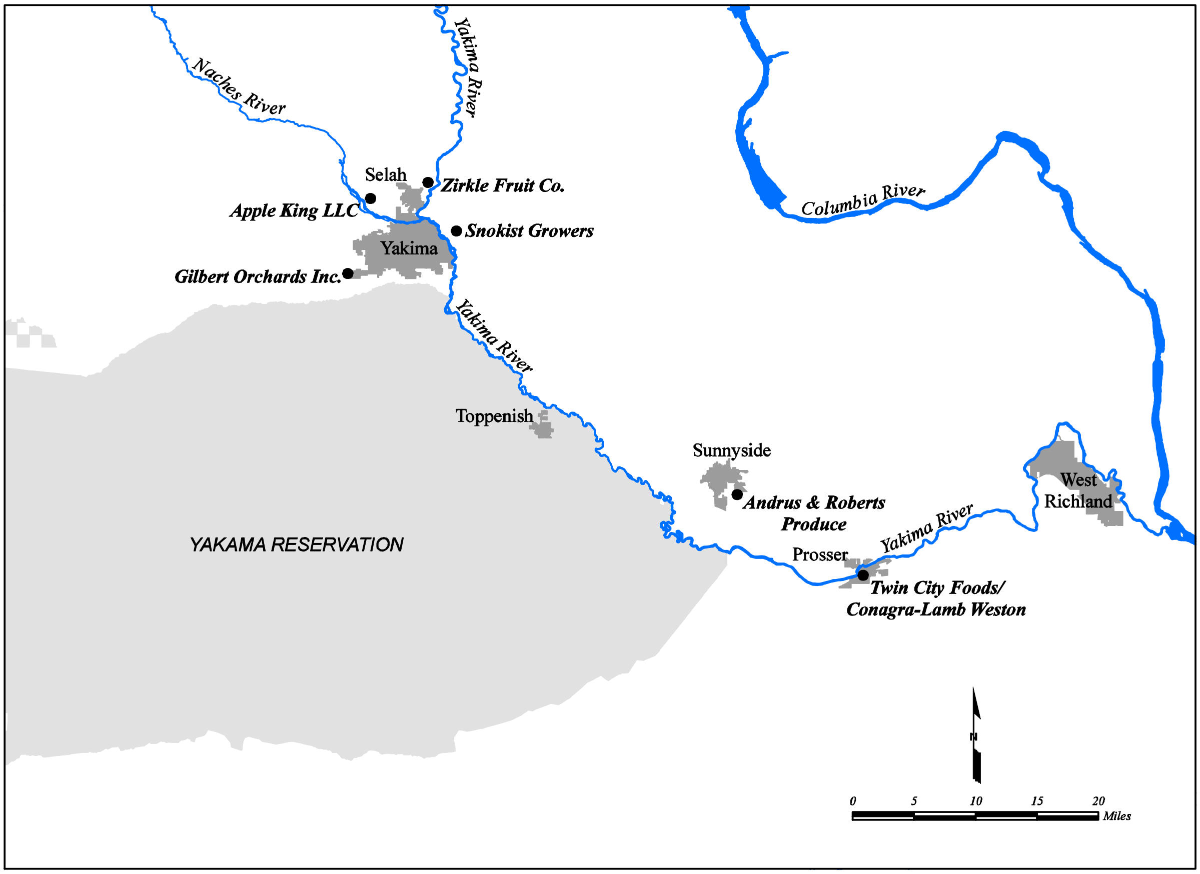

Figure 14. Fruit Packers and Vegetable Processors Monitored in the Lower Yakima River Basin during 2007-08.

Urban Stormwater Runoff

In 2006, Ecology issued a draft version of the Phase II Municipal Stormwater Permit for Eastern Washington for public comment. The final permit became effective February 16, 2007. By EPA mandate in November 2002, a TMDL must address the pollutant loads from NPDES permitted stormwater discharge. Stormwater runoff can accumulate and transport pollutants such as pesticides, PCBs, and sediment via the stormwater conveyance system to receiving waters and thereby degrade water quality. The occurrence of these types of contaminants has been documented in several stormwater studies in other parts of Eastern Washington (Lubliner et al., 2006; Serdar et al., 2006; Parsons, 2007). Some of these data are presented later in this report.

Phase II communities are identified under the rule as jurisdictions that: (1) own and operate a municipal separate storm sewer system (MS4), (2) discharge to surface waters, (3) are located in urbanized areas, and (4) have a population of greater than 10,000 and less than 100,000. Yakima basin cities that come under Phase II are Ellensburg, Selah, Yakima, Union Gap, urbanized portions of Yakima County, Sunnyside, West Richland, and Richland. Richland has one or two storm drains that run to the Yakima River and others that connect to Amon Creek Wasteway, but West Richland discharges to an irrigation canal that goes to the Columbia River near Finley.

Within the limited wet-weather season covered by the water quality study, it was impractical to obtain stormwater samples from all these cities. Eastern Washington storms usually have very little onset rainfall and a short duration single peak. The storms are also geographically sporadic. Low rainfall in Sunnyside and Richland, for example, makes it extremely difficult to catch storms. Therefore, stormwater sampling for the water quality study focused on characterizing pollutant levels in runoff from the Yakima/Union Gap and Ellensburg urban areas, with the intent of applying the results to other Phase II stormwater communities in the TMDL.

Eight storm events were captured during the winter and spring of 2007-08. Two to five storm drains were sampled each time in Yakima/Union Gap and Ellensburg (Figures 15 and 16). To the extent possible, the drains sampled represented typical urban, commercial, and residential land uses. The field study for the *Yakima Area Creeks Fecal Coliform TMDL* identified a number of potential sampling sites around Yakima (Joy, 2005). The drains sampled in the present study were selected in consultation with the cities of Yakima and Ellensburg.

Storm duration and intensity are likely the greatest factors in generating pollution. However, logistical restrictions effectively reduce most sampling efforts to grabs or manual composites at any given period during a storm. The stormwater samples for the present study consisted of either single grabs or a composite of two grabs collected 10-40 minutes apart, depending on the anticipated duration of stormwater influx. Many of these drains flow year-round, with base flows likely supplied by groundwater input. Sampling was delayed until turbid water began to flow.

The stormwater samples were analyzed for pesticides (SPE, Appendix I), PCBs (HR GC/MS), TSS, turbidity, and conductivity. The Ellensburg samples were not analyzed for pesticides due to the existing TMDL for these compounds.

Stormwater comes under NPDES regulation in three additional areas: Washington State Department of Transportation (DOT), construction projects, and industrial facilities.

DOT highways and facilities are required to be covered under a MS4 permit. DOT controls the major roads and highways through the urbanized areas of the Yakima basin (e.g., U.S. Highways 97 and 12, Interstate 82, and State Route 24). Highway surfaces are significant contributors to stormwater runoff volume, but are not known to be significant sources of any of the 303(d) listed pesticides or PCBs.

The NPDES Construction Stormwater General Permit covers soil disturbance for projects of one acre or more. These types of activities are potential sources of pesticides or PCBs when building on farm land or ground that has been otherwise contaminated. While no specific sampling was conducted for construction sites, the stormwater samples would include contributions from ongoing construction within the urban areas being monitored.

Fifteen industries in the Yakima basin fall under the NPDES Industrial General Stormwater Permit. These include fruit packers, vegetable processors, manufacturing companies, industrial parks, log yards, air carriers, and transit. Selected fruit packers and vegetable processors were monitored through their wastewater. The other types of industries are not known as sources of pesticides or PCBs and thus were not monitored.

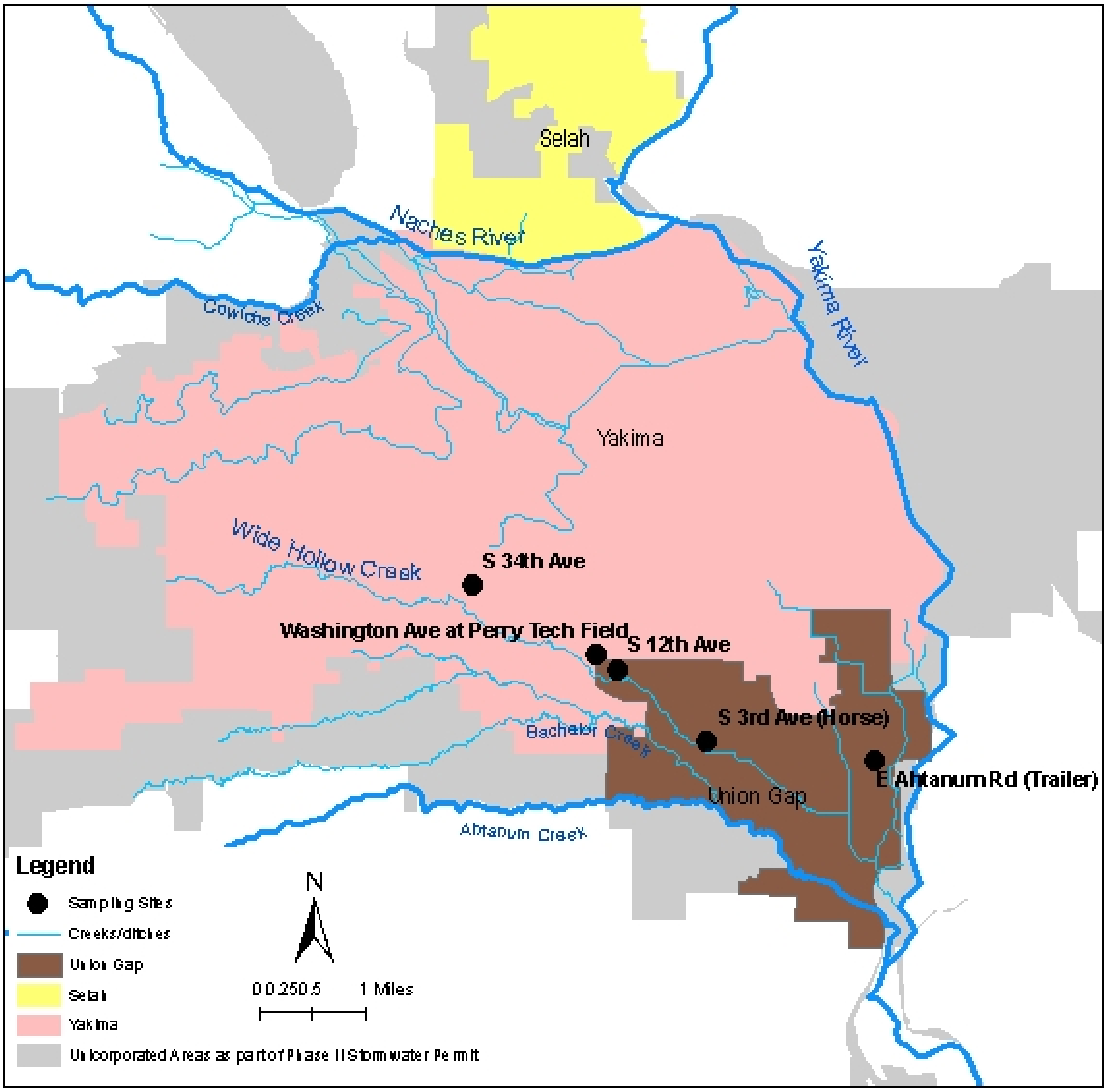

Figure 15. Location of Yakima and Union Gap Storm Drains Sampled during 2007-08.

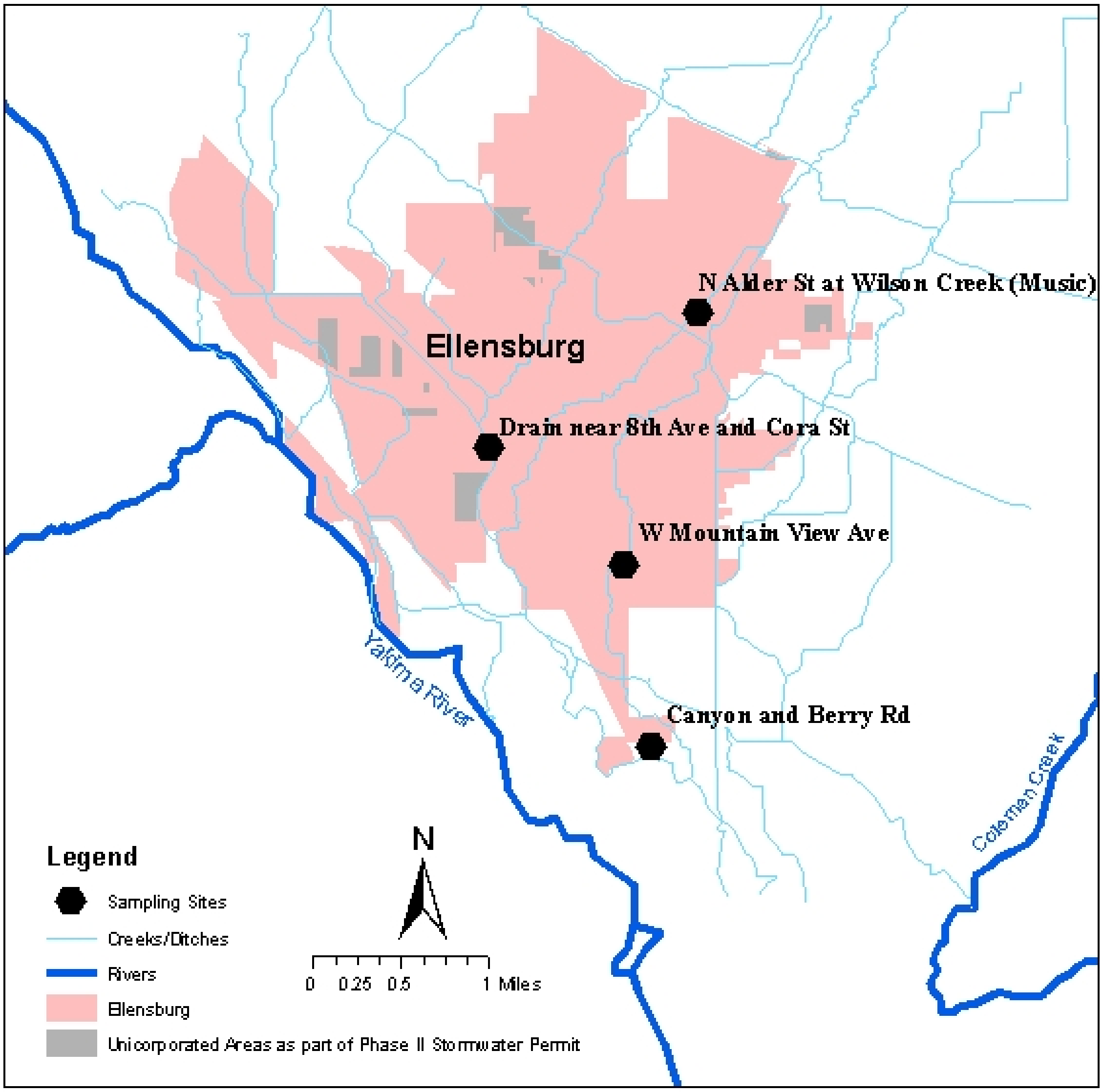

Figure 16. Location of Ellensburg Storm Drains Sampled during 2007-08.

Number of Samples

The approximate number and timing of samples collected for each task in the Yakima River pesticides and PCBs water quality study is shown in Table 14.

Table 14. Number of Samples Collected for the 2007-08 Water Quality Study.

Task	Approximate Number of Samples															
	April	May	June	July	August	September	October	November	December	January	February	March	April	May	June	Sub-Total
Surface Water																
Routine Monitoring	18	18	18	18	18	18	9	9	9	9	9	13				166
Screening Survey		22			22			22			22					88
SPMD Deployments		12						12								24
Permitted Discharges																
Wastewater Treatment Plants			18			18			18			18				72
Fruit & Vegetable Processors				6		6			6			6				18
Urban Stormwater Runoff							5	8	7			5			3	28
															Total =	396

Other Sources of Contamination

A variety of other potential sources of 303(d) listed pesticides and PCBs exist within the Yakima River basin. These include, but are not limited to, landfills, illegal dumpsites, hazardous waste sites, toxic cleanup sites, and pesticide handling facilities that will fall under regulations other than the Water Quality Laws to investigate and stop discharge if and when they are identified as potential sources of water pollution.

It was beyond the scope of this water quality study to investigate all of these sources. For purposes of the TMDL, they will be considered part of the nonpoint load.

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Field Procedures

Sample containers, preservation, and holding times for the water samples collected during this project are shown in Table 15. A detailed description of procedures for collecting each type of sample follows.

Table 15. Field Procedures for Water Samples.

Parameter	Minimum Sample Size	Container	Preservation	Holding Time
Pesticides (LVI)	1 gallon	1 gal. glass; Teflon lid	Cool to 4°C	7 days
Pesticides (SPE)	1 liter	1 L amber glass; Teflon lid	Cool to 4°C	7 days
PCBs	1 liter	1 L amber glass; Teflon lid	Cool to 4°C	1 year
TSS/TNVSS	1,000 mL	1 L poly bottle	Cool to 4°C	7 days
Turbidity	100 mL	500 mL poly bottle	Cool to 4°C	48 hours
Organic Carbon	50 mL	60 mL poly bottle	HCl to pH<2, 4°C	28 days
Conductivity	300 mL	500 mL poly bottle	Cool to 4°C	28 days

LVI = large volume injection (low detection limits).
SPE = solid phase extraction (routine detection limits).

Surface Water

Routine Monitoring and Screening Survey

The routine monitoring and screening survey samples were collected by hand in one-liter, amber glass, narrow-mouth bottles, cleaned to EPA (1990) quality assurance/quality control (QA/QC) specifications. Bridge samples were taken by placing the bottle in a metal holder that orients the mouth of the bottle upstream and lowering the sampler on a line. Wadeable streams were sampled by hand. The samples were taken as composites from a quarter-point transect across the width of the stream. The sample bottle was lowered and raised through the water column to obtain a depth integrated sample. Grabs from each transect were composited into appropriate sample containers for pesticides, TSS, turbidity, and conductivity. A new bottle was used for each sample site.

A number of the TSS and turbidity samples collected during the irrigation season were also intended for TMDL effectiveness monitoring. These samples were taken using depth- and width-integrating procedures consistent with the previous effectiveness monitoring effort (Coffin et al., 2006). Deepwater sites were sampled with a US-DH-59 or a US-DH-76 attached to a rope. A US-DH-81 sampler was used for wadeable streams. Three verticals representing equal widths of the stream cross-section were sampled.

Where required, streamflow was measured using a Swoffer Model 2100 or Marsh-McBirney Model 201 meter and top-setting rod. The latitude and longitude of each sampling site was recorded from a global positioning system (GPS) receiver.

All water samples were placed on ice, returned to Ecology Headquarters (HQ), and held in a secure cooler for later transport with chain-of-custody record to the Ecology Manchester Environmental Laboratory.

Semipermeable Membrane Devices

Deployment and retrieval procedures for SPMDs followed standard operating procedures of the Ecology EA Program (Johnson, 2007b). Standard SPMDs (91 x 2.5 cm membrane containing 1 mL triolein) and the stainless steel canisters (16.5 x 29 cm) and spindle devices that hold the membranes during deployment were obtained from Environmental Sampling Technologies (EST). The SPMDs were preloaded onto the spindles by EST in a clean room and shipped in solvent-rinsed metal cans under argon atmosphere. The SPMDs were kept frozen until deployed.

On arriving at the sampling site, the cans were pried open, spindles slid into perforated stainless steel canisters, and the device anchored and tethered in the stream. Field personnel wore nitrile gloves and did not touch the membranes. Water samples for total and dissolved organic carbon (TOC, DOC) were collected at the beginning, midpoint, and end of each deployment.

The SPMDs were deployed for approximately one month, as recommended by USGS and EST. The retrieval procedure was essentially the opposite of deployment. The cans holding the SPMDs were carefully sealed and the SPMDs maintained at or near freezing for next day shipment to EST for extraction. Chain-of-custody was maintained.

Wastewater Treatment Plants

The WWTP samples were composites of the final effluent. Each composite consisted of two grabs per day (morning and afternoon) for two days.

The grabs were taken with 1-liter amber glass bottles, cleaned to EPA (1990) QA/QC specifications, and split into appropriate sample containers (Table 13). A new 1-liter bottle was used for each sample. The samples were kept on ice and in the dark during the compositing period.

The effluent samples were returned to Ecology HQ and held in a secure cooler for later transport with chain-of-custody record to Manchester Laboratory. Manchester packaged the PCB samples and shipped them to an accredited contract laboratory for HR GC/MS analysis. The remaining samples were analyzed at Manchester.

Fruit Packers and Vegetable Processors

Sample collection and handling for fruit packer and vegetable processor effluents followed the same procedures used for WWTPs, except PCB samples were not taken.

Stormwater

Pesticide, PCB, TSS, turbidity, and conductivity samples were collected as simple grabs or composites of two grabs collected over a 15-minute period during the early part of the storm. Pesticide samples were not collected for Ellensburg. Samples were taken directly into the appropriate container (Table 15) and kept on ice at all times.

The stormwater samples were returned to Ecology HQ and held in a secure cooler for later transport with chain-of-custody record to Manchester Laboratory. Manchester packaged the PCB samples and shipped them to an accredited contract laboratory for HR GC/MS analysis. The remaining samples were analyzed at Manchester.

Laboratory Methods

Table 16 shows sample preparation, analysis methods, and laboratories used in this study.

Table 16. Laboratory Methods for Water Samples.

Analysis	Sample Preparation Method	Analytical Method	Laboratory
Surface Water			
Pesticides	EPA 3510M	LVI*/EPA 8081	Manchester
TSS	N/A	EPA 160.2	Manchester
TNVSS	N/A	SM 2540E	Manchester
Turbidity	N/A	EPA 180.1	Manchester
Conductivity	N/A	EPA 120.1	Manchester
TOC/DOC	N/A	EPA 415.1	Manchester
SPMDs			
Toxaphene	dialysis/GPC†	EPA 8081	EST/Manchester
PCBs	dialysis/GPC†	EPA 1668A	Pace
WWTP Effluent			
Pesticides	EPA 3535M (SPE**)	EPA 8081M	Manchester
PCBs	EPA 1668A	EPA 1668A	Pace, Test America, Pacific Rim
TSS	N/A	EPA 160.2	Manchester
Turbidity	N/A	EPA 180.1	Manchester
Conductivity	N/A	EPA 120.1	Manchester
Fruit &Vegetable Effluents			
Pesticides	EPA 3510M	LVI/EPA 8081	Manchester
TSS	N/A	EPA 160.2	Manchester
Turbidity	N/A	EPA 180.1	Manchester
Conductivity	N/A	EPA 120.1	Manchester
Stormwater			
Pesticides	EPA 3535M (SPE)	EPA 8081M	Manchester
PCBs	EPA 1668A	EPA 1668A	Pace, Pacific Rim
TSS	N/A	EPA 160.2	Manchester
Turbidity	N/A	EPA 180.1	Manchester
Conductivity	N/A	EPA 120.1	Manchester

*large volume injection.
†EST SOPs E14, E15, E19, E21, E33, E44, E48.
**solid phase extraction.

Data Quality Assessment

Data Review and Verification

The Ecology Manchester Laboratory reviewed the chemical data for this project. For results generated by Manchester, final data review was performed by the unit supervisor or an analyst experienced with the method. Chemists on the Manchester Laboratory staff performed the review for analytical work sub-contracted to commercial laboratories. Quality assurance and quality control at Manchester are described in the Lab Users Manual (Ecology intranet: http://aww.ecologydev/programs/eap/forms/labmanual.pdf).

Manchester prepared written case narratives assessing the quality of all data collected. These reviews include a description of analytical methods and an assessment of holding times, initial and continuing calibration and degradation checks, method blanks, surrogate recoveries, internal standard recoveries, matrix spike recoveries, laboratory control samples, and laboratory duplicates. The reviews and the complete Manchester data reports are available from the author on request.

A Quality Assurance Project Plan (Johnson, 2007a) established measurement quality objectives (MQOs) for accuracy, bias, and reporting limits. To determine if MQOs were met, the project lead compared results on field and laboratory quality control samples to the MQOs. To evaluate whether the reporting limit targets were met, the results were examined for non-detects and to determine if any values exceeded the lowest concentration of interest. Based on these assessments and a review of the laboratory data packages and Manchester's data verification reports, the data were either accepted, accepted with appropriate qualifications, or rejected and re-analyzed or re-sampled where possible.

In the present report, qualified data are flagged as follows:

- U = The analyte was not detected at or above the reported sample quantitation limit.
- UJ = The analyte was not detected at or above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately measure the analyte in the sample.
- J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- N = The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification.
- NJ = The analysis indicates the presence of an analyte that has been tentatively identified, and the associated numerical value represents its approximate concentration.
- E = Reported result is an estimate because it exceeds the calibration range.
- REJ = The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

Field Blanks

Transfer blanks and bottle blanks were analyzed to detect contamination arising from sampling procedures. The blanks were prepared in the field using sample bottles filled with blank water at the analyzing laboratories. The transfer blanks were prepared by pouring the blank water into new sample containers. The bottle blanks were carried through the survey unopened. All field blank results are included in the data appendices.

Pesticides were not detected in any of the field blanks, except for one instance of a trace of endosulfan sulfate. Endosulfan sulfate has never been shown to be a chemical of concern in the Yakima River.

PCBs were detected in the field blanks associated with WWTP effluent and stormwater sampling. The levels were similar in both the bottle and transfer blank indicating the sampling method was not contributing additional PCBs to the samples. Because the blank water is not used in analyzing the samples, the field blanks do not indicate contamination at the laboratory, which is assessed with method blanks. Only those PCB compounds detected at greater than 10 times the method blank were included in the PCB concentrations reported here for effluent, stormwater, and SPMD samples.

Because SPMDs sample vapors while being exposed to air, field blanks were needed to assess chemical accumulation during deployment and retrieval. The SPMD field blank consisted of five membranes in an argon-filled stainless steel can. It was exposed to the air for the average amount of time it took to open and place the SPMDs in the water, typically one to three minutes. The blank was then resealed and refrozen. It was taken back into the field and opened and closed again to mimic the retrieval process. The blank was prepared, processed, and analyzed the same as deployed SPMDs. There were two field blanks for each sampling period, one in the upper reaches of the Yakima River at Easton and one in the lower Yakima River at Sulphur Creek Wasteway.

A PCB background was present in the SPMD field blanks. It appeared to have originated at EST laboratory where the membranes were prepared. Because the PCB levels agreed closely among the field and laboratory blanks (i.e., within 4%), the average of the field blank values was subtracted from the samples before calculating final water column PCB concentrations. Toxaphene was not detected in the blanks. The results for the SPMD field blanks are in the data appendices.

Replicate Samples

Field replicate samples were collected to provide estimates of the total variability (field + laboratory) associated with the data generated in this study. The replicates were collected in pairs within a few minutes of each other. For SPMDs, the replicates consisted of separate samplers deployed in the same vicinity. Sites for replication were rotated through the study area to cover a range of analytes and concentrations. One or two sets of replicates were analyzed with every sample collection, except every few months for routine pesticide monitoring. The results are in the data appendices.

The relative percent difference between replicates for the constituents of primary interest in this study is summarized in Table 17. For pesticides, TSS, and turbidity, the replicates agreed within 30% or better in most cases. Greater variability was encountered for PCBs, 33-66%. In terms of PCB concentrations, this translates into a difference of about a factor of 2 or less. Overall, the most variable results were obtained on organic compounds in stormwater. The complete results on replicate samples are in the data appendices.

Table 17. Mean Relative Percent Difference* Between Replicate Field Samples Analyzed during the 2007-08 Water Quality Study.

Sample Type	N=	DDE	Dieldrin	Chlorpyrifos	Endosulfan
Surface water (routine monitoring)	12	6%	12%	10%	7%
Surface water (screening survey)	8	11%	8%	34%	29%
SPMDs	3	31%	17%	12%	11%
WWTP effluent	6-8	ND	ND	18%	4%
Fruit and Vegetable effluent	4	2%	19%	32%	22%
Stormwater	4-6	19%	22%	47%	25%
Sample Type	N=	Total PCBs	Toxaphene	TSS	Turbidity
Surface water (routine monitoring)	12	NA	ND	11%	10%
Surface water (screening survey)	8	NA	ND	25%	14%
SPMDs	3	35%	6%	NA	NA
WWTP effluent	6-8	42%	ND	2%	14%
Fruit and Vegetable effluent	4	NA	ND	7%	16%
Stormwater	4-6	66%	4%	18%	8%

*difference between replicates as percent of replicate average.
NA = not analyzed.
ND = not detected.

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Results of the 2007-08 Water Quality Study

Water Supply

In describing conditions in the Yakima River, Fuhrer et al. (2004) cautioned that water availability and dilution effects must be considered when comparing water quality between years or examining findings from a particular year. Streamflows in the basin vary from year to year depending on snowfall, snowmelt, and how the irrigation system is operated.

Figure 17 shows the flow in the lower Yakima River at Kiona while the 2007-08 water quality study was being conducted. Kiona is located at Benton City, about 30 miles upstream of the Columbia River. The 2007-08 data are compared to the average daily flow at this site from 1933 to 2007. This period dates back to when the last of the six storage dams at the headwaters of the Yakima and Naches Rivers was completed.

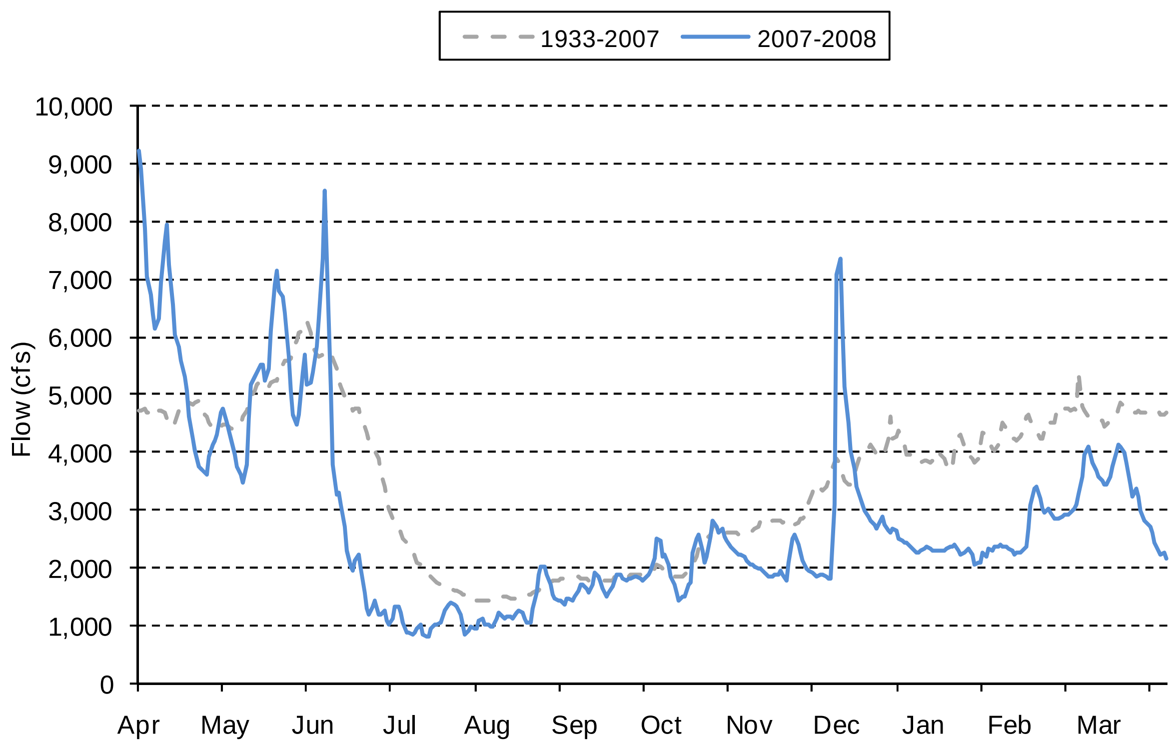


Figure 17. Historical Flow in the Yakima River vs. Flow during the 2007-08 Water Quality Study.
(*USGS 12510500, Yakima River at Kiona* http://waterdata.usgs.gov/wa/nwis/sw)

Mainstem flows tracked historical averages fairly closely during most of the 2007 irrigation season (April to October). Note that peak high and low flows in the historical data are smoothed out by averaging.

Streamflow departed from the historical average in several instances. There was a large snowmelt event in March 2007 with the bulk of the runoff extending into April. A series of four storms also brought rain and increased runoff in April. Much of the snow that would normally have melted in June melted in March and April. The last part of December through the middle of February was characterized by cold temperatures and heavy snowfall in the mountains, and thus lower flows. (www.wrh.noaa.gov/pdt/climate/monthInReview/index.php?wfo=pdt).

The average annual flow at Kiona since the TMDL effort was initiated is plotted in Figure 18. The first year of sampling for the *Lower Yakima River Suspended Sediment and DDT TMDL* was 1994, a drought year. A period of higher than average runoff occurred over the next six years, followed by another drought in 2001. Flows have been lower than average over the past several years. Water supplies since about 1994 have generally been less than the historical mean would indicate they should have been over the last decade and a half (Coffin, 2008).

The average flow during 2007 was close to the long-term mean − 3,813 cfs vs. 3,516 cfs, respectively. Most of the surface water samples for the water quality study (80%) were collected during this period. Therefore, the results reported here should be representative of the typical flow regime in the Yakima River basin, at least to the extent that they do not reflect a particularly low- or high-flow year.

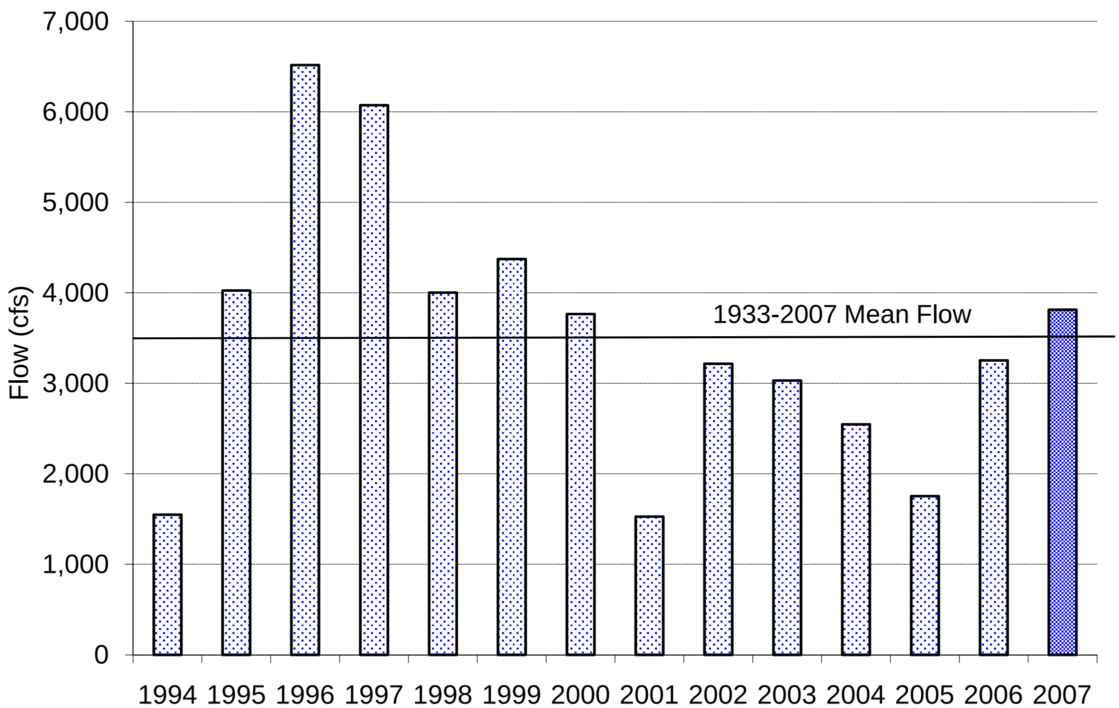


Figure 18. Annual Mean Flow in the Yakima River at Kiona, 1994-2007.
(USGS 12510500, http://waterdata.usgs.gov/wa/nwis/sw)

Surface Water Quality

Pesticides

Four stations on the lower Yakima River mainstem, the Naches River, and four major left-bank irrigation returns were monitored for chlorinated pesticides, the organophosphate insecticide chlorpyrifos, suspended sediment, and turbidity from April 2007 through March 2008. Samples were collected twice-a-month during the irrigation season and monthly during the non-irrigation season, providing results for approximately 170 samples, 18-19 samples per site. Sampling locations were shown previously in Figure 7.

Pesticides other than those on the 303(d) list were infrequently detected and, when present, the levels were low. These results are not discussed further. All of the data obtained on pesticides and ancillary water quality parameters in surface water samples can be found in Appendices J and K.

The complete project data are also available through Ecology's Environmental Information Management (EIM) website www.ecy.wa.gov/eim/index.htm; search User Study ID AJOH0055.

Detection Frequency and Concentration Ranges

Lower Mainstem and Naches River

Results for 303(d) listed pesticides[d] in the lower Yakima mainstem and Naches River are summarized in Table 18. Concentrations are in units of ng/L (nanograms per liter) which is equivalent to parts per trillion. The reporting limit was used to calculate summary statistics when a pesticide was not detected.[e] The same convention is followed throughout the report, unless stated otherwise.

The pesticides or breakdown products most frequently detected in the Yakima mainstem and Naches River were DDE, chlorpyrifos, and endosulfan: 76%, 61%, and 49% of samples, respectively. DDD and dieldrin were detected less frequently: 26% and 22% of samples. DDT was reported in only 18% of the samples, most of it having broken down to DDE and DDD. The other two 303(d) pesticides analyzed, chlordane and alpha-BHC, were below the limits of detection. The reporting limit for these compounds was 0.061-0.067 ng/L.

Toxaphene was not detected at or above 3 ng/L (data not shown). Low detection limits could not be achieved for toxaphene in these samples due to interferences. Better toxaphene data were obtained through the use of SPMD passive samplers (see *PCBs and Toxaphene*, page 102).

[d] In this report, the terms DDT, DDE, and DDD refer to the 4,4' isomers. The 2,2' isomers are also present but at insignificant levels. Endosulfan is the sum of detected concentrations of endosulfan I and endosulfan II. Chlordane is the sum of detected concentrations of cis & trans chlordane, cis & trans nonachlor, and oxychlordane.

[e] The detection limit is the lowest concentration where there is evidence of the analyte being present. The reporting limit is the lowest concentration that can reliably be reported, based on method blanks, instrument calibration, and other factors.

Table 18. Summary of Results from Monitoring 303(d) Listed Pesticides at Four Locations in the Mainstem Lower Yakima River and in the Naches River during 2007-08: Yakima River at Harrison Bridge, Naches River at mouth, Yakima River at Parker Bridge, Yakima River at Euclid Bridge, Yakima River at Kiona Bridge *(concentrations in ng/L, parts per trillion).*

	DDT		DDE		DDD		Dieldrin	
No. of Samples	90		90		90		90	
Detection Frequency (%)	18%		76%		26%		22%	
Median Concentration	0.063	U	0.15		0.063	U	0.065	U
Mean Concentration	0.077		0.21		0.072		0.091	
90th Percentile Concentration	0.10		0.43		0.094		0.15	
Maximum Concentration	0.44	J	1.3		0.22		0.29	
	Endosulfan		Chlorpyrifos		Chlordane		Alpha-BHC	
No. of Samples	90		90		90		90	
Detection Frequency (%)	49%		61%		0%		0%	
Median Concentration	0.066	U	0.18		0.063	U	0.063	U
Mean Concentration	0.24		1.7		0.063	U	0.063	U
90th Percentile Concentration	0.48		4.1		0.065	U	0.065	U
Maximum Concentration	2.4		20		0.067	U	0.067	U

U = not detected at or above reported value.
J = estimated.

The highest concentrations recorded were 20 ng/L for chlorpyrifos and 2.4 ng/L for endosulfan. Both of these insecticides are currently used in the Yakima basin. The maximum DDE concentration was 1.3 ng/L. Dieldrin reached 0.29 ng/L. DDT, dieldrin, chlordane, and alpha-BHC were all banned in the 1970s and 1980s and are no longer used.

Figure 19 compares the detections of DDE, dieldrin, endosulfan, and chlorpyrifos at each of the mainstem and Naches River monitoring sites. Results are arranged in downstream order from the Yakima River at Harrison Bridge (r.m. 121.7, above the city of Yakima) to the Yakima River at Kiona (r.m. 29.8, above the Columbia River confluence).

DDE was always below detection limits in the Yakima River at Harrison Bridge, but was routinely detectable in the Naches River and all downstream locations (89-100% of samples). DDE, dieldrin, endosulfan, and chlorpyrifos all showed a consistent increase in detection frequency moving downriver from Harrison Bridge. These results point to the Naches River as being a larger contributor of DDT compounds than the upper Yakima River.

Dieldrin was rarely detected at Harrison Bridge and never detected in the Naches River. The major dieldrin sources appear to lie downstream of Parker.

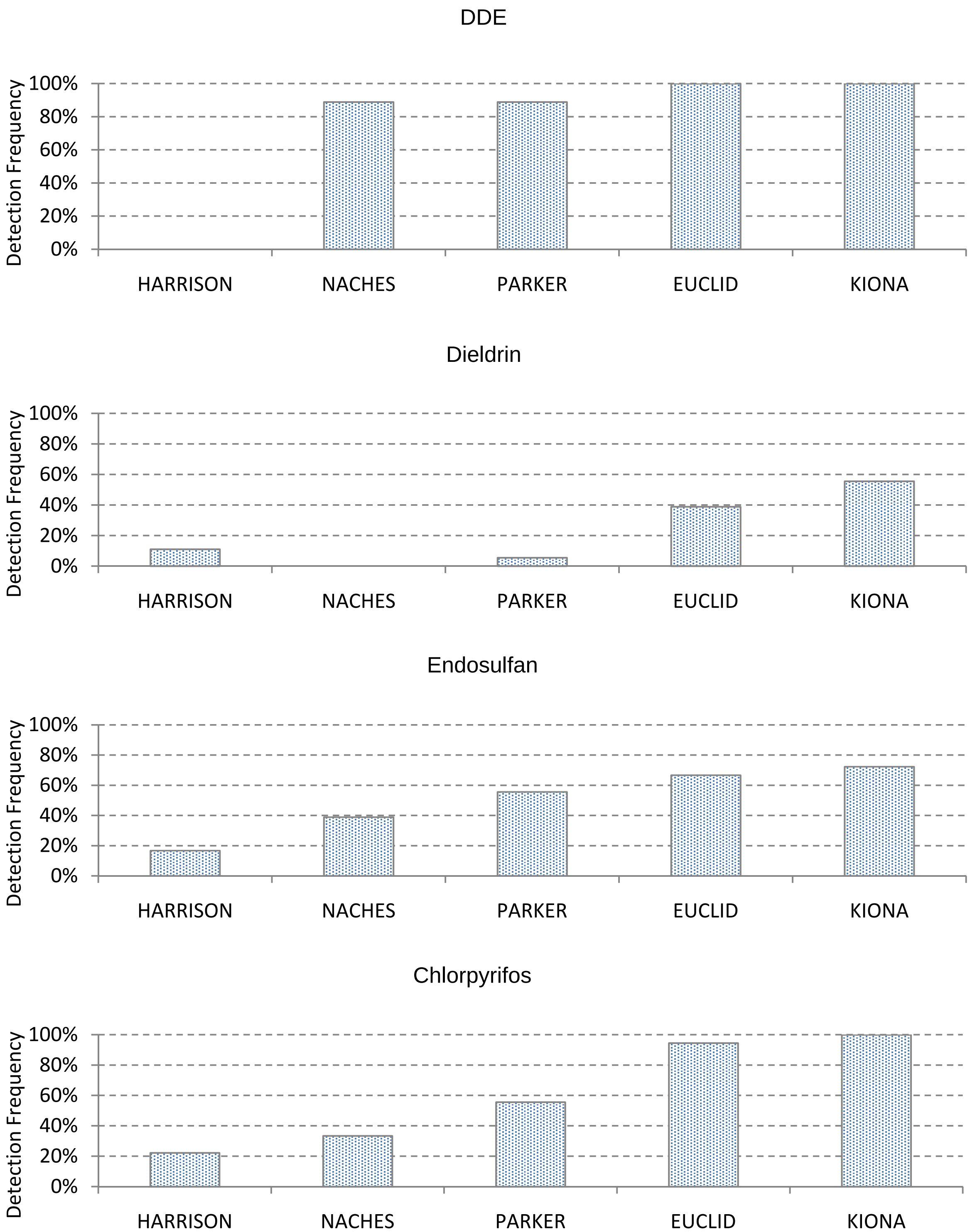


Figure 19. Detection Frequency of Selected 303(d) Listed Pesticides in the Mainstem Lower Yakima River and Naches River during 2007-08 *(percent of samples detected, N=18).*

Major Irrigation Returns

Table 19 summarizes the pesticide data for the four major lower river irrigation returns monitored in conjunction with mainstem: Moxee Drain (r.m. 107.3 near Union Gap), Granger Drain (r.m. 82.8 at Granger), Sulphur Creek Wasteway (r.m. 61.0 at Sunnyside), and Spring Creek (r.m. 41.8 below Prosser). The initial TMDL investigation identified these returns as priority discharges for monitoring (Joy and Patterson, 1997).

Table 19. Summary of Results from Monitoring 303(d) Listed Pesticides in Four Major Irrigation Returns to the Lower Yakima River during 2007-08: Moxee Drain, Granger Drain, Sulphur Creek Wasteway, Spring Creek *(concentrations in ng/L, parts per trillion).*

	DDT	DDE	DDD	Dieldrin
No. of Samples	76	76	76	76
Detection Frequency (%)	82%	100%	97%	71%
Median Concentration	0.19	1.2	0.22	0.16
Mean Concentration	0.87	1.4	0.24	0.22
90th Percentile Concentration	0.64	2.6	0.42	0.47
Maximum Concentration	44	5.5	0.89	0.92
	Endosulfan	Chlorpyrifos	Chlordane	Alpha-BHC
No. of Samples	76	76	76	76
Detection Frequency (%)	88%	87%	3%	0%
Median Concentration	0.36	0.54	0.063 U	0.063 U
Mean Concentration	1.2	8.1	0.063 U	0.063 U
90th Percentile Concentration	3.2	15	0.065 U	0.065 U
Maximum Concentration	15	211	0.082	0.095 UJ

U = not detected at or above reported value.
J = estimated.

DDT compounds, dieldrin, endosulfan, and chlorpyrifos were detected much more frequently in the irrigation returns than in the mainstem: 71-100% vs. 18-76%. The maximum concentrations observed were higher in the returns by factors of 4 to 10. Chlordane was reported in only 3% of the return samples and alpha-BHC was never detected, which is consistent with findings for the mainstem.

Despite elevated reporting limits, toxaphene was detected in four samples (5% detection frequency) from the major irrigation returns, two each from Moxee Drain and Sulphur Creek Wasteway. Estimated concentrations were in the range of 3.5 – 7.0 ng/L. Low-level data for toxaphene for the mainstem and major irrigation returns is discussed later this report.

The term “total DDT” refers to the summed concentrations of the insecticide DDT and its breakdown products DDE and DDD. A particularly high total DDT concentration of 50 ng/L was recorded in Granger Drain on 1/1/08. This sample was comprised of 86% un-degraded DDT (Figure 20). A large amount of the DDT parent compound (52%) was also found in Spring Creek on 4/5/07 (5.6 ng/L total DDT). Studies done elsewhere have attributed similar findings to disturbance of subsurface farm soils, rather than recent use of DDT (e.g., Risebrough et al., 1984). DDT degrades more slowly when buried than when near the surface and exposed to light and greater biological activity (Callahan et al., 1979). The un-degraded DDT residual in 95% of the samples analyzed from the returns in the present study was less than 30% of the total, indicating the source is historical application.

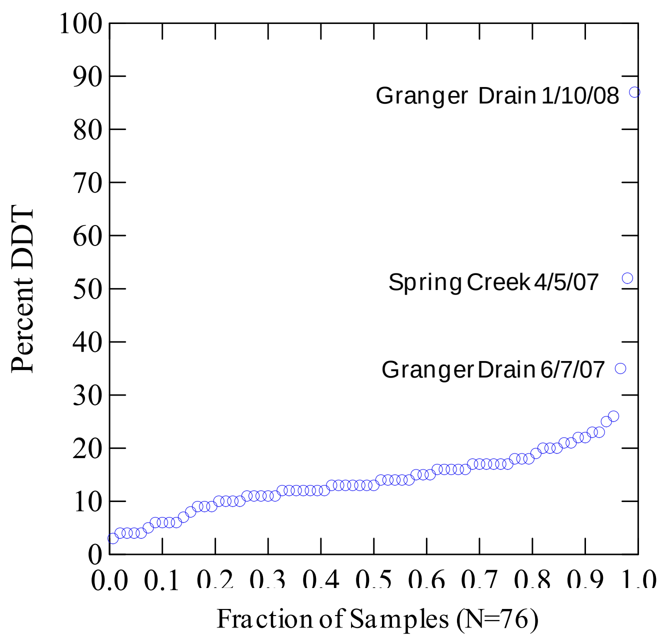


Figure 20. Percent of Un-degraded DDT in Water Samples From Four Major Irrigation Returns to the Lower Yakima River during 2007-08: Moxee Drain, Granger Drain, Sulfur Creek Wasteway, and Spring Creek.

Pesticide detection frequency was similar among the four returns, except for dieldrin in Moxee Drain (Figure 21). Dieldrin was reported in only 26% of the Moxee samples, compared to 84-89% in the three other discharges.

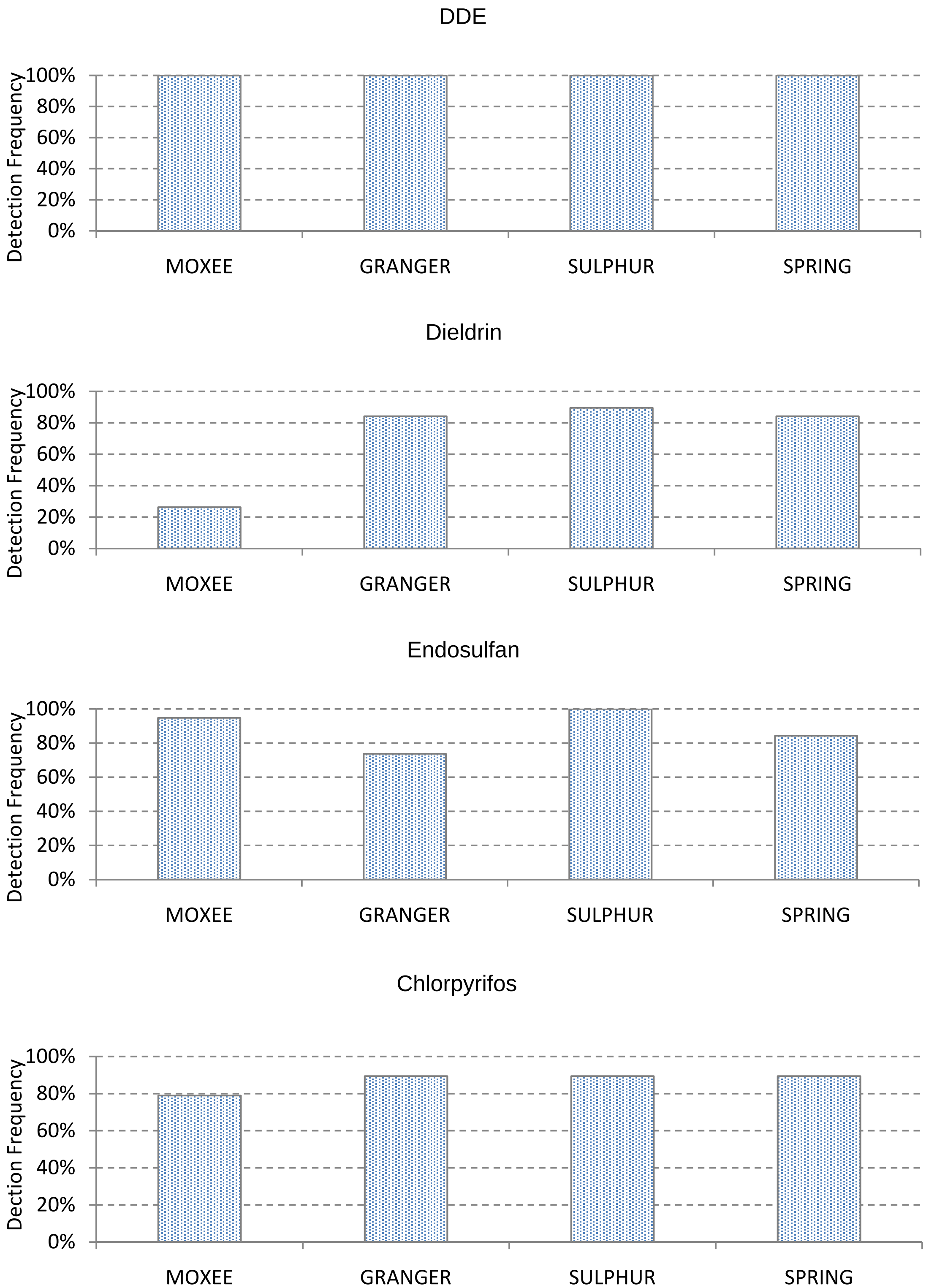


Figure 21. Detection Frequency of Selected 303(d) Listed Pesticides in Four Major Irrigation Returns to the Lower Yakima River during 2007-08 *(percent of samples, N=19).*

Comparison with Water Quality Criteria

Human Health

The human health criteria are intended to protect the average consumer from excess cancer and other health risks incurred from exposure to contaminated fish and water. People with higher or lower body weights and fish or water consumption rates than used to calculate the criteria would face higher or lower risks. As previously noted, the human health criteria were promulgated on the states through the EPA National Toxics Rule. Washington State does not have human health criteria for chlorpyrifos, none having been proposed by EPA. The water quality criteria are described in more detail starting on page 9.

Lower Mainstem and Naches River

The percentage of Yakima and Naches River water samples that exceeded Washington State human health criteria for pesticides is shown in Table 20. The criteria shown are for consumption of both fish and water. In the case of DDT compounds, dieldrin, and chlordane, these criteria are the same as or only slightly lower than the criteria for fish consumption only (see Table 3).

Table 20. Percent of Samples Exceeding Human Health Criteria for 303(d) Listed Pesticides in the Mainstem Lower Yakima River and Naches River during 2007-08. *(N=18)*

Location	DDT	DDE	DDD	Dieldrin
Human Health Criteria (ng/L):	0.59	0.59	0.83	0.14
Yakima River at Harrison	0%	0%	0%	0%
Naches River at mouth	0%	0%	0%	0%
Yakima River at Parker	0%	0%	0%	0%
Yakima River at Euclid	0%	17%	0%	22%
Yakima River at Kiona	0%	6%	0%	28%
Location	Endosulfan	Chlorpyrifos	Chlordane	Alpha BHC
Human Health Criteria (ng/L):	930	NA	0.57	3.9
Yakima River at Harrison	0%	NA	0%	0%
Naches River at mouth	0%	NA	0%	0%
Yakima River at Parker	0%	NA	0%	0%
Yakima River at Euclid	0%	NA	0%	0%
Yakima River at Kiona	0%	NA	0%	0%

NA = not applicable (criteria have not been adopted).

Instances where human health criteria were exceeded in the Yakima mainstem were limited to DDE and dieldrin and were observed at Euclid and Kiona, but not further upstream. 17-22% of samples exceeded at Euclid and 6-28% of samples exceeded at Kiona. Other 303(d) listed pesticides were always within human health criteria in the mainstem. The Naches River never exceeded criteria.

Major Irrigation Returns

Table 21 shows how the four major lower river returns compared to human health criteria. Comparing the returns directly with human health criteria is appropriate for several reasons. First, both state and federal opinions have concluded that waters within the Columbia Basin, including irrigation returns, are waters of the state and therefore subject to the water quality standards (AGO 1969 No. 4 www.atg.wa.gov/opinion.aspx?section=archive&id=9166; Levigne, 1997; Ryan, 1997). Second, as demonstrated in Ecology's 2006 fish tissue survey and confirmed in the 2007-08 water quality study, the Yakima River is often at or above criteria for several of these compounds, and thus does not have additional assimilative capacity. Third, some segments of the local population are known to catch fish out of irrigation returns on a routine basis.

Table 21. Percent of Samples Exceeding Human Health Criteria for 303(d) Listed Pesticides in Four Major Irrigation Returns to the Lower Yakima River during 2007-08. *(N=19)*

Location	DDT	DDE	DDD	Dieldrin
Human Health Criteria (ng/L):	0.59	0.59	0.83	0.14
Moxee Drain	0%	74%	0%	26%
Granger Drain	47%	100%	5%	53%
Sulphur Creek Wasteway	0%	100%	0%	89%
Spring Creek	11%	32%	0%	58%
Location	Endosulfan	Chlorpyrifos	Chlordane	Alpha BHC
Human Health Criteria (ng/L):	930	NA	0.57	3.9
Moxee Drain	0%	NA	0%	0%
Granger Drain	0%	NA	0%	0%
Sulphur Creek Wasteway	0%	NA	0%	0%
Spring Creek	0%	NA	0%	0%

NA = not applicable (criteria have not been adopted for chlorpyrifos).

The returns exceeded human health criteria for DDT, DDE, and dieldrin much more frequently than the mainstem. Endosulfan, chlordane, and alpha-BHC, however, always remained within criteria.

As illustrated in Figure 22, DDE and dieldrin typically exceeded human health criteria 50% of the time or more, with 100% exceedance of the DDE criterion in Granger Drain and Sulphur Creek Wasteway. Exceptions were DDE in Spring Creek, which exceeded 32% of the time, and dieldrin in Moxee Drain, which exceeded 26% of the time. Granger Drain and Spring Creek were the only returns where the DDT human health criterion was exceeded. As previously noted, these discharges had an unusually high percentage of un-degraded DDT in several instances.

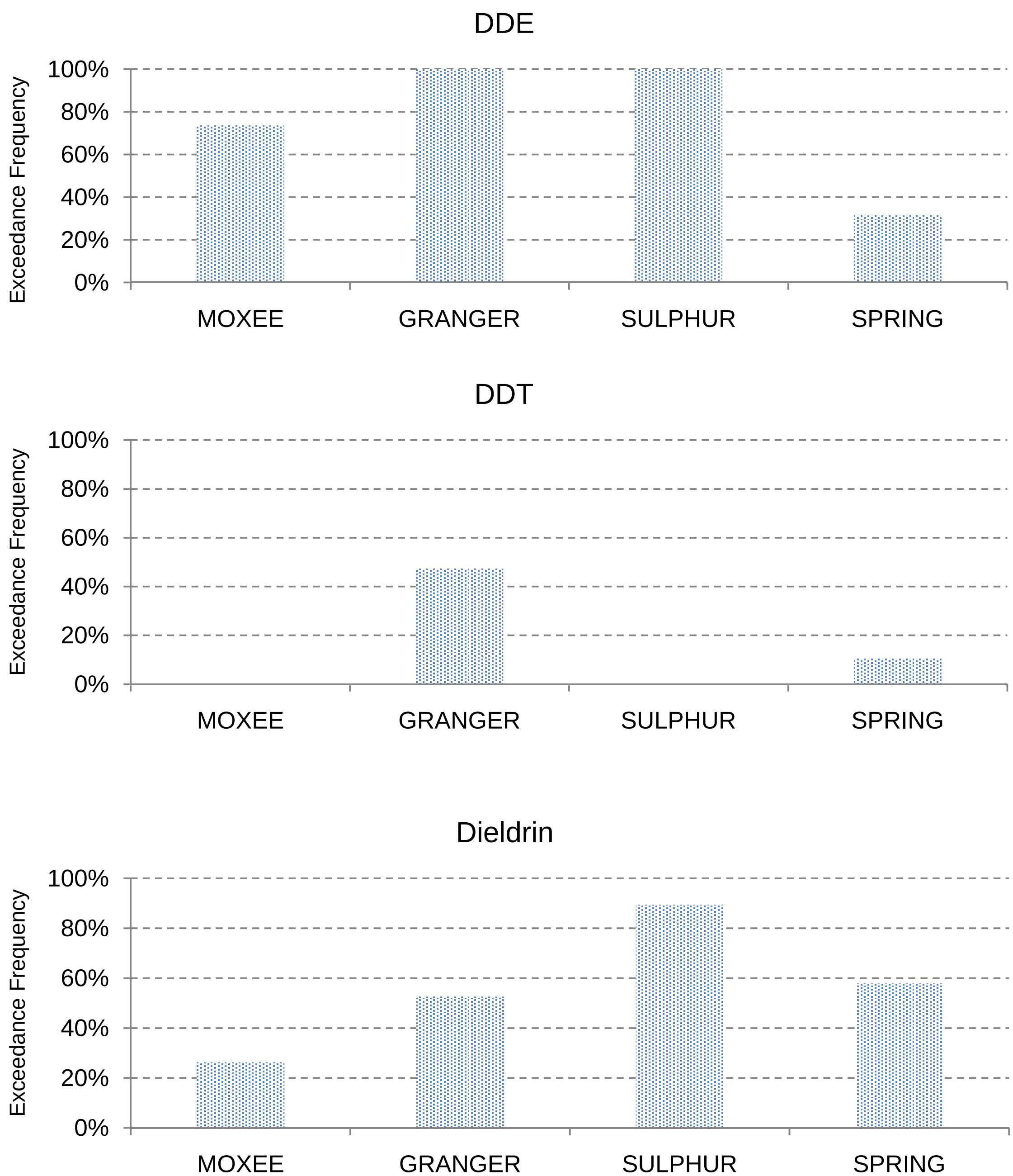


Figure 22. Percent of Samples Exceeding Human Health Criteria for DDE, DDT, and Dieldrin in Four Major Irrigation Returns to the Lower Yakima River during 2007-08. *(N=19)*

Aquatic Life

Water quality criteria to protect aquatic life are typically less restrictive than the human health criteria, i.e., higher concentrations are considered to be protective. The aquatic life criteria for DDT compounds apply to total DDT, rather than the individual concentrations of DDT, DDE, or DDD. Human health criteria have not been proposed for total DDT.

Lower Mainstem and Naches River

Washington State's aquatic life criteria for chronic (long-term) exposure to 303(d) pesticides were rarely exceeded in the mainstem Yakima River and never exceeded in the Naches River during 2007-08 (Table 22). The acute criteria (short-term exposure) were always being met.

The chronic total DDT criterion was exceeded in 6% of the samples collected in the mainstem at Euclid and 6% of samples at Kiona (1 out of 18). Other pesticides were always within chronic criteria.

Table 22. Percent of Samples Exceeding Chronic Aquatic Life Criteria for 303(d) Listed Pesticides in the Mainstem Lower Yakima River and Naches River during 2007-08. *(N=18)*

Location	Total DDT*	Dieldrin	Endosulfan
Aquatic Life Criteria (ng/L):	1.0	1.9	56
Yakima River at Harrison	0%	0%	0%
Naches River at mouth	0%	0%	0%
Yakima River at Parker	0%	0%	0%
Yakima River at Euclid	6%	0%	0%
Yakima River at Kiona	6%	0%	0%
Location	Chlorpyrifos	Chlordane	Alpha BHC
Aquatic Life Criteria (ng/L):	41	4.3	NA
Yakima River at Harrison	0%	0%	NA
Naches River at mouth	0%	0%	NA
Yakima River at Parker	0%	0%	NA
Yakima River at Euclid	0%	0%	NA
Yakima River at Kiona	0%	0%	NA

NA = not applicable (criteria have not been adopted).
*Total DDT = DDT+DDE+DDD.

Major Irrigation Returns

Tributaries and irrigation returns to the lower Yakima River provide habitat for salmonids and other fish species (Joy and Patterson, 1997). They also discharge to reaches of the mainstem with important fish habitat. The presence of chinook, coho, and steelhead has been documented in Moxee Drain, Sulphur Creek Wasteway, and Spring Creek, with coho spawning observed in Sulphur and Spring (http://wdfw.wa.gov/mapping/salmonscape/index.html). Rearing and migration are specifically identified as designated uses for Sulphur Creek Wasteway in the water quality standards.[f] It is therefore important that these discharges comply with aquatic life criteria.

Total DDT commonly exceeded the chronic aquatic life criterion in all four returns, with Granger Drain and Sulphur Creek Wasteway exceeding throughout the year (Table 23). Chlorpyrifos was occasionally above the chronic criterion in Moxee Drain, Sulphur Creek Wasteway, and Spring Creek (5-11% of samples). Dieldrin, endosulfan, and chlordane were always within aquatic life criteria. There are no aquatic life criteria for alpha-BHC.

Table 23. Percent of Samples Exceeding Chronic Aquatic Life Criteria for 303(d) Listed Pesticides in Four Major Irrigation Returns to the Lower Yakima River during 2007-08. *(N=19)*

Location	Total DDT*	Dieldrin	Endosulfan
Aquatic Life Criteria (ng/L):	1.0	1.9	56
Moxee Drain	68%	0%	0%
Granger Drain	100%	0%	0%
Sulphur Creek Wasteway	100%	0%	0%
Spring Creek	26%	0%	0%
Location	**Chlorpyrifos**	**Chlordane**	**Alpha BHC**
Aquatic Life Criteria (ng/L):	41	4.3	NA
Moxee Drain	5%	0%	NA
Granger Drain	0%	0%	NA
Sulphur Creek Wasteway	11%	0%	NA
Spring Creek	11%	0%	NA

*DDT+DDE+DDD.
NA = not applicable (criteria have not been adopted).

Spatial and Seasonal Patterns

Lower Mainstem

Figures 23 and 24 illustrate how the average total DDT and dieldrin concentrations increased in the Yakima mainstem moving downstream from Harrison Bridge to Kiona during the 2007 irrigation season. The highest levels of these compounds were generally observed during irrigation. Previous studies have had similar findings (Joy and Patterson, 1997; Rinella et al., 1999; Ebbert and Embrey, 2002).

On average, total DDT concentrations increased by a factor of 2 or more between Harrison and Parker. This was due, at least in part, to the Naches River and Moxee Drain. The greatest impacts occurred between Parker and Euclid where concentrations increased by a factor of 4. Granger Drain, Sulphur Creek Wasteway, and a large number of right bank tributaries and returns discharge to this reach. Total DDT levels at Kiona averaged about two-thirds of those at Euclid due to dilution and sedimentation.

[f] The Roza-Sunnyside Board of Joint Control installed an adult fish barrier in lower Sulphur Creek Wasteway during the winter of 2007-08.

Dieldrin was at or below detection limits from Harrison to Parker, including in the Naches River and, in most cases, Moxee Drain. There did not appear to be large dieldrin sources in this reach of the river. Dieldrin increased by a factor of at least 2 at Euclid and then decreased slightly by Kiona.

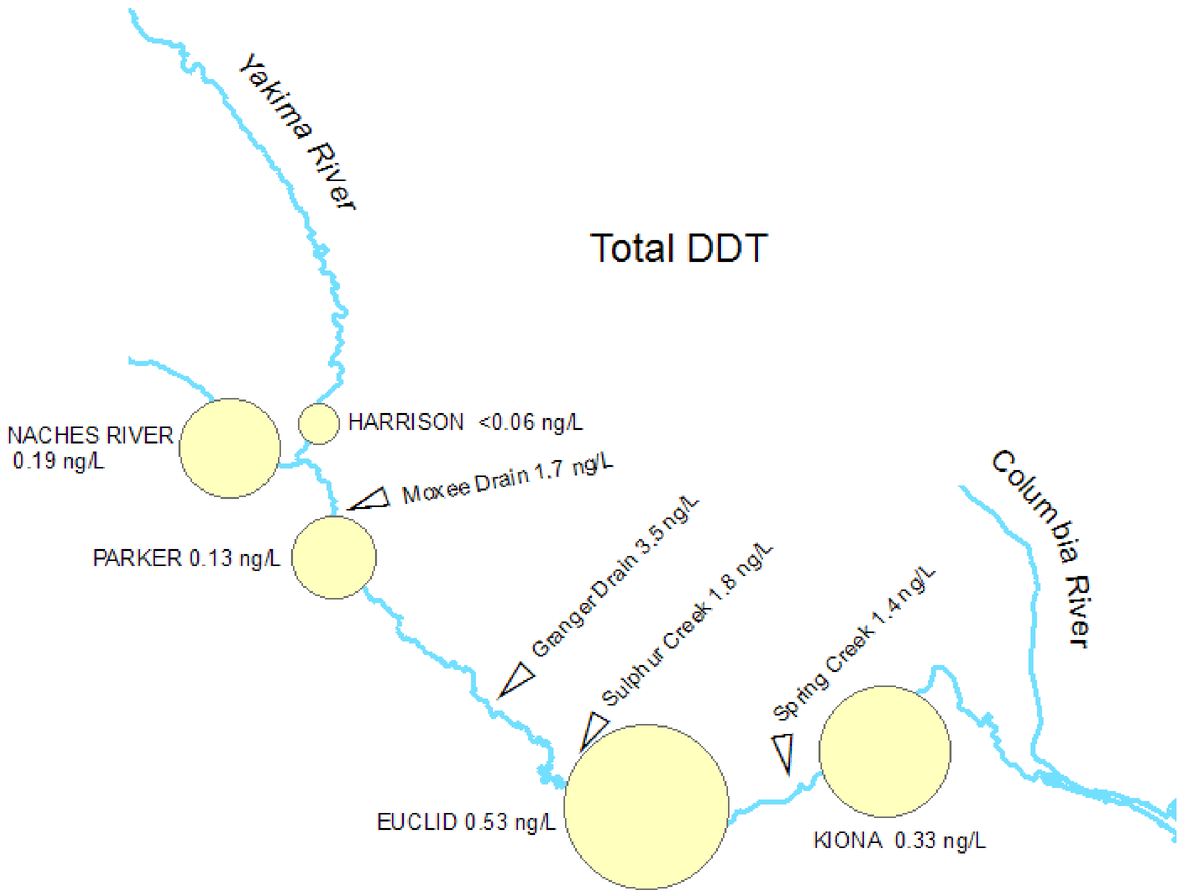


Figure 23. Average Total DDT Concentrations in the Lower Yakima River during the 2007 Irrigation Season *(ng/L = parts per trillion, concentration proportional to circle area, non-detects shown as less than ½ detection limit).*

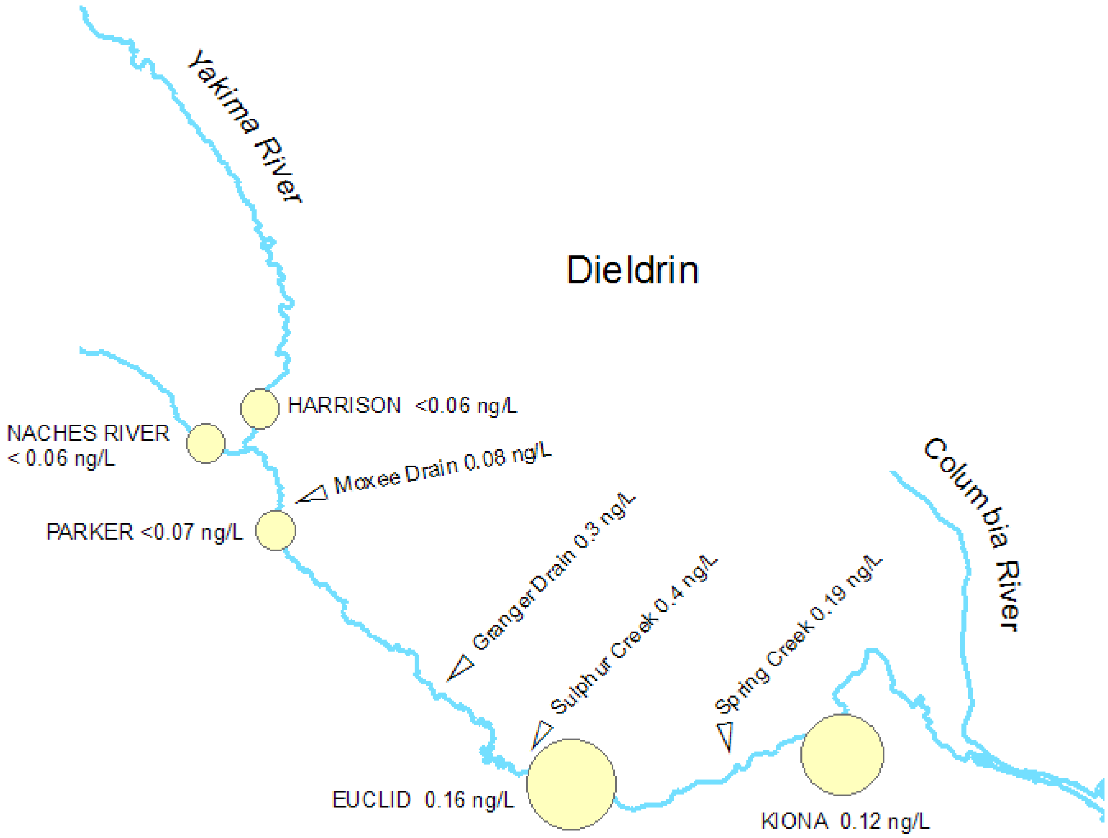
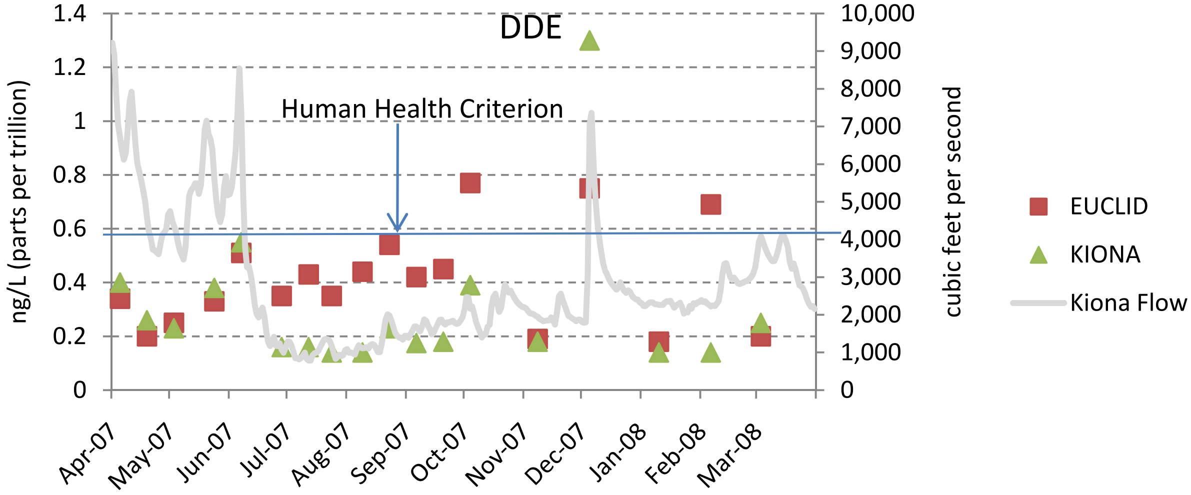


Figure 24. Average Dieldrin Concentrations in the Lower Yakima River during the 2007 Irrigation Season *(ng/L = parts per trillion, concentration proportional to circle area, non-detects shown as less than ½ detection limit).*

Figure 25 shows how DDE and total DDT levels varied at Euclid and Kiona from April 2007 through March 2008. These are the two mainstem locations where water quality criteria were not being met consistently. The daily flow at Kiona is also shown (USGS station 12510500 http://waterdata.usgs.gov/wa/nwis/sw).

DDE and total DDT varied directly with discharge. The pattern corresponded to changes in suspended sediment and reflects the affinity these compounds have for soil particles and other suspended matter. The suspended sediment data are discussed later in this report.

Concentrations of DDT compounds were similar at both locations, except during the second half of the irrigation season (July- October) when much lower levels were measured at Kiona. This can be partly attributed to dilution. Due to irrigation withdrawals, the flow at Euclid was about 80% of the flow at Kiona during this period. Lower river velocities also cause suspended sediments to settle out, thereby reducing concentrations of DDT compounds in the water column. The low gradient reach from above Sunnyside (approximately r.m. 70) to Prosser Dam (r.m. 47.2) is an area where deposition is known to occur (Zuroske, 2008). USGS has characterized this reach as a "slow-moving meandering pool" (Morace et al., 1999).



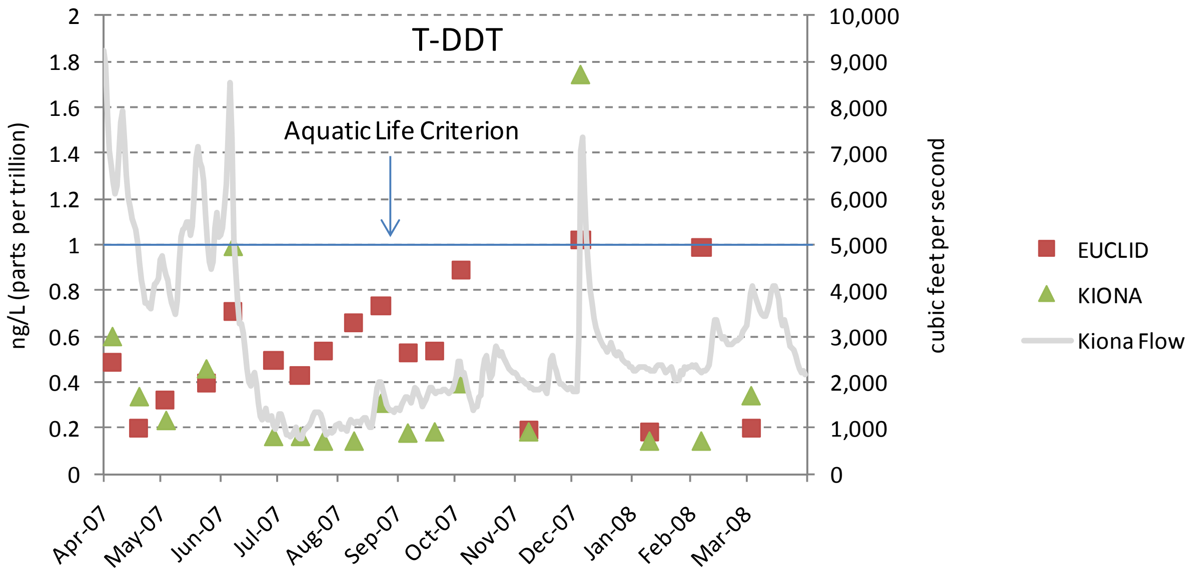


Figure 25. Seasonal Patterns in DDE and Total DDT at Two Sites in the Lower Mainstem Yakima River *(ng/L= parts per trillion; non-detects plotted at the reporting limit).*

The highest DDE and total DDT concentrations were recorded during a storm event in December (12/4/08). Ebbert and Embrey (2002) and others have demonstrated that pesticides like DDT that persist in soil continue to be transported in Yakima River streams and drains throughout the year, especially during storm runoff or snowmelt.

DDE was meeting the human health criterion (0.59 ng/L) at Euclid and Kiona throughout most the irrigation season. However, it was at or close to the criterion in June and September and exceeded the criterion at Euclid in early October. Concentrations fluctuated widely during the winter, at which time the human health criterion was exceeded on two occasions. The river was at or above the chronic aquatic life criterion for total DDT (1.0 ng/L) on three occasions, once during irrigation and twice during the winter.

A different pattern was observed for dieldrin, which showed an inverse relationship with flow (Figure 26). Concentrations increased substantially at Euclid and Kiona as flows decreased during the second half of the irrigation season; dieldrin then dropped to levels at or below detection in the fall and winter. Unlike DDT compounds, dieldrin was little affected by the December storm event. Thus, dieldrin appears to fluctuate primarily with the amount of available dilution.

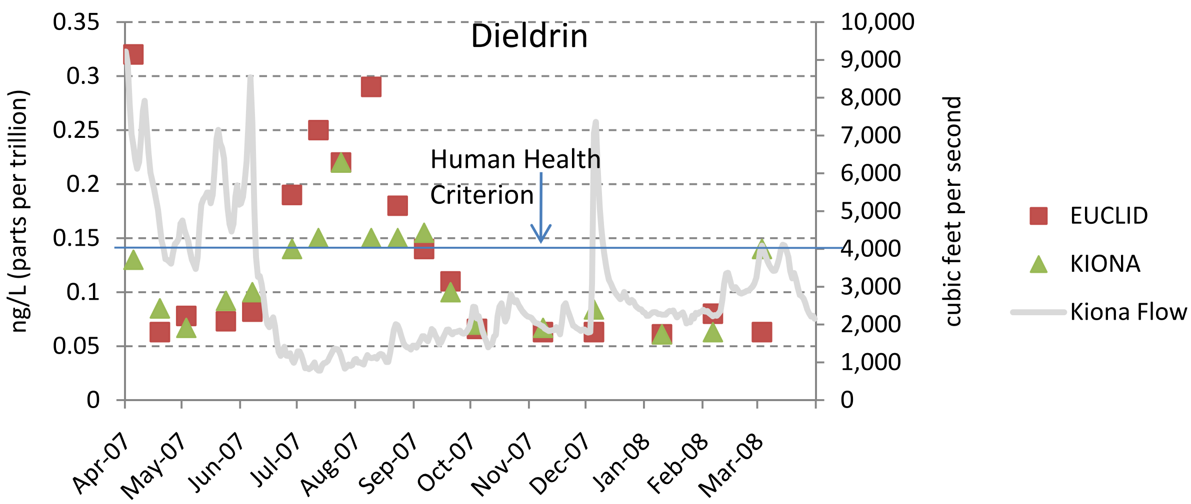


Figure 26. Seasonal Patterns in Dieldrin Concentrations at Two Sites in the Lower Mainstem Yakima River *(ng/L= parts per trillion; non-detects plotted at the reporting limit).*

The contrasting behavior of dieldrin vs. DDT compounds is likely due to dieldrin's greater solubility and lower affinity for suspended matter. Estimates obtained from the SPMD deployments indicate that more than 90% of the dieldrin is in dissolved form and not associated with particulates. The inverse relationship with flow suggests a potential groundwater contribution. A similar pattern was not observed in any of the four major irrigation returns, but has been reported for Wide Hollow Creek and attributed to subsurface flows (Johnson and Burke, 2006).

The human health criterion for dieldrin (0.14 ng/L) was exceeded at Euclid at the start of the irrigation season and from July through September. Kiona had lower concentrations, but was at or slightly above the criterion on a number of occasions during the second half of the irrigation season and substantially exceeded it once. Dieldrin never approached the chronic aquatic life criterion (1.9 ng/L) at either location.

Endosulfan and chlorpyrifos exhibited several distinct peaks associated with their application during the growing season (Figure 27). Concentrations were uniformly low during the winter.

Figures 28 and 29 give a snapshot of the concentrations observed during the initial spike detected on April 4-5, 2007. At this time, concentrations in the lower river increased by more than a factor of 3 for endosulfan and by a factor of 10 or more for chlorpyrifos. Although neither of these insecticides approached water quality criteria, the timing of the maximum concentrations may have been missed due to the twice-a-month sampling schedule.

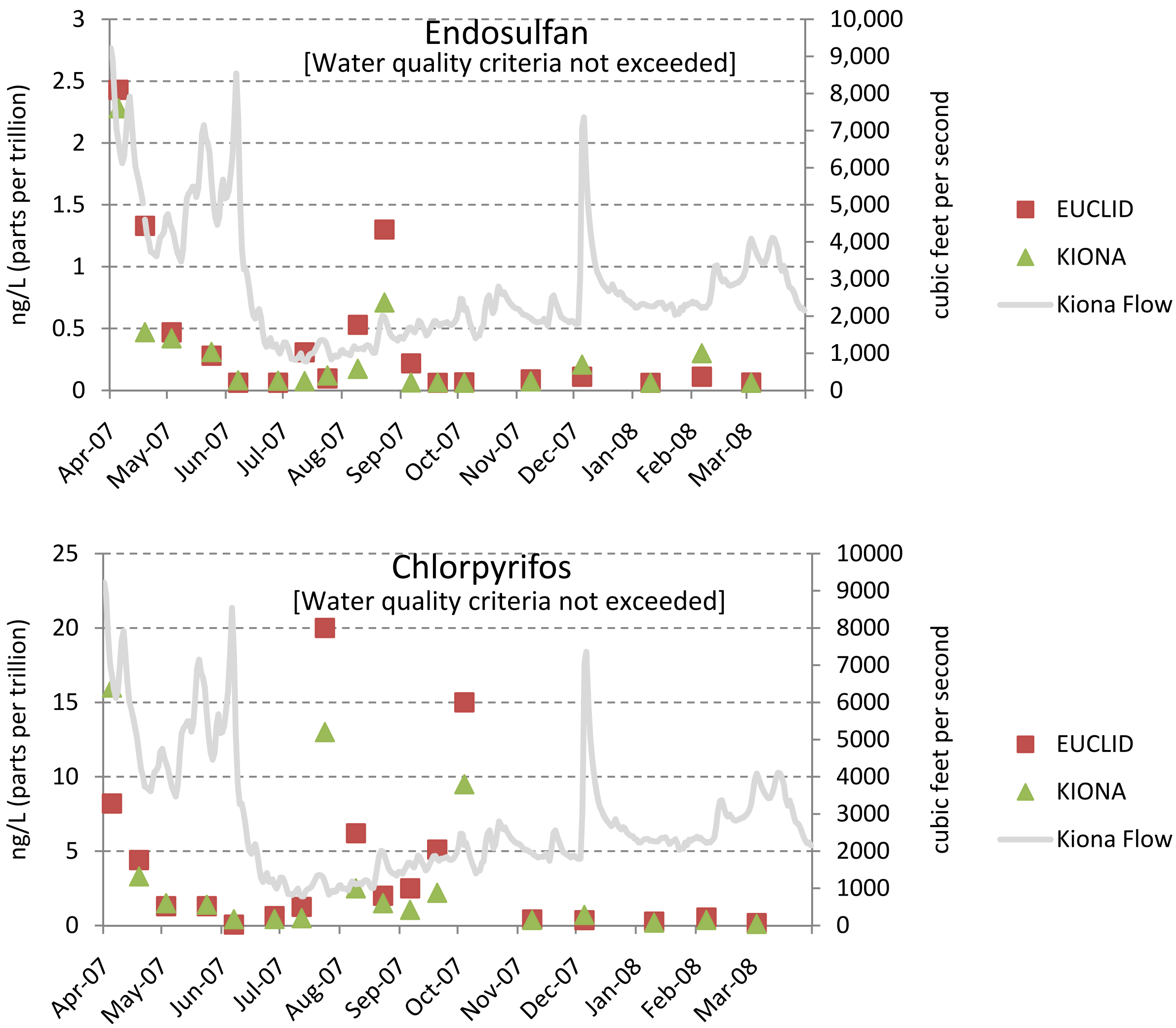


Figure 27. Seasonal Patterns in Endosulfan and Chlorpyrifos Concentrations at Two Sites in the Lower Mainstem Yakima River *(ng/L= parts per trillion; non-detects plotted at the reporting limit).*

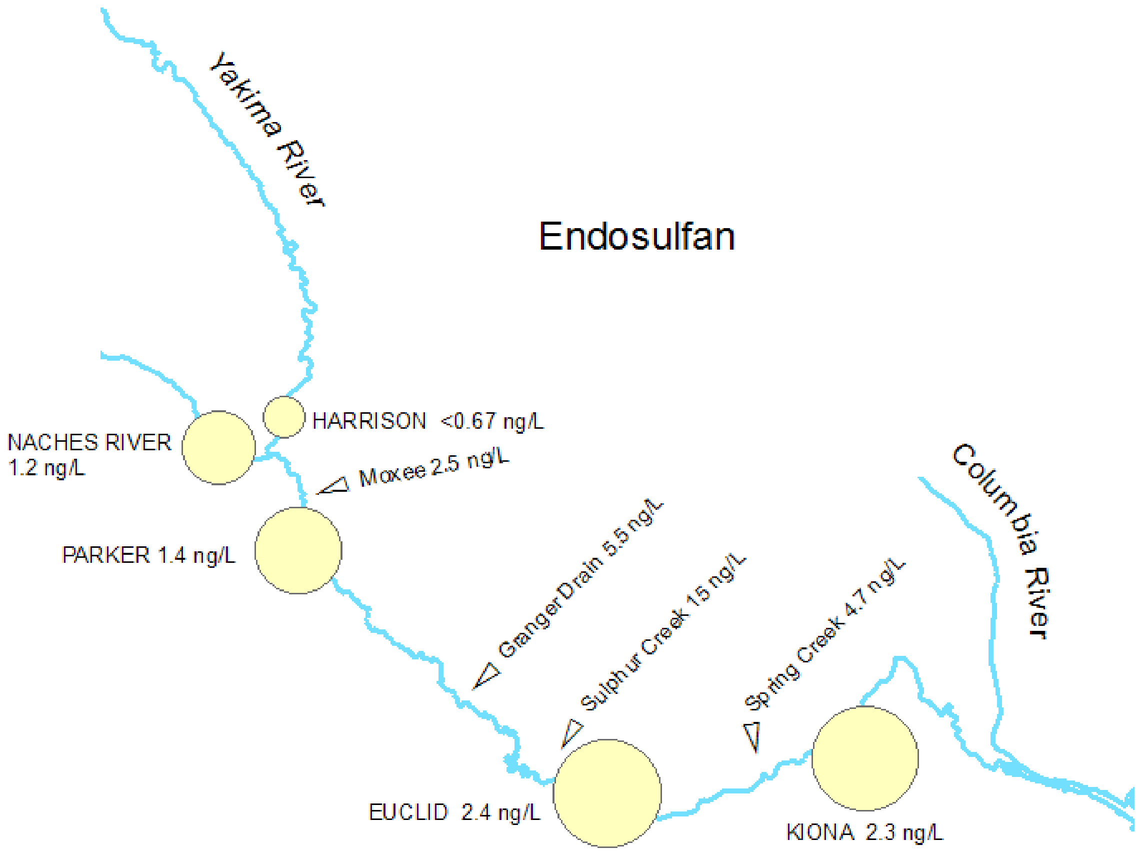


Figure 28. Endosulfan Concentrations in the Lower Yakima River on April 4-5, 2007
(ng/L = parts per trillion, concentration proportional to circle area, non-detects shown as less than ½ detection limit).

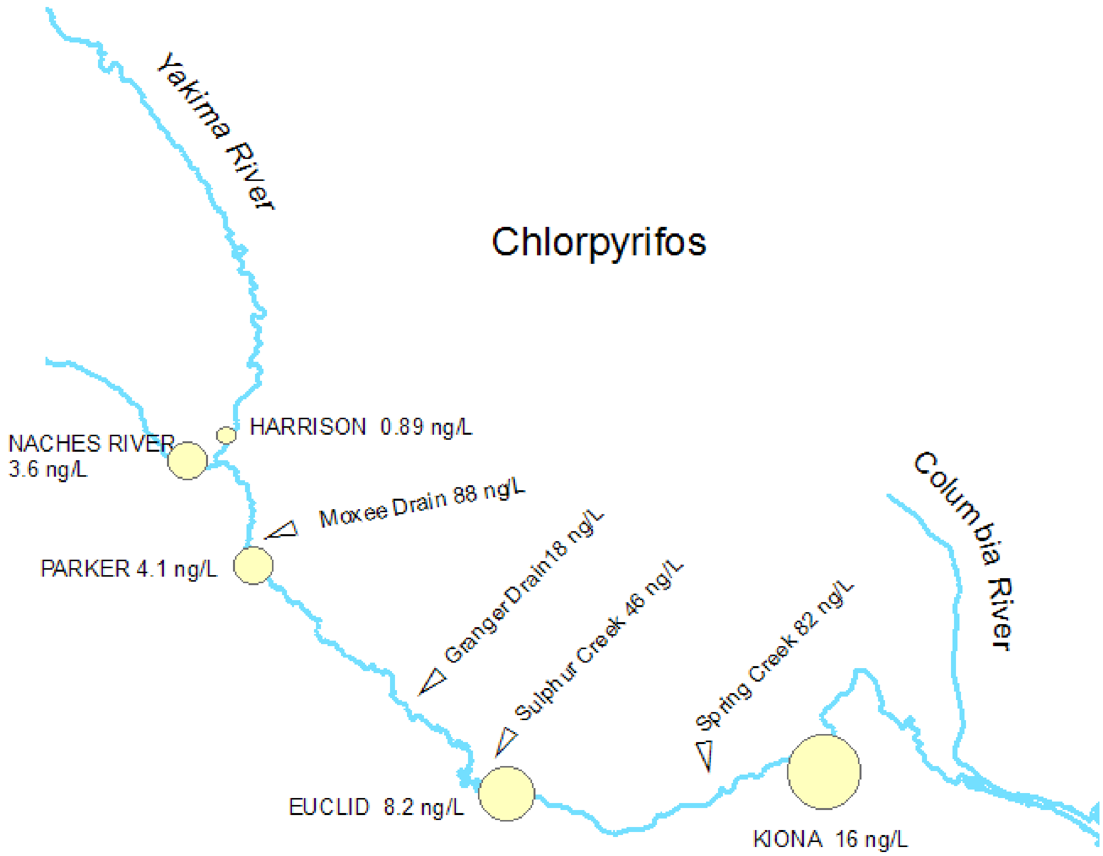


Figure 29. Chlorpyrifos Concentrations in the Lower Yakima River on April 4-5, 2007 *(ng/L = parts per trillion, concentration proportional to circle area).*

Major Irrigation Returns

Time-series plots for DDE, total DDT, and dieldrin in Moxee Drain, Granger Drain, Sulphur Creek Wasteway, and Spring Creek are displayed in Figures 30-33. Flow data were obtained from USGS (http://waterdata.usgs.gov/wa/nwis) or gauged in the field (Spring Creek). In general, concentrations increased in the early part of the irrigation season, followed by a decrease into fall and winter. Sulphur Creek Wasteway showed a second period of elevated concentrations during winter that corresponded to increases in TSS and turbidity.

In Moxee Drain and Spring Creek, water quality criteria violations for DDT compounds and dieldrin were primarily limited to the irrigation season. Granger Drain and Sulphur Creek Wasteway had exceedances throughout the year.

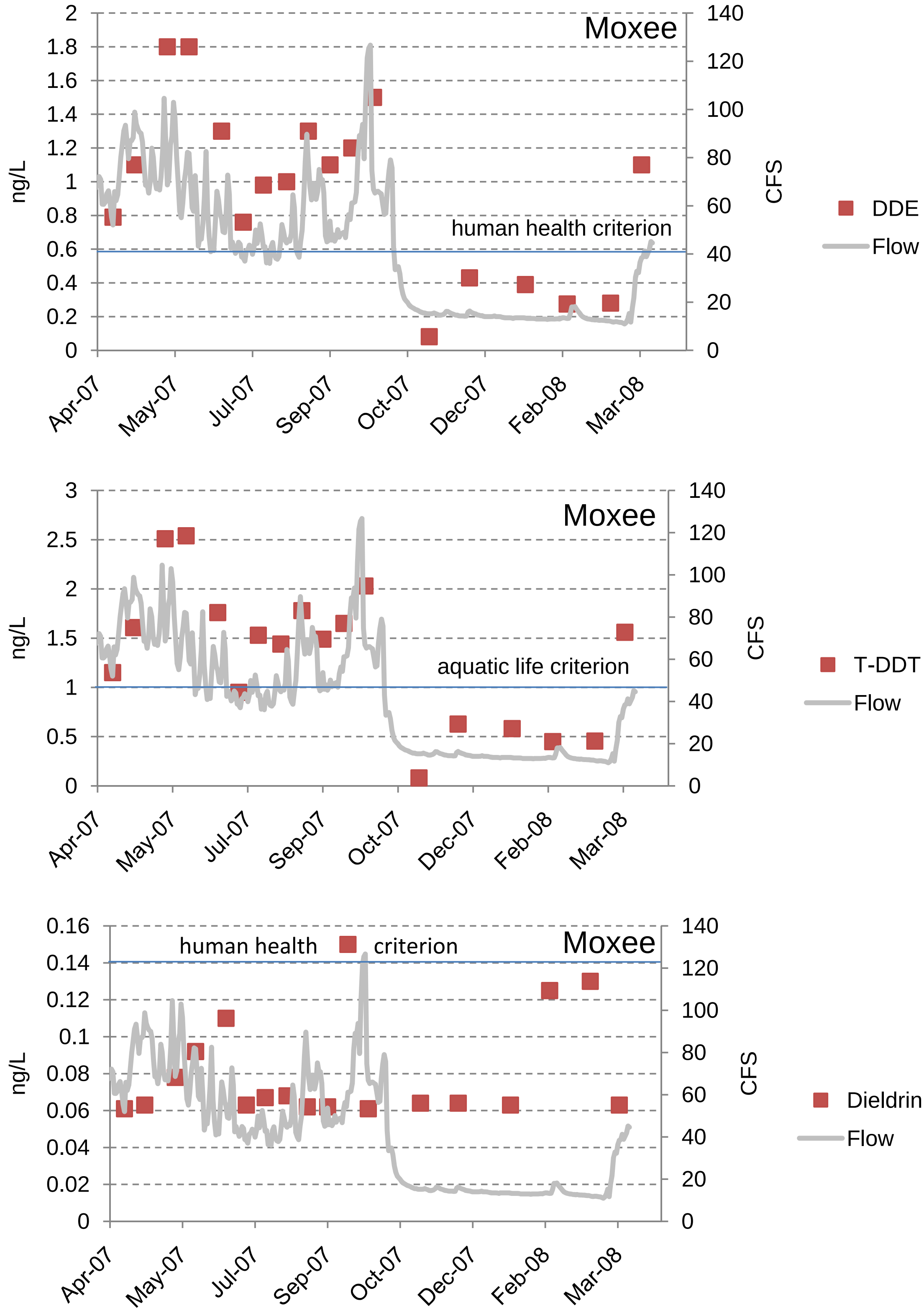


Figure 30. DDT Compounds and Dieldrin in Moxee Drain during 2007-08.

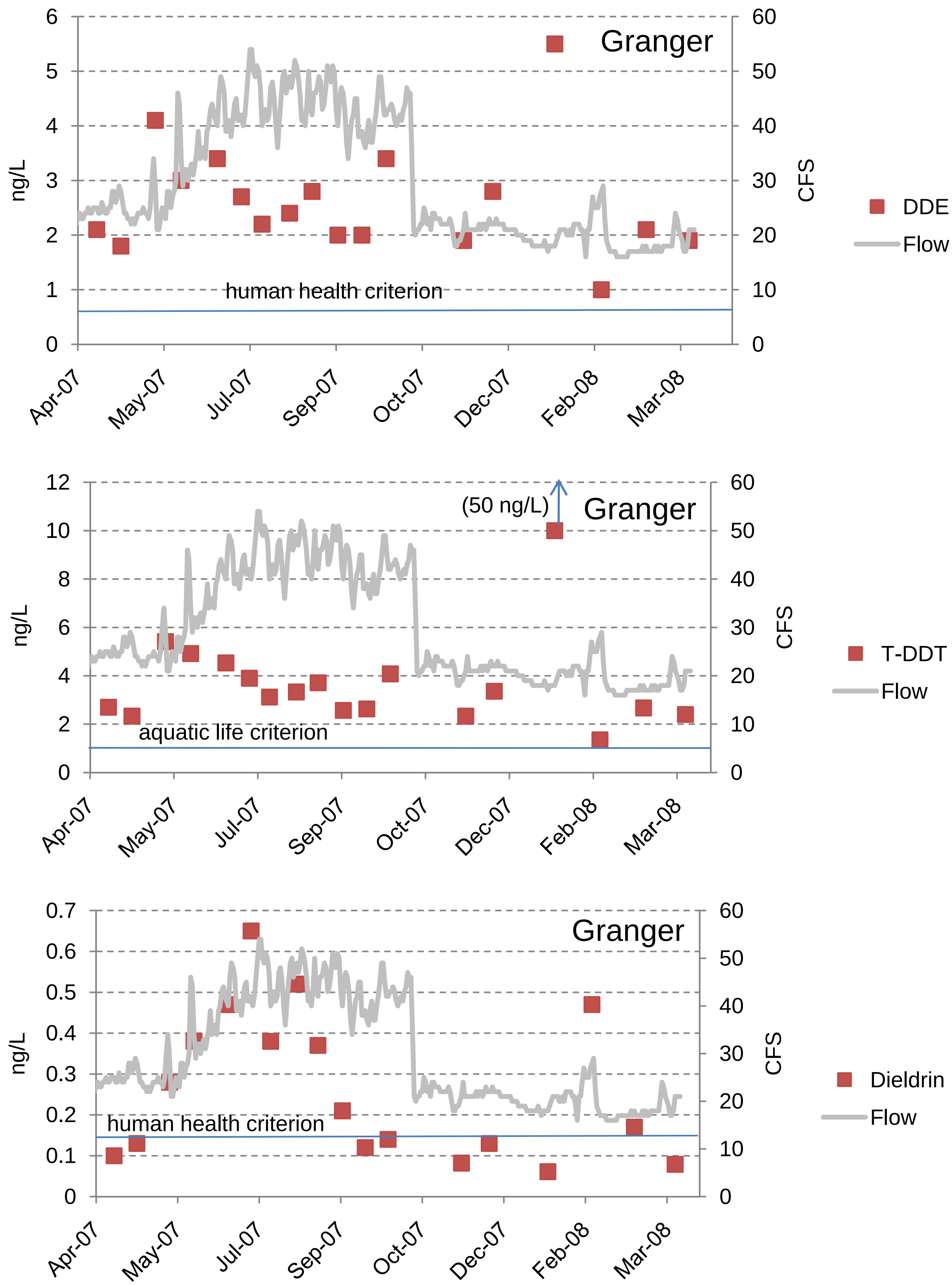


Figure 31. DDT Compounds and Dieldrin in Granger Drain during 2007-08.

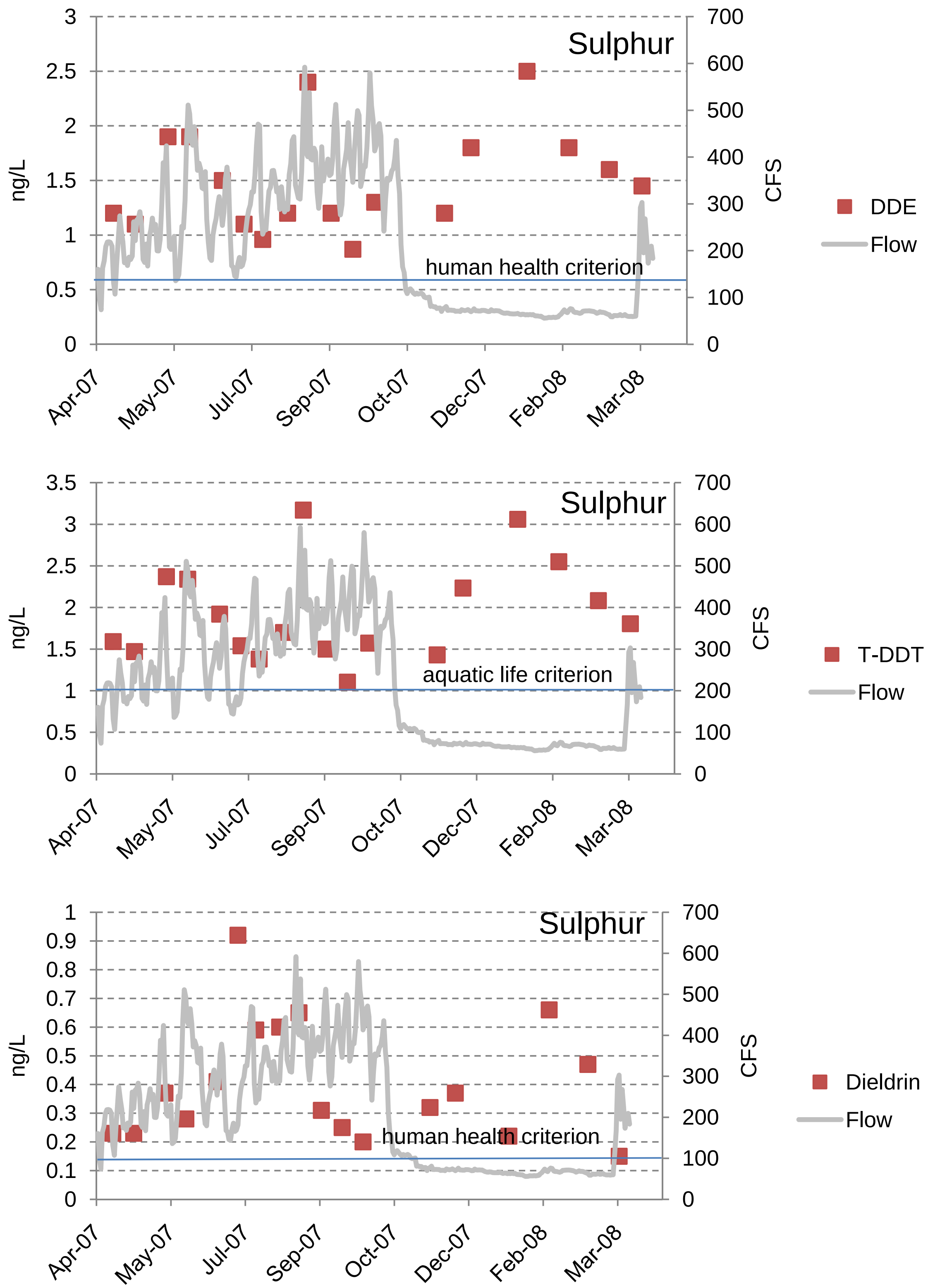


Figure 32. DDT Compounds and Dieldrin in Sulphur Creek Wasteway during 2007-08.

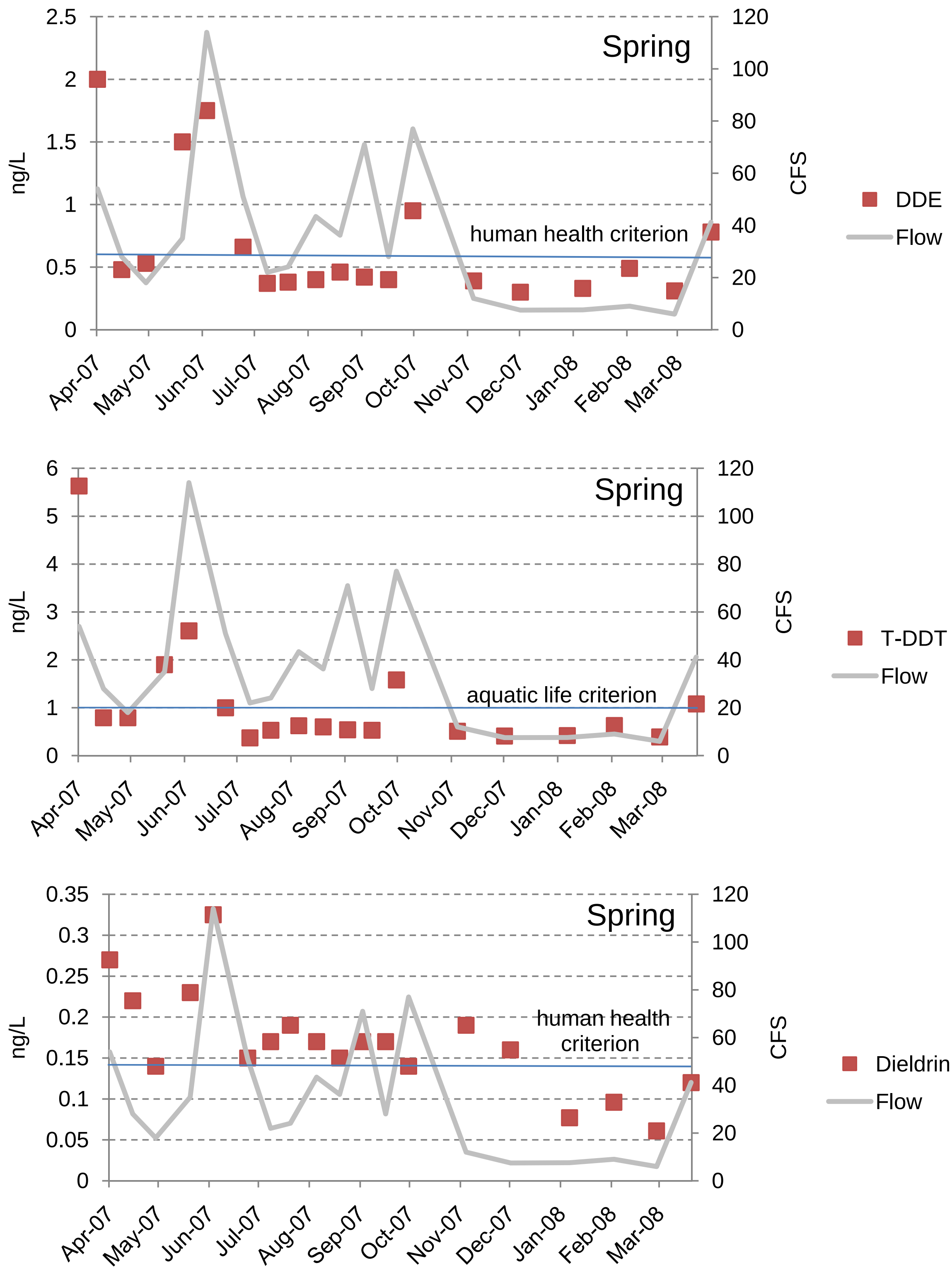
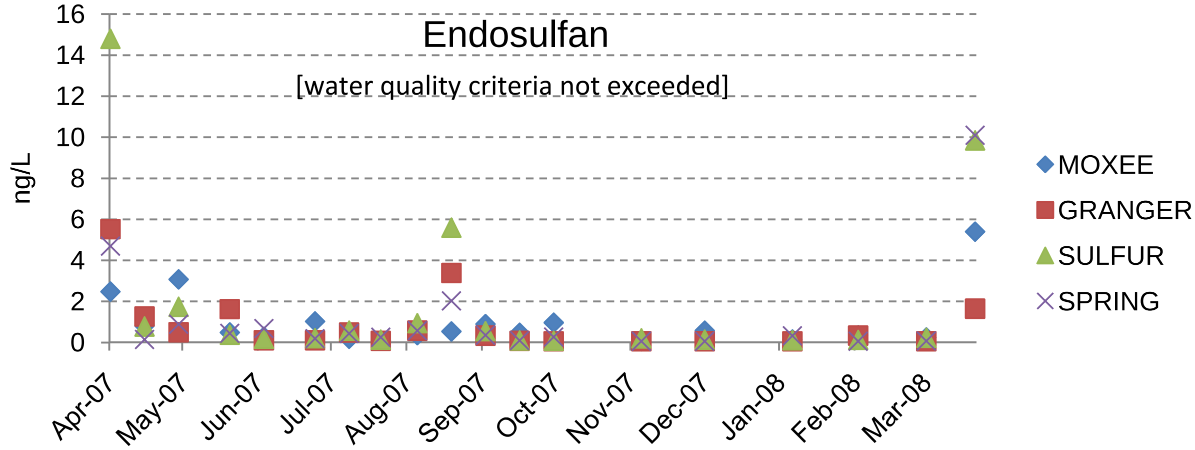


Figure 33. DDT Compounds and Dieldrin in Spring Creek during 2007-08.

Endosulfan exhibited the same peaks seen in the mainstem, demonstrating that the returns were contributing sources (Figure 34). No mainstem samples were collected that corresponded to the late March 2008 peak seen in all four returns (3/28/08). The maximum endosulfan concentrations observed in the returns were always well within water quality criteria.



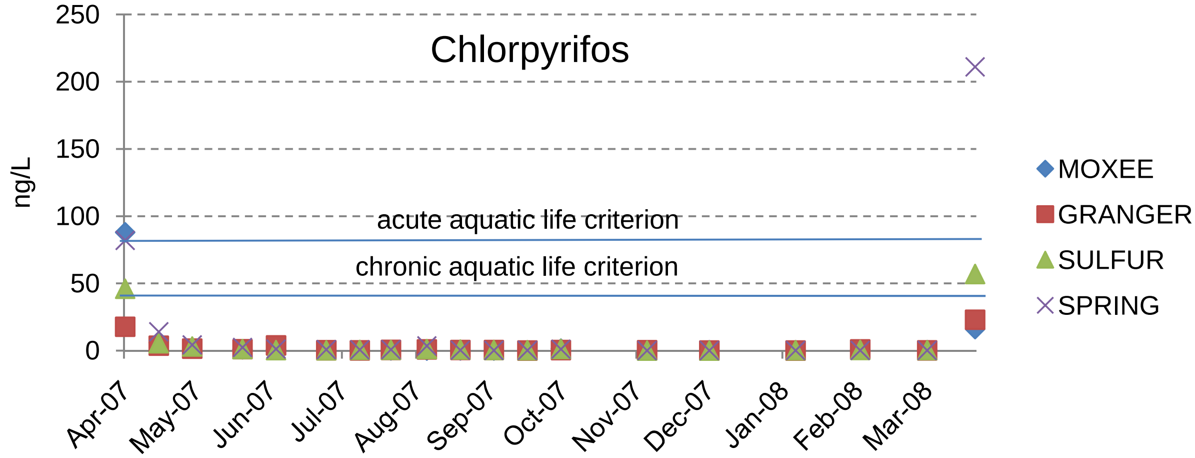


Figure 34. Endosulfan and Chlorpyrifos in Four Major Irrigation Returns to the Yakima River during 2007-08.

The returns and the mainstem showed corresponding chlorpyrifos peaks in April. The mainstem peaks of August and October, however, were not seen in any of the returns, indicating there were other sources. The highest chlorpyrifos levels were recorded at the start of irrigation in both 2007 and 2008, at which time the acute aquatic life criterion was exceeded in Spring Creek and, marginally, in Moxee Drain.

Endosulfan and chlorpyrifos are applied during certain windows over the growing season. Again, peak concentrations were potentially missed with a twice-a month sampling regime. Ecology conducted more intensive pesticides monitoring in Sulphur Creek Wasteway and Spring Creek during 2007 as part of the *Surface Water Monitoring Program for Pesticides in Salmonid-Bearing Streams* (SWMP; Dugger et al., 2008). Samples were collected weekly from February through October. Current-use pesticides are the focus of this ongoing effort.

SWMP's chlorpyrifos data are compared to results from twice-a-month sampling in Figure 35. Although the present study detected the approximate timing of the chlorpyrifos peaks, it did not record the highest concentrations, which substantially exceeded criteria. During the remainder of the year, concentrations were below the SWMP reporting limit of 33 ng/L and thus not comparable to the present study (0.06 ng/L reporting limit).

SWMP also monitored Sulphur Creek Wasteway and Spring Creek in previous years. Although chlorpyrifos levels appeared to be lower, acute or chronic aquatic life criteria were still exceeded during peak usage periods (Table 24).

SWMP's reporting limit for endosulfan is 50 ng/L. Endosulfan has not been detected at or above this level in either of these returns. Reporting limits for DDT compounds, dieldrin, and other 303(d) listed pesticides analyzed by SWMP are not low enough to compare to water quality criteria.

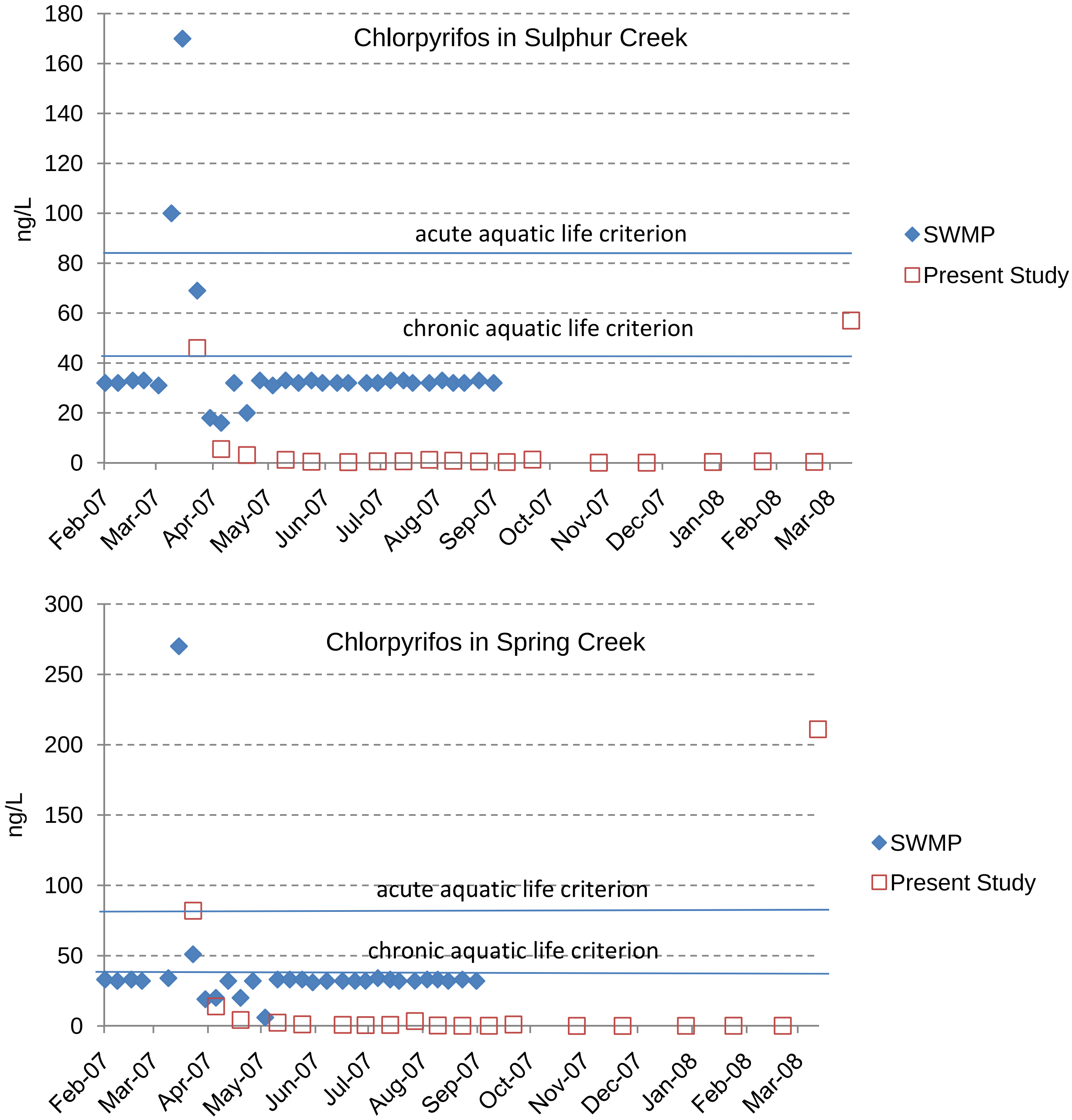


Figure 35. Chlorpyrifos Concentrations in Sulphur Creek Wasteway and Spring Creek Compared to Results from the SWMP *(Dugger et al., 2008; non-detects plotted at the reporting limit).*

Table 24. Summary of Chlorpyrifos Data Reported for Sulphur Creek Wasteway and Spring Creek by SWMP *(ng/L; parts per trillion).*

Year:	2007	2006	2005	2004	2003
Monitoring Period:	Feb.-Sept.	March-Oct.	March-Oct.	April-Oct.	April-Dec.
Sulphur Creek Wasteway					
No. of Samples	31	24	29	31	18
Detection Frequency	13%	29%	21%	19%	19%
Median Concentration	100	13	19	11	8
Maximum Concentration	170	100	37	47	13
Spring Creek					
No. of Samples	31	36	29	31	18
Detection Frequency	19%	31%	24%	19%	24%
Median Concentration	30	15	28	11	4
Maximum Concentration	270	60	89	77	9

Source: Burke et al. (2006); Dugger et al. (2008).

Pesticide Loads

The routine monitoring data were used to calculate average loads of total DDT, dieldrin, endosulfan, and chlorpyrifos in the Yakima River, Naches River, and major returns during the 2007 irrigation season (Table 25). A concentration equal to half the reporting limit was assumed where a pesticide was not detected.

Table 25. Average Loads of Selected 303(d) Pesticides during the 2007 Irrigation Season *(grams per day).*

Location	Mean Flow (cfs)	Total DDT	Dieldrin	Endosulfan	Chlorpyrifos
Yakima River at Harrison	1,646	~0.1	~0.2	~0.4	~0.9
Naches River at mouth	1,843	0.8	~0.1	1.0	~4.0
Yakima River at Parker	2,081	0.7	~0.2	2.2	6.4
Yakima River at Euclid	2,657	3.2	0.6	5.2	27
Yakima River at Kiona	3,227	3.6	0.6	4.3	36
Moxee Drain	62	0.3	0.01	0.2	1.3
Granger Drain	37	0.3	0.03	0.1	0.2
Sulfur Creek Wasteway	293	1.3	0.3	1.2	2.3
Spring Creek	46	0.2	0.02	0.1	1.0

Note: Half the reporting limit used for non-detects.
"~" indicates >50% of samples were below reporting limit.

Figure 36 shows the loads in downstream order. A substantial increase in loading is evident between Harrison Bridge and Euclid for all four pesticides, with most of the increase occurring between Parker and Euclid. Total DDT, dieldrin, and endosulfan loads remained about the same between Euclid and Kiona indicating an absence of large sources in this reach. There was increased chlorpyrifos loading downstream of Euclid.

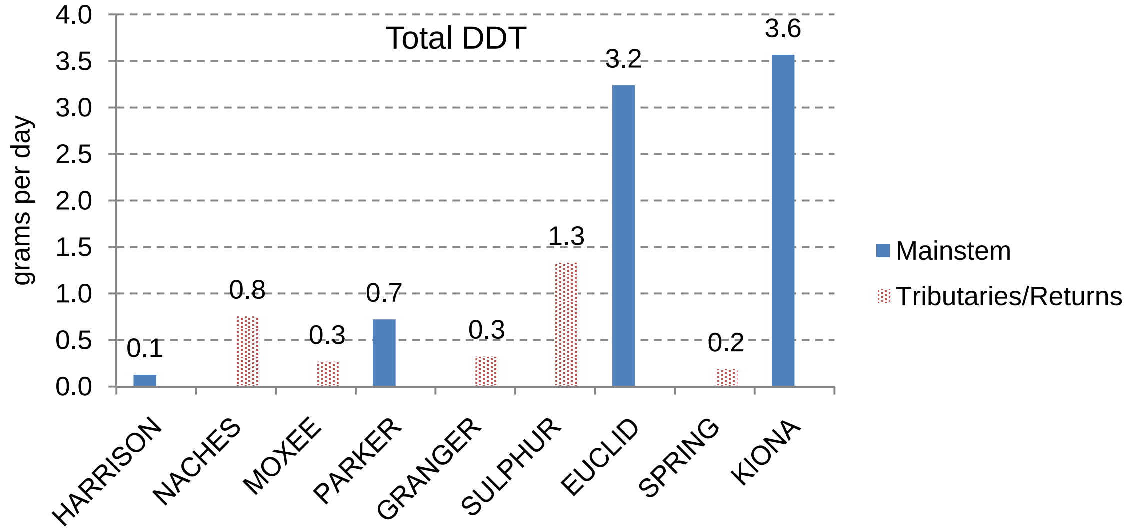


Figure 36. Average Loads of Selected 303(d) Pesticides during the 2007 Irrigation Season *(grams per day).*

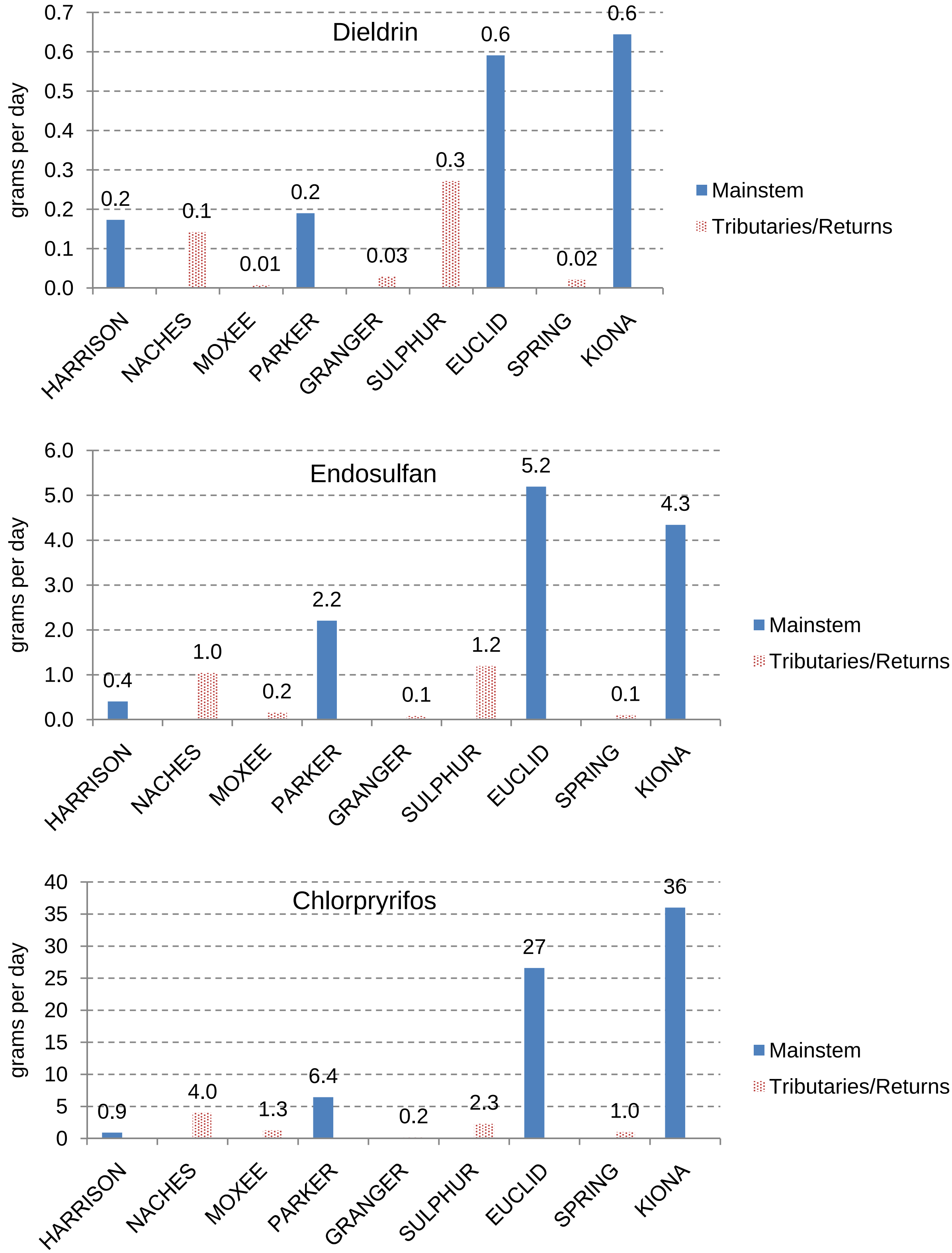


Figure 36. Average Loads of Selected 303(d) Pesticides (continued).

Figure 37 illustrates the relative importance of the four returns as pesticide sources during and after the irrigation season. On average, the combined loading of total DDT, dieldrin, and endosulfan potentially accounted for half to a third of the load at Kiona during irrigation. The returns appeared to be minor sources of chlorpyrifos, on average. The endosulfan and chlorpyrifos loads could be biased low due to sampling frequency, as previously described. The potential for the returns to affect pesticide levels in the Yakima River was much reduced after the end of the irrigation season.

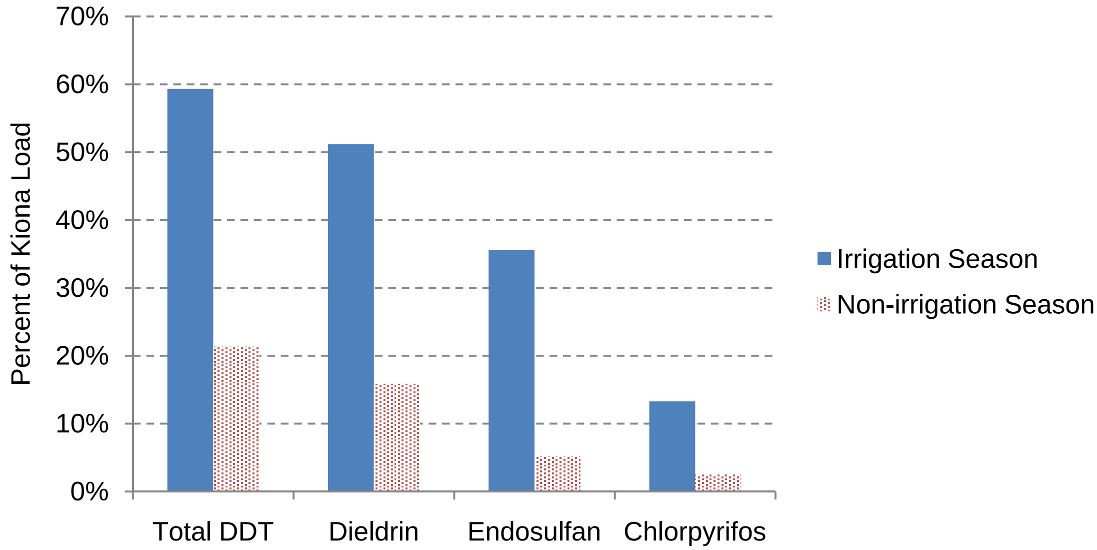


Figure 37. Average Combined Pesticide Loading from Moxee Drain, Granger Drain, Sulphur Creek Wasteway, and Spring Creek as a Percentage of the Average Load in the Yakima River @ Kiona during 2007-08.

Other Lower River Tributaries and Returns

Twenty-three additional tributaries and irrigation returns to the lower Yakima River were screened for pesticides, suspended sediment, and turbidity during 2007-08. Most of these discharges had either never been sampled for pesticides or the samples had not been analyzed down to human health criteria levels. Quarterly monitoring provided results for 85 samples. The sampling locations were previously shown in Figure 8.

A summary of the data for 303(d) listed pesticides is provided in Table 26. Reporting limits were the same as for the routine monitoring stations (0.061-0.067 ng/L, 3 ng/L for toxaphene). Once again, pesticides not on the 303(d) list were infrequently detected or present at low levels. The complete results from the screening survey are in Appendix K.

Table 26. Summary of Results from Screening for 303(d) Listed Pesticides in 23 Tributaries and Irrigation Returns to the Lower Yakima River during 2007-08 *(concentrations in ng/L, parts per trillion).*

	DDT	DDE	DDD	Dieldrin
No. of Samples	85	85	85	84
Detection Frequency (%)	44%	93%	65%	46%
Median Concentration	0.066 U	0.56	0.11 U	0.11 U
Mean Concentration	0.24	1.0	0.21	0.25
90th Percentile Concentration	0.63	2.8	0.48	0.55
Maximum Concentration	1.3	6.1	1.3	1.9
	Endosulfan	**Chlorpyrifos**	**Chlordane**	**Alpha-BHC**
No. of Samples	84	84	85	85
Detection Frequency (%)	79%	83%	7%	2%
Median Concentration	0.33	0.65	0.063 U	0.063 U
Mean Concentration	0.66	2.2	0.064 U	0.064 U
90th Percentile Concentration	1.3	7.3	0.065 U	0.065 U
Maximum Concentration	12	21	0.14	0.14

U = not detected at or above reported value.

Pesticide detection frequencies and concentration levels were generally similar to findings for Moxee Drain, Granger Drain, Sulphur Creek Wasteway, and Spring Creek. DDT and dieldrin, however, tended to be detected less frequently.

DDE, total DDT, and dieldrin exceeded water quality criteria in a number of the screening survey discharges. Endosulfan, chlorpyrifos, chlordane, and alpha-BHC were always meeting criteria. Toxaphene was not detected at or above 3 ng/L.

Figure 38 plots the DDE, total DDT, and dieldrin concentrations as a ratio of the applicable water quality criterion (concentration divided by criterion). Values greater than 1.0 exceed the criterion. The results are arranged in downstream order, starting with Selah Creek above the city of Yakima (r.m. 123.7) and ending with Amon Wasteway near Richland (r.m. 2.1).

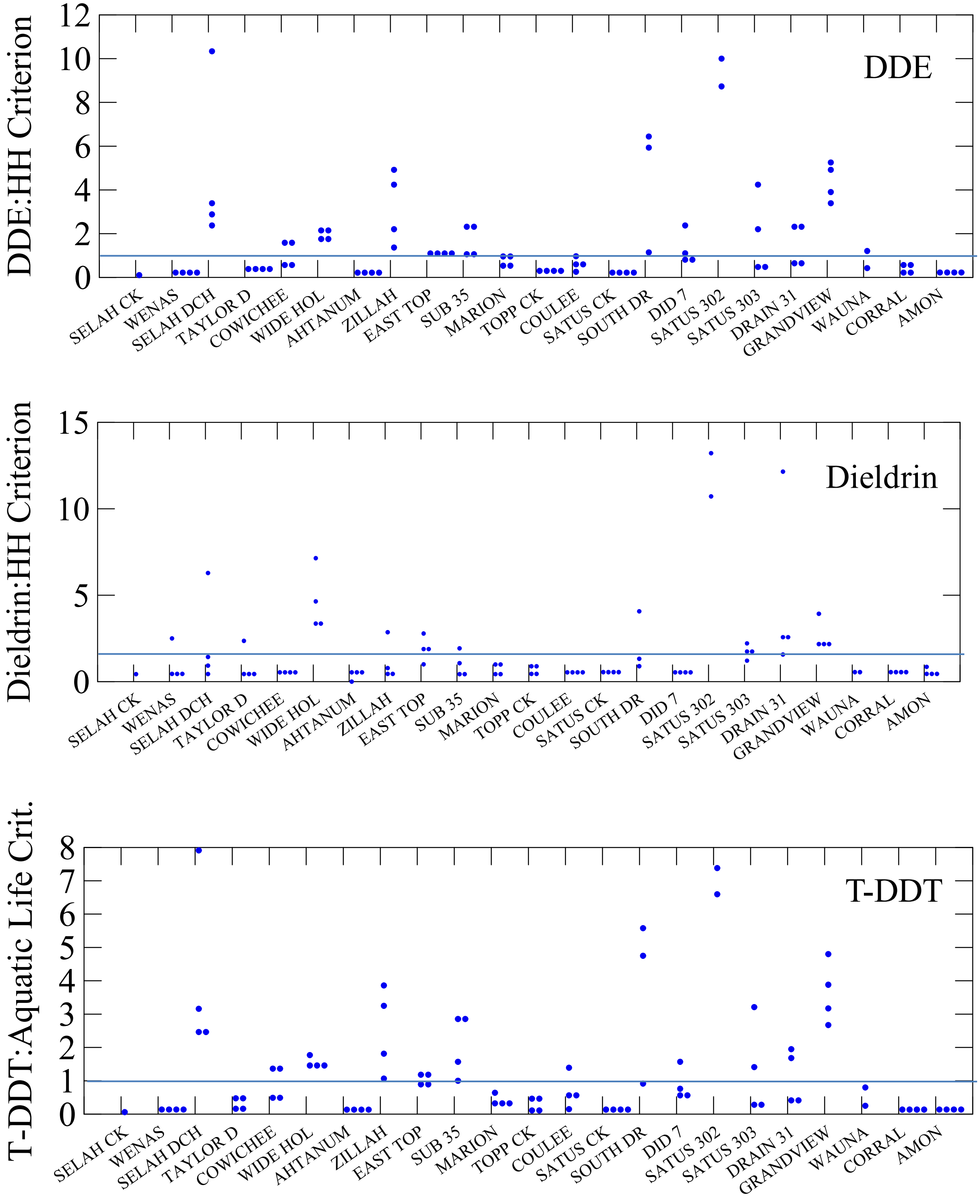


Figure 38. Concentration:Criteria Ratios for DDT compounds and Dieldrin in 23 Tributaries and Irrigation Returns to the Lower Yakima River *(ratios >1 exceed criterion).*

Table 27 highlights those discharges where human health or chronic aquatic life criteria were exceeded by a factor of 2 or more in at least half of the quarterly screening samples. Ten discharges fall into this category. All are irrigation return or have a significant agricultural return flow component (Wide Hollow Creek). Because sample size for the screening survey was small, these results may over or underestimate the true extent of water quality criteria violations in individual discharges.

Table 27. Lower Yakima River Irrigation Returns that Substantially Exceeded Human Health or Chronic Aquatic Life Criteria in Screening Samples Collected during 2007-08. *(N=4)*

Irrigation Return	Human Health Criteria Exceeded		Chronic Aquatic Life Criteria Exceeded
	DDE	Dieldrin	Total DDT
Grandview Drain	●	●	●
Satus Drain #302	●	●	●
Drain #31	●	●	
Selah Ditch	●		●
Zillah Drain	●		●
Satus Drain #303	●		
South Drain	●		●
Subdrain 35	●		●
Wide Hollow Creek		●	
East Toppenish Drain		●	

There was evidence of substantial amounts of un-degraded DDT in several of these returns (Table 28). As discussed elsewhere in this report, the source is assumed to be disturbance of subsurface soils rather than recent use. All other tributaries and drains in the screening survey consistently had 35% or less DDT.

Table 28. Instances Where a High Proportion of Un-degraded DDT was Found in 2007-08 Screening Survey Samples *(DDT as percent of total DDT).*

Irrigation Return	Collection Period			
	May-07	Aug-07	Nov-07	Feb-08
Satus 302	**65%**	**65%**	---- not flowing ----	
South Drain	**63%**	40%	3%	3%
Subdrain 35	**60%**	29%	3%	14%
Grandview Drain	24%	32%	15%	**55%**

Overall, the screening survey showed water quality criteria for DDE and total DDT were exceeded more frequently during the irrigation season (Figure 39). Dieldrin exceeded at a similar rate both during and after irrigation.

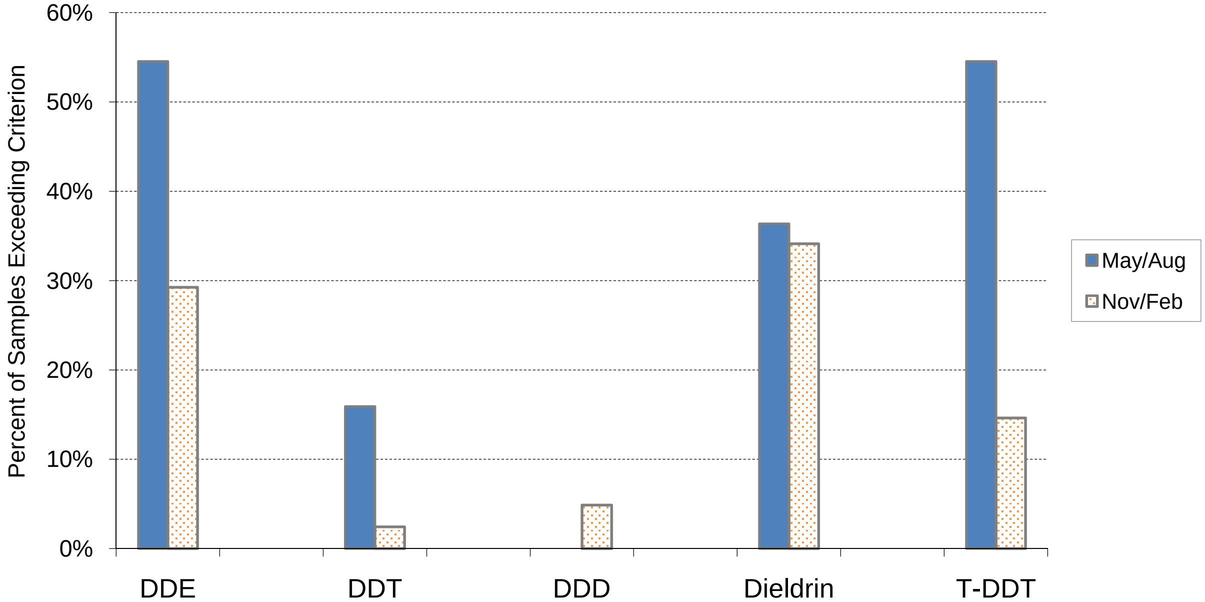


Figure 39. Percent of Samples Exceeding Human Health or Chronic Aquatic Life Criteria (T-DDT) in 23 Tributaries and Irrigation Returns to the Lower Yakima River during (May/August) and after (November/February) the 2007 Season (quarterly samples).

Ecology's SWMP has done intensive pesticide monitoring in Marion Drain, located on the Yakama Reservation (Dugger et al., 2008). The results for 2007 show two large chlorpyrifos peaks that were missed in the quarterly screening survey samples (Figure 40). The acute aquatic life criterion was exceeded on both occasions. Endosulfan was not detected in these samples at or above 50 ng/L. SWMP reporting limits for other 303(d) listed pesticides were not low enough to compare to water quality criteria.

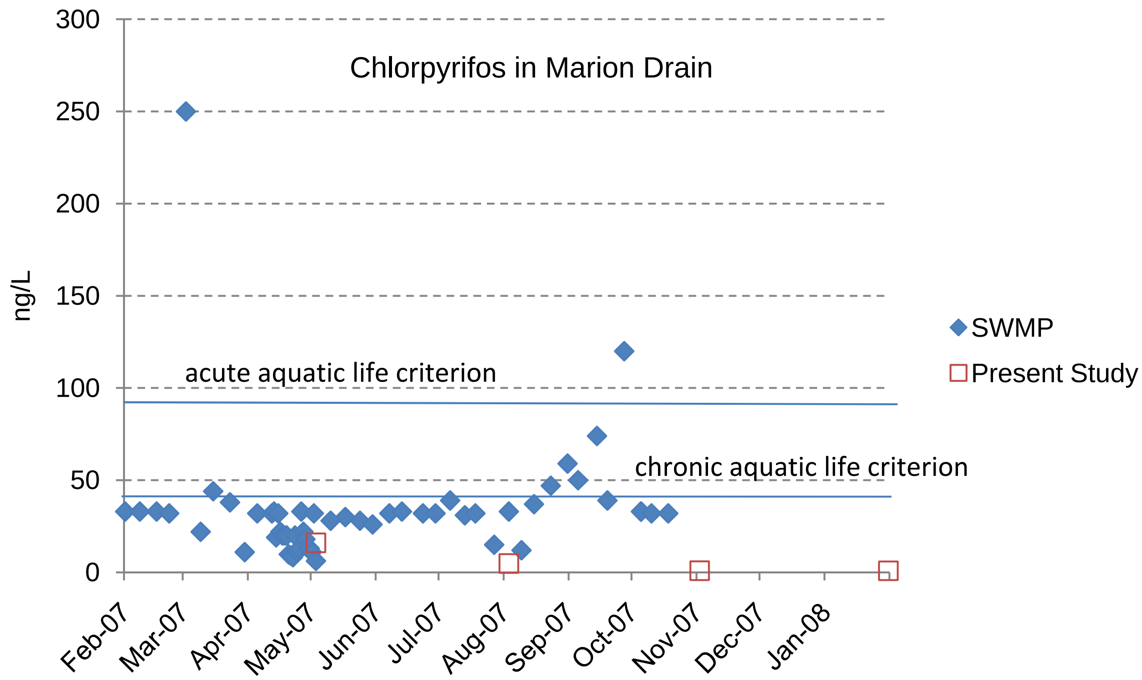


Figure 40. Chlorpyrifos Concentrations Measured in Marion Drain Compared to Results from the SWMP *(Dugger et al., 2008; non-detects plotted at the reporting limit).*

In a 2005-06 study, Ecology conducted twice-a-month monitoring for dieldrin and endosulfan in Wide Hollow Creek which flows through Union Gap (Johnson and Burke, 2006). As in 2007-08, Wide Hollow consistently exceeded the human health criterion for dieldrin (Figure 41). The chronic aquatic life criterion was also exceeded on two occasions. Peak dieldrin concentrations occurred after the irrigation season and showed an inverse relationship with flow and positive correlation with conductivity. This was attributed to subsurface drainage in the watershed.

Endosulfan showed a spring peak in Wide Hollow associated with the treatment window in local orchards. Water quality criteria were not exceeded, which is consistent with the quarterly samples collected in 2007-08.

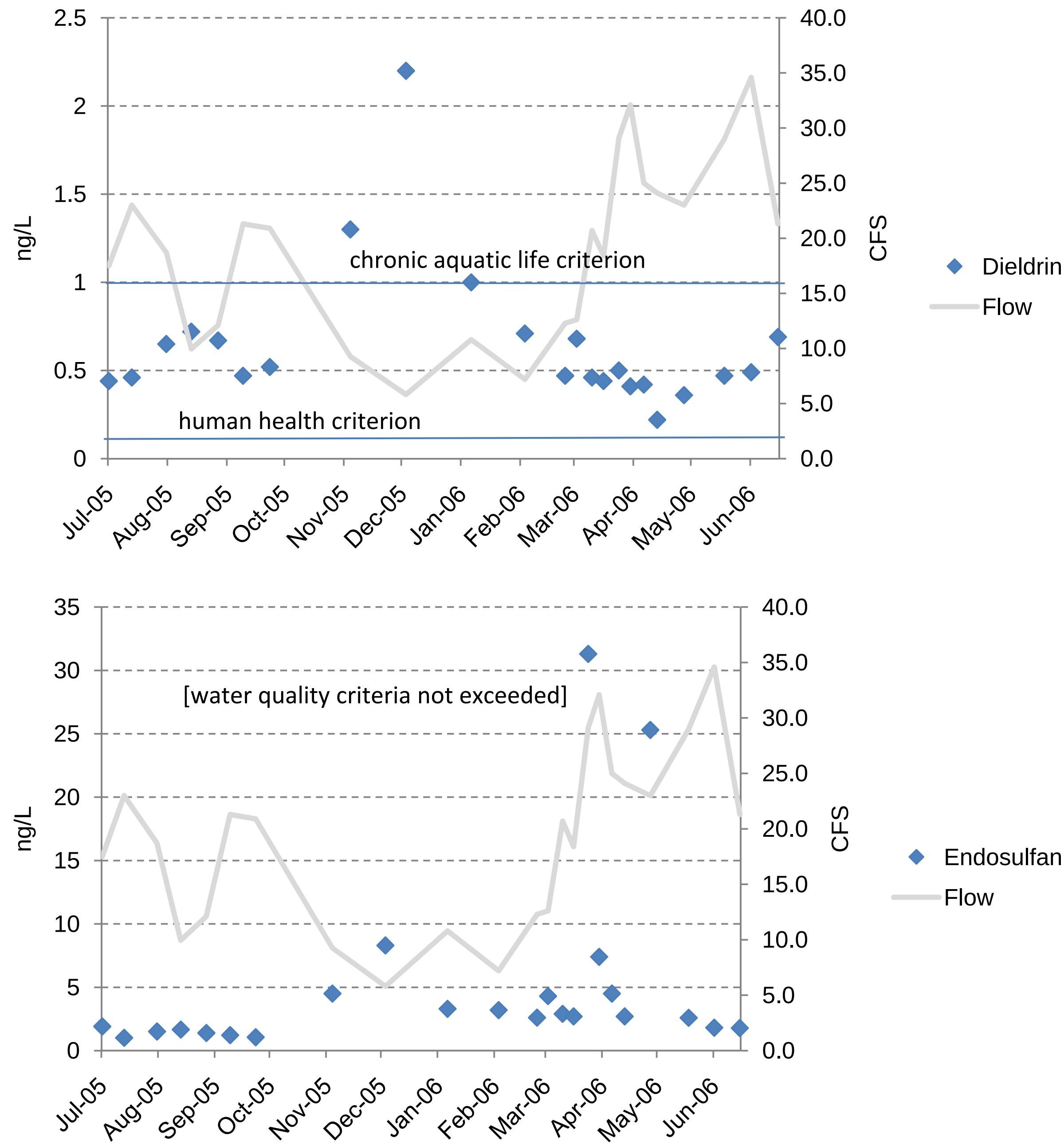


Figure 41. Results from Monitoring Dieldrin and Endosulfan in Wide Hollow Creek in 2005-06 *(Johnson and Burke, 2006).*

The screening survey data from May and August were used to provide a rough estimate of the average combined loads of total DDT, dieldrin, endosulfan, and chlorpyrifos during the 2007 irrigation season (Table 29). The loads are compared to the loads measured through more intensive monitoring of the four major returns. The screening survey results, although limited, suggest these discharges may have a comparable impact on the river.

Table 29. Pesticide Loads from 23 Screening Survey Tributaries and Irrigation Returns Compared to Loads from the Four Major Returns: Moxee Drain, Granger Drain, Sulfur Creek Wasteway, and Spring Creek *(average combined load during the 2007 irrigation season (grams per day).)*

Source	Total DDT	Dieldrin	Endosulfan	Chlorpyrifos
Screening Survey Tributaries & Returns*	2.1	0.30	1.1	8.7
Major Returns†	2.1	0.33	1.5	4.8

*May and August samples.
†April through October samples.

Comparison with Historical Pesticide Data

Surface Water

Pesticide levels in the lower Yakima River before and after the *Suspended Sediment and DDT TMDL* have been documented for 1988-89 (Rinella et al., 1993, 1999), 1992-96 (Davis, 1993; Davis and Johnson, 1994; Davis, 1996; Davis et al., 1998a; Joy and Patterson, 1997; Johnson and Burke, 2006), and 1999-2000 (Ebbert and Embrey, 2002). The analytical methods employed in these studies have been adequate to consistently quantify concentrations of DDT compounds, dieldrin, and endosulfan at a number of locations. Chlorpyrifos has been analyzed, but detections were sporadic. Chlordane and alpha-BHC are rarely seen in the historical water quality data.

Figure 42 shows the total DDT, dieldrin, and endosulfan concentrations recorded between 1988 and 2008 for Moxee Drain, Granger Drain, Sulphur Creek Wasteway, Wide Hollow Creek, and the Yakima River at Euclid and Kiona. These sites are where the most significant contamination has been documented. Historical detections of dieldrin and endosulfan have primarily been confined to irrigation returns.

As first reported for total DDT by Fuhrer et al. (2004), there has been a significant drop in pesticide levels in Yakima surface water over the past 10 years. Since the TMDL effort was initiated, concentrations of DDT compounds, dieldrin, and endosulfan have decreased by one-to-two orders of magnitude (factors of 10). This can be attributed to the combined effects of reduced soil erosion, pesticide degradation, and, in the case of endosulfan, improved application practices.

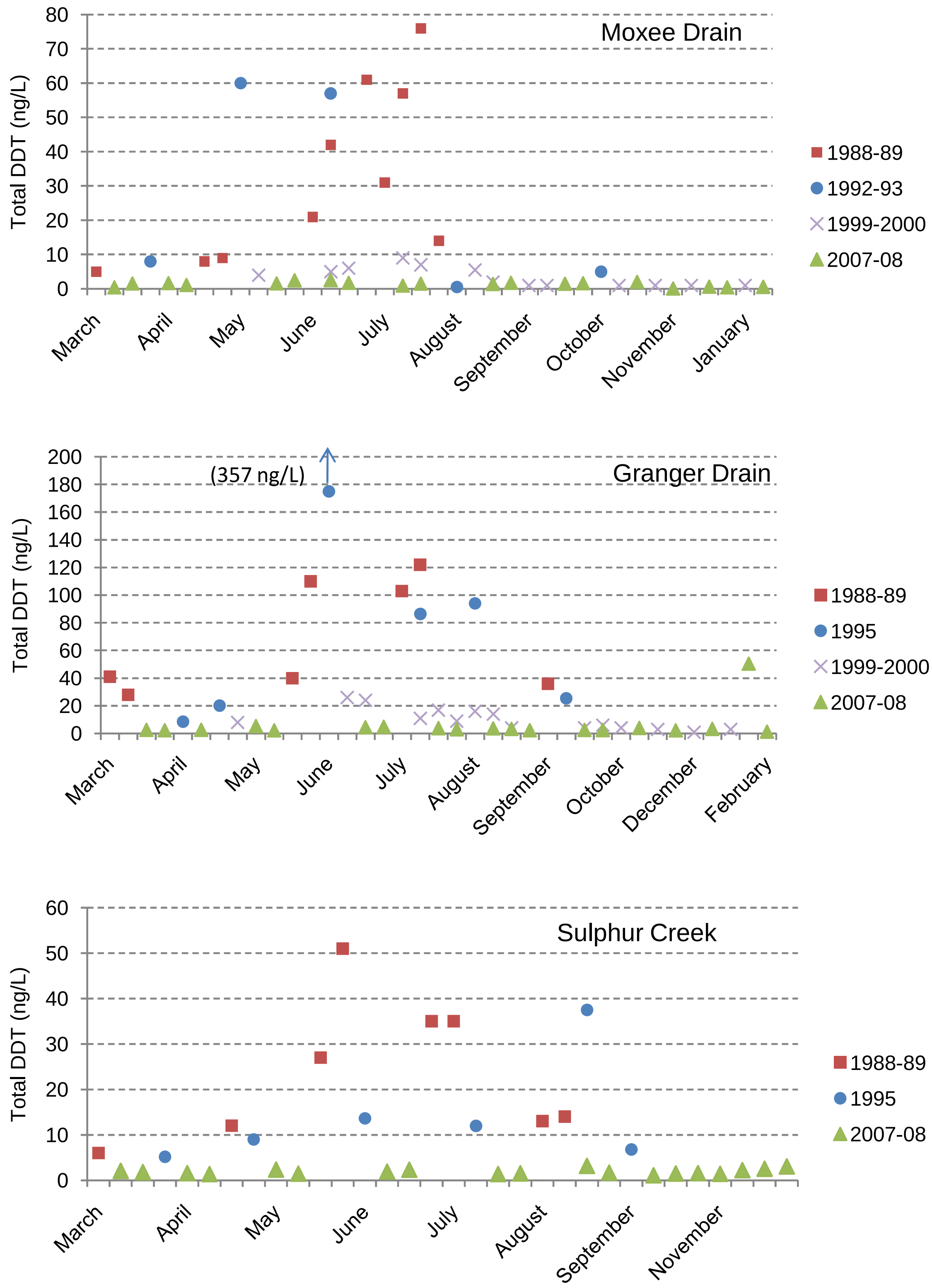


Figure 42. Pesticide Levels in the Lower Yakima River Drainage, 1988-2008 *(nondetects plotted as unfilled symbols).*

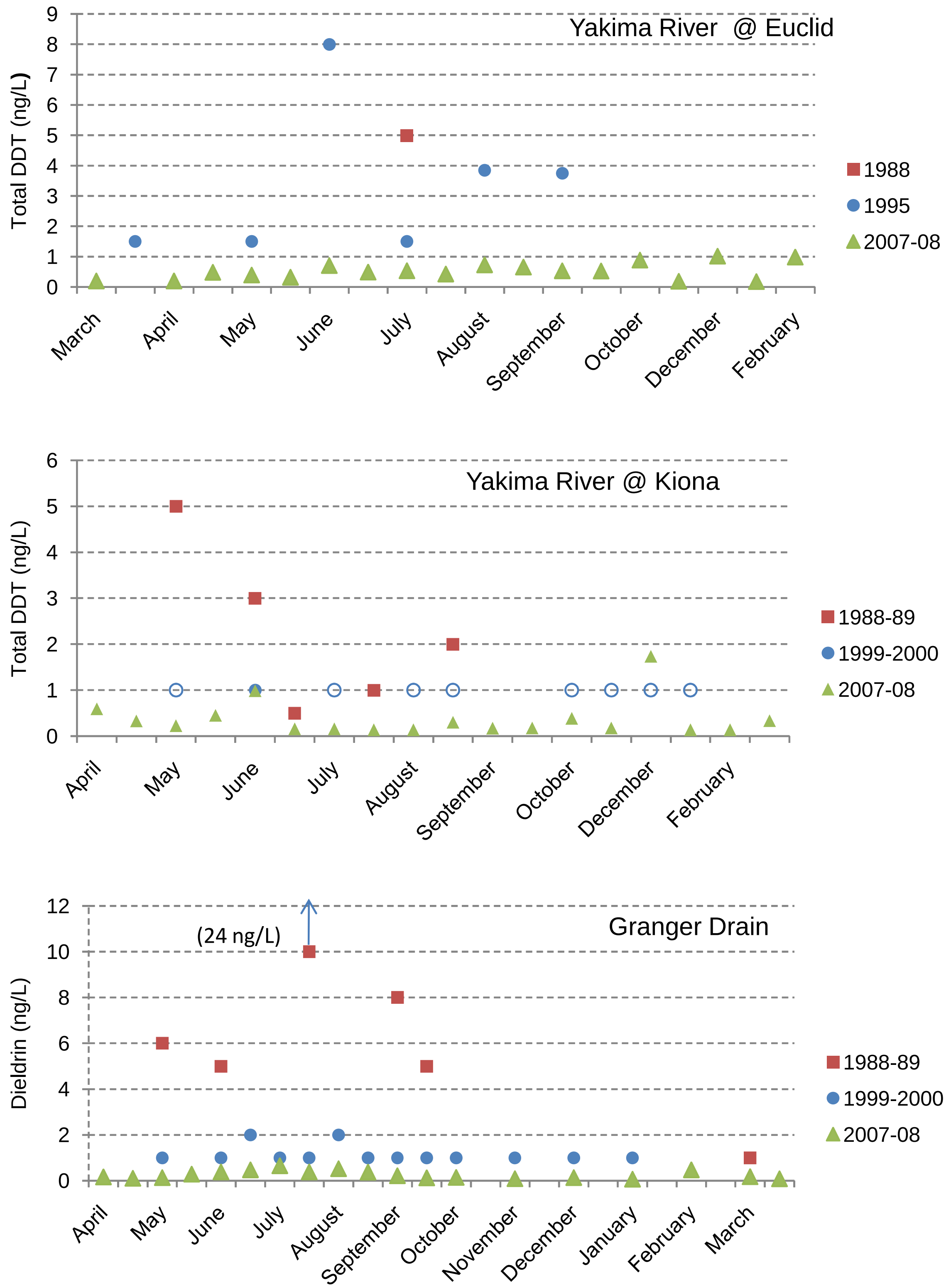
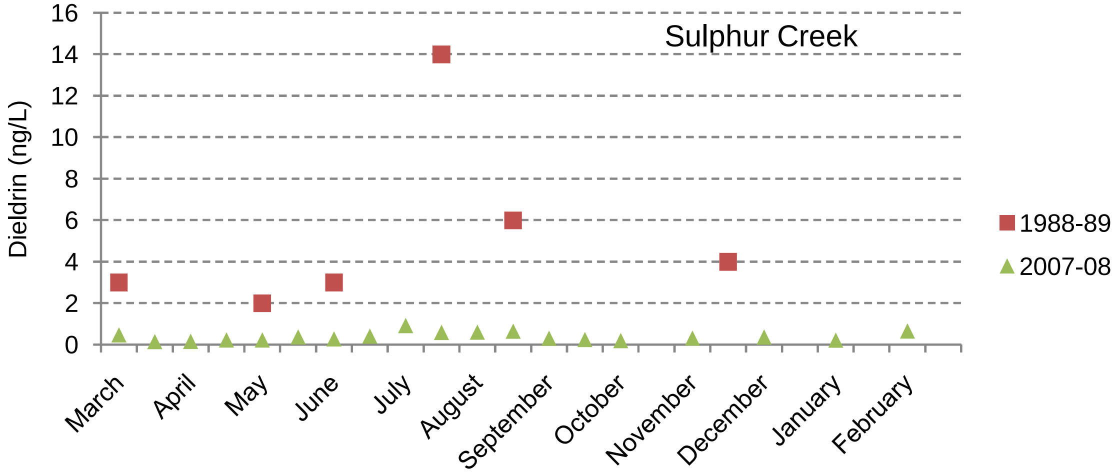
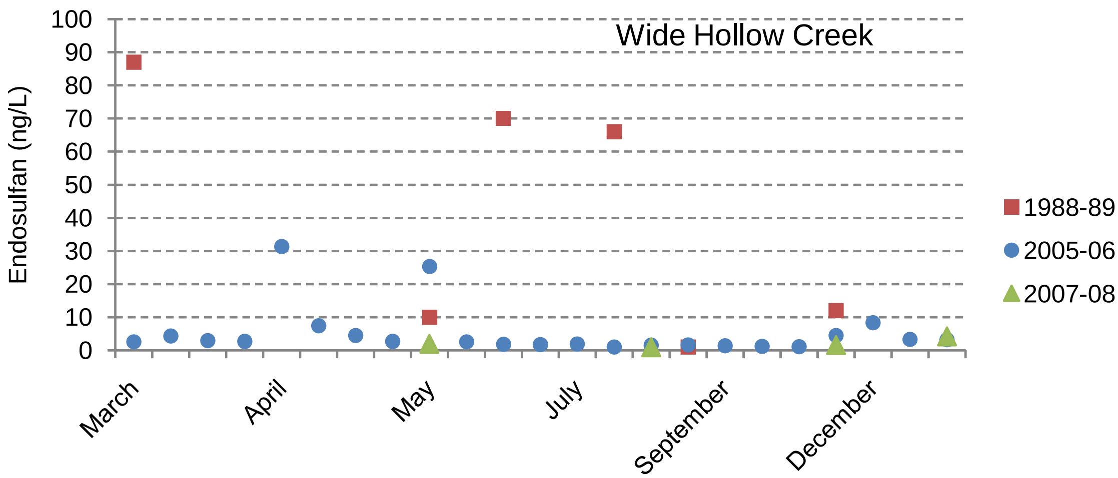


Figure 42. Historical Pesticide Data (continued).





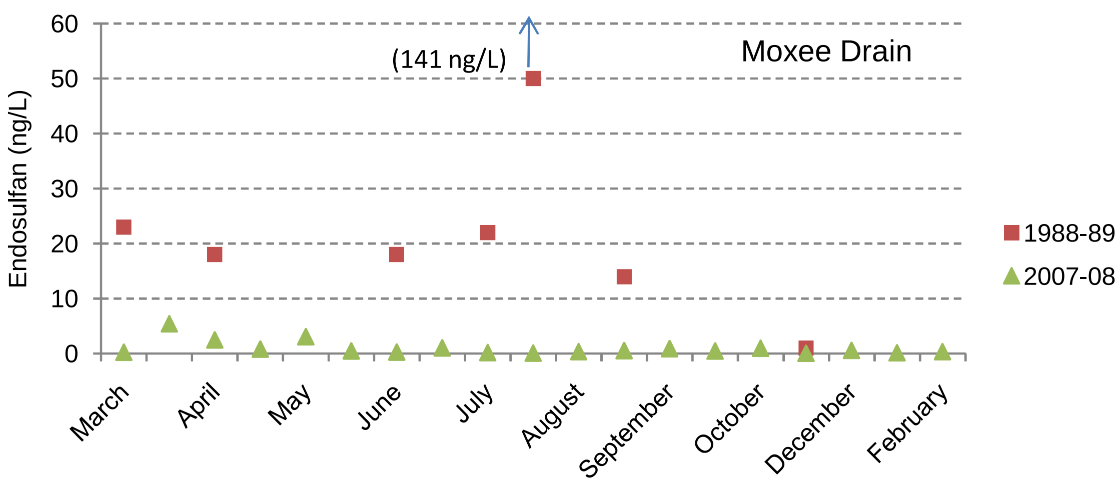


Figure 42. Historical Pesticide Data (continued).

DDT compounds break down extremely slowly. DDT's half-life in soil has been reported to reach 15-30 years (Makay et al., 1997; Edwards, 1973). Investigations in California have led to the conclusion that DDT is "preserved" in agricultural soils statewide (Agee, 1986; Mischke et al., 1985). Once discharged to surface water, the DDE breakdown product is essentially stable (Callahan et al., 1979). Thus, water quality improvements for DDT in the Yakima River can largely be attributed to soil conservation efforts initiated as a result of the TMDLs. This conclusion is bolstered by the accompanying decreases seen in TSS and turbidity, described later in this report.

Fish Tissue

Legacy chlorinated pesticide residues have also decreased in Yakima River fish in recent years. The trends, however, are not as clear-cut as in water samples. This is because of differences between studies in analytical methods; when and where fish were collected; the age, sex, tissues, and species analyzed; and fish movements within the river and its tributaries.

Yakima River fish have been analyzed for pesticide residues by the U.S. Fish and Wildlife Service, USGS, EPA, and Ecology; the data are tabulated in Johnson et al. (2007). Results on edible tissue samples collected from the lower river since 1995 were examined for comparable data with respect to species, sampling location, and tissues analyzed.

Data comparable to results from Ecology's 2006 survey are limited to two studies which analyzed fillets in four species from the Toppenish-Prosser reach and one species in the Kiona-Horn Rapids reach (Davis et al., 1998b; EPA, 2002a). One or two composite samples were analyzed for each species, with five or more individual fish per composite. These data show a large decrease in DDE and dieldrin residues in lower Yakima River fish between 1995 and 2006 (Figure 43).

Fish Consumption Advisories

In 1993, the Washington State Department of Health (WDOH) issued an advisory that recommended limiting consumption of bottom fish from the lower Yakima River due to the high levels of DDT compounds.

WDOH evaluated Ecology's 2006 fish tissue data and observed that DDT levels had dropped substantially. They determined that "the fish advisories based on DDT levels were no longer needed." A news release was issued on April 30, 2009 lifting the fish consumption advisory due to the lower DDT levels

In the same news release, WDOH concluded that PCB levels in carp from the lower Yakima River were above background levels for Washington State freshwater fish, indicating the need for consumers to reduce their exposure. WDOH advised that people limit consumption of common carp in the lower section of the river to one meal per week. The advisory applies to carp taken from the city of Prosser to the Yakima River mouth near Richland.

The full text of WDOH's news release is in Appendix L.

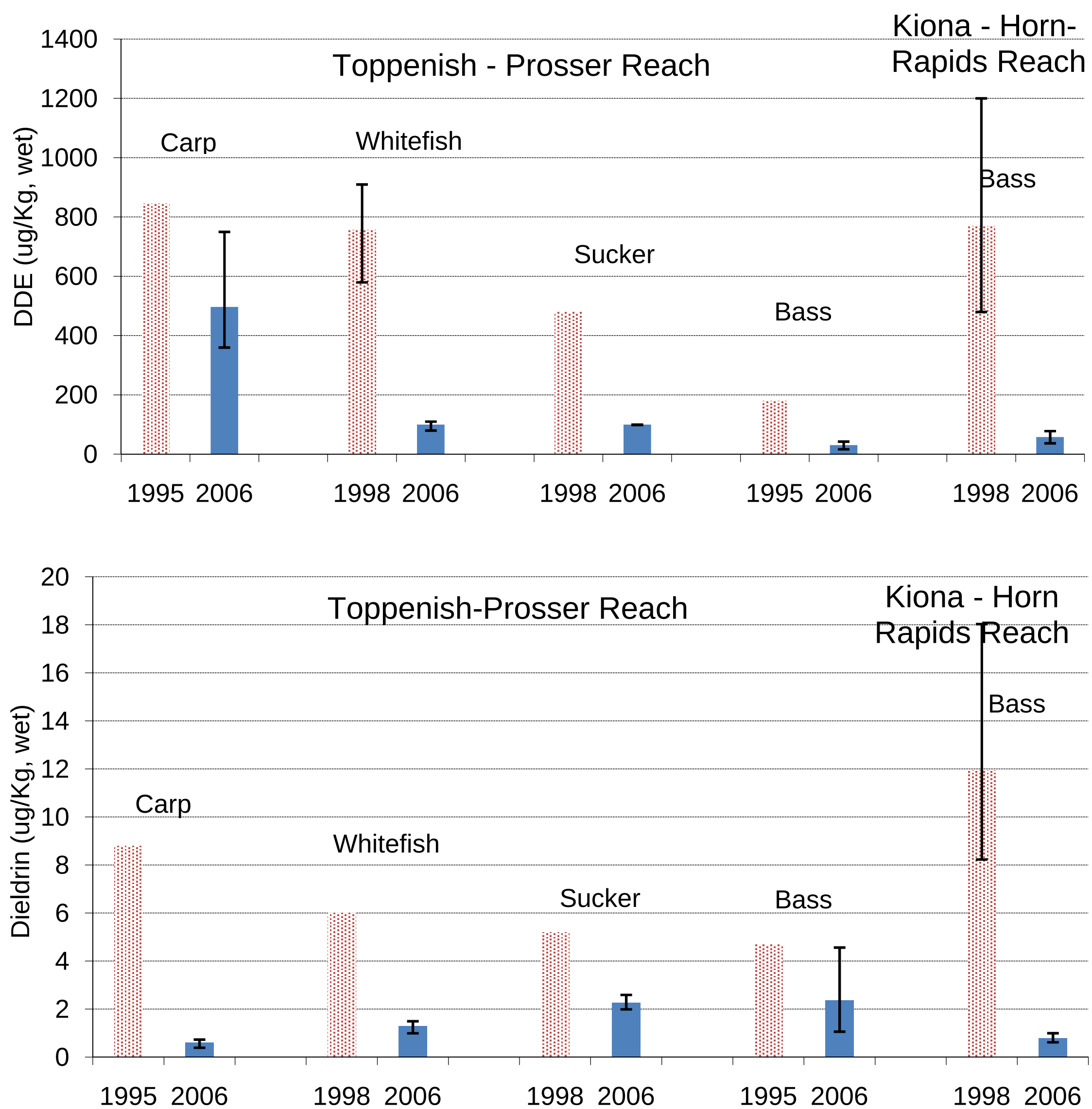


Figure 43. DDE and Dieldrin in Fillets from Lower Yakima River Fish: 1995, 1998, and 2006 *(ug/Kg = parts per billion; error bars are minimum and maximum values).*

Data from the present study on PCBs in surface water and permitted discharges in the Yakima basin is discussed in sections of this report that follow.

PCBs and Toxaphene

Unlike other samples collected for this study, the surface water data on PCBs and toxaphene were obtained by a passive sampling technique using a semipermeable membrane device (SPMD). This was done due to the expense and difficulty of analyzing these compounds directly in whole water samples. Whole surface water samples were screened for toxaphene, but at high detection limits.

Although chemical concentrations derived from SPMDs usually agree closely with other types of more complex low-level sampling techniques, the results are calculated values based on experimental uptake rates and partitioning theory and should therefore be considered estimates. The calculation procedures are outlined in Appendix H.

The SPMDs were deployed for approximately 30 days each during the irrigation season (May-June) and after the end of irrigation (October-November) at six sites on the mainstem and in six major tributaries and irrigation returns. In view of the 303(d) listings for PCBs in fish from Keechelus Lake and the Yakima Canyon, the sampling effort was extended into the upper Yakima River, with SPMDs placed in the mainstem at Easton, above Ellensburg, and in Wilson Creek. The deployment sites were previously shown in Figures 10 and 11.

Concentrations

The concentration estimates obtained for total PCBs[g] and toxaphene are shown in Table 30. The results are the total concentrations (dissolved + particulate fractions) and represent a 30-day, time-weighted average. Figure 44 plots the data in downstream order to illustrate spatial and temporal patterns; non-detects were plotted at zero. The residue and dissolved concentration data on which the totals are based are in Appendix M.

During the irrigation season, PCB concentrations were two-to-four times higher in the mainstem lower Yakima River compared to the upper mainstem. The lower river approached the human health criterion (0.14 vs. 0.17 ng/L).

The Naches River had elevated PCB levels compared to the upper Yakima River at Roza Dam, but during the irrigation season only. Granger Drain and Sulphur Creek Wasteway both appeared to be significant PCB sources, substantially exceeding the human health criterion during the irrigation season. The Naches River was at the human health criterion in the spring. Lower PCB concentrations were observed in most areas after the end of irrigation. The chronic aquatic life criterion for PCBs (14 ng/L) was never approached in any of these samples.

PCBs are associated with urban/industrial applications more so than agriculture. They were used in closed applications (e.g., capacitor, transformers, heat transfer and hydraulic fluids) and, to a lesser extent, open-end applications (e.g., flame retardants, inks, adhesives, carbonless paper, paints, pesticide extenders, and plasticizers) (ATSDR, 2000).

[g] Total PCBs is the sum of detected concentrations of the 209 individual PCB compounds analyzed.

In contrast to other chemicals in this study, toxaphene's chronic aquatic life criterion is more restrictive than its human health criterion (0.2 ng/L vs. 0.73-0.75 ng/L). The acute aquatic life criterion for toxaphene, however, is relatively high at 730 ng/L.

Table 30. Estimated PCB and Toxaphene Concentrations in the Yakima River, Tributaries, and Irrigation Returns during Spring and Fall 2007 *(ng/L, parts per trillion).*

Location	Total PCBs				Toxaphene			
	May-June		Oct.-Nov.		May-June		Oct.-Nov.	
Mainstem								
Easton Dam	0.12	UJ	0.034	J	0.08	UJ	0.08	UJ
Ellensburg Water Co. Diversion	0.026	J	0.057	J	0.10	UJ	0.08	UJ
Roza Dam	0.050	J	0.019	J	0.19	J	0.08	UJ
Sunnyside Dam	0.057	J	0.011	J	0.23	J	0.10	J
Prosser Dam	0.14	J	0.070	J	0.31	J	0.13	J
Horn Rapids Dam	0.14	J	0.020	J	0.37	J	0.10	J
Tributaries/Returns								
Wilson Creek*	0.041	J	0.039	J	0.52	J	0.13	J
Naches River	0.18	J	0.016	J	0.12	J	0.09	UJ
Moxee Drain	0.078	J	0.080	J	0.73	J	0.15	J
Granger Drain	0.49	J	0.27	J	0.87	J	0.30	J
Sulphur Creek	0.80	J	0.12	J	2.9	J	0.70	J
Spring Creek	0.11	J	0.086	J	0.43	J	0.19	J

*Wilson Creek PCB data for May-June are from a sample collected during same time frame in 2008.
U = not detected at or above reported value.
J = estimated value.

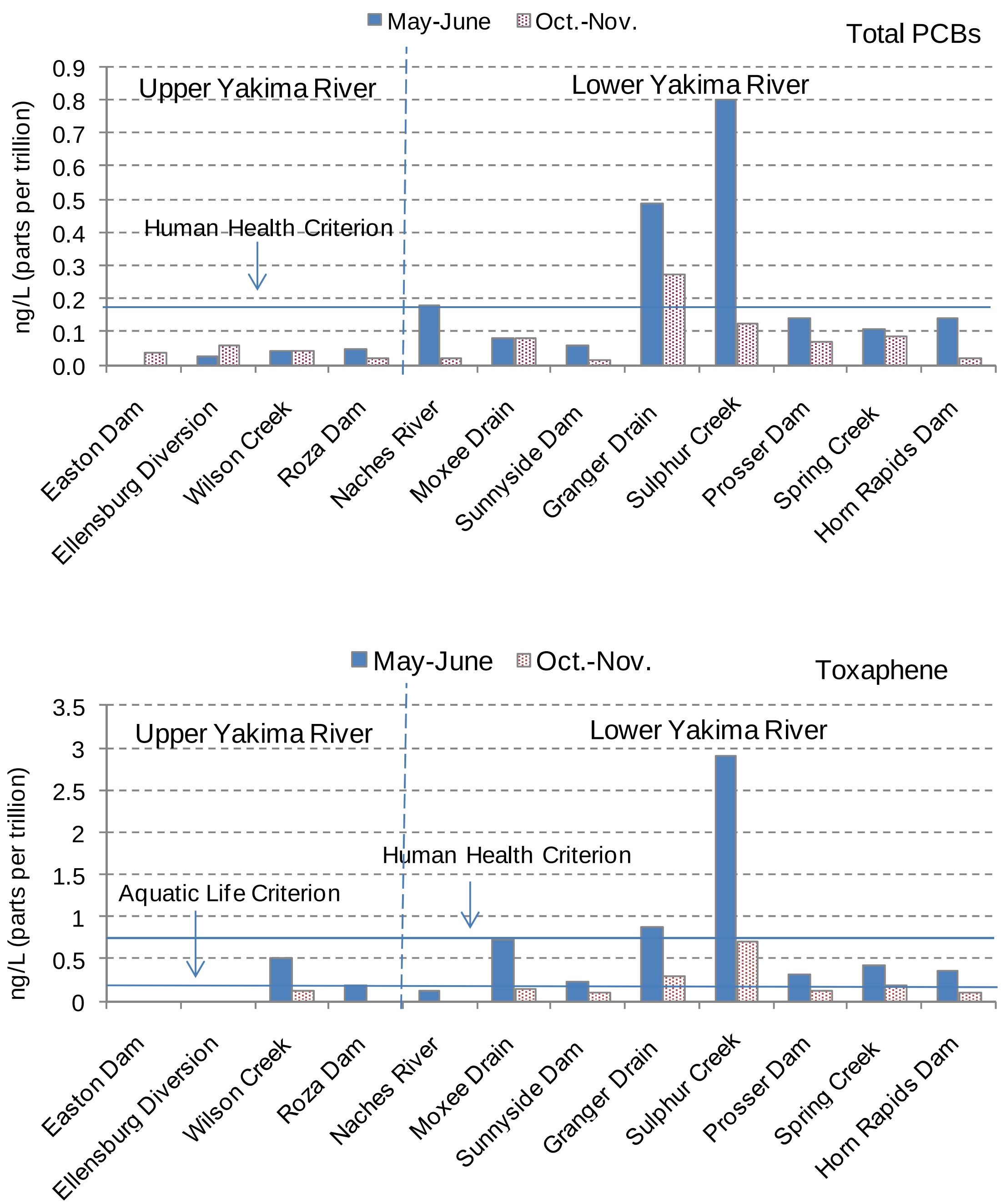


Figure 44. Estimated PCB and Toxaphene Concentrations in the Mainstem Yakima River, Tributaries, and Irrigation Returns during and after the 2007 Irrigation Season *(non-detects plotted at zero).*

Toxaphene levels gradually increased in the mainstem Yakima River moving downstream from Easton to Horn Rapids Dam below Kiona. During the irrigation season, toxaphene was below detection limits down to at least Ellensburg (Ellensburg Water Co. Diversion). Wilson Creek, which enters the Yakima at Ellensburg, had an elevated toxaphene concentration of 0.52 ng/L. Further downstream, levels rose to 0.19 ng/L at Roza Dam, and 0.23 ng/L by Sunnyside Dam just below the city of Yakima, slightly exceeding the chronic aquatic life criterion. Between Sunnyside Dam and Horn Rapids, toxaphene nearly doubled to 0.37 ng/L. After the end of the irrigation season, toxaphene continued to exhibit increased concentrations in the lower river, but remained within criteria.

Toxaphene substantially exceeded the chronic aquatic life criterion in Wilson Creek, Moxee Drain, Granger Drain, and especially Sulphur Creek Wasteway. This occurred primarily during the irrigation season, at which time the 0.2 ng/L criterion was exceeded by a factor of 2-4 in Wilson Creek, Moxee Drain, and Granger Drain, and by more than a factor of 10 in Sulphur Creek Wasteway (2.9 ng/L). Concentrations decreased markedly in all the four drains after the end of irrigation, but remained elevated in Sulphur Creek, exceeding the criterion by a factor of 3. Toxaphene was at or above the human health criterion in three of these returns.

As previously noted, toxaphene was also detected in whole water samples from Moxee Drain and Sulphur Creek Wasteway during routine monitoring water quality monitoring. The Moxee Drain detections were estimated at 3.5 and 7.0 ng/L on 5/2/07 and 5/23/07, respectively. The Sulphur Creek Wasteway detections were estimated at 4.3 and 4.1 ng/L on 5/24/07 and 7/24/07, respectively. These concentrations are much higher than the average values seen in the SPMDs. All other whole water samples from these drains were below the reporting limit of 3 ng/L.

Toxaphene is primarily an agricultural chemical, once used on cotton, fruit, vegetables, small grains, and livestock (ATSDR, 1996). 80-85% of the toxaphene produced in the U.S. was used on cotton or soybeans in the southeast U.S. Its secondary major use for parasite control on livestock may be noteworthy in connection with the high toxaphene levels in Sulphur Creek Wasteway. The Sulfur Creek drainage has a particularly high concentration of dairies and feedlots, with approximately 150 confined animal feeding operations (Carmack, 2008). Many of these were in existence prior to the ban on toxaphene in 1990.

No low-level data were obtained on PCB or toxaphene levels in the Yakima basin surface water from December through April. Results from stormwater sampling, described later in this report, suggest there is potential for elevated concentrations during this period. Due to the expense and difficulty of analyzing these chemicals, there are no useful data on historical levels of PCBs or toxaphene in Yakima surface water.

The PCB and toxaphene concentrations measured in the Yakima mainstem were lower than would be predicted from the fish samples Ecology collected the previous year. Total PCBs exceeded the human health criterion in most of the fish species analyzed in 2006. Toxaphene exceeded the human health criterion in some lower river species. In the two sets of SPMD samples analyzed in 2007, several tributaries exceeded human health criteria for PCBs and toxaphene, but the mainstem did not exceed for human health.

Several factors contribute to this apparent discrepancy. First, 2007 was preceded by several years of lower than average streamflows which affords less dilution for PCBs and toxaphene discharges. Second, the 2007 results do not include the winter or early spring when there is potential for elevated PCB and toxaphene levels. Third, the EPA bioconcentration factors (BCFs) used to calculate the human heath criteria are based on fish uptake from water only. Food is known to be an especially important pathway for PCBs (Mackay and Fraser, 2000). Finally, the EPA BCFs are national averages that do not necessarily correspond closely to the BCF for every fish species and location.

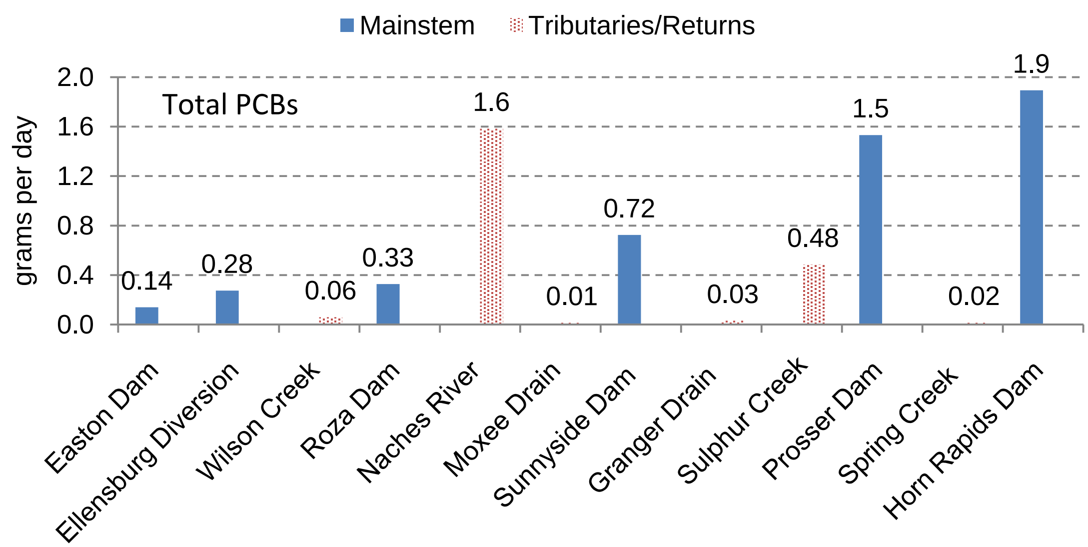
Loads

Table 31 has estimates of PCB and toxaphene loads in the Yakima River during the first part of the irrigation season (May-June SPMD data). The calculations are based on the average flow during the deployment period. Flow data were obtained from the USBR Yakima Hydromet website (www.usbr.gov/pn/hydromet/yakima/yakwebarcread.html), USGS website (http://waterdata.usgs.gov/wa/nwis), or gauged in the field (Spring Creek). Half the reporting limit was used where a chemical was not detected. Figure 45 shows the loads plotted in downstream order from Easton to Horn Rapids.

Table 31. Estimates of PCB and Toxaphene Loads during May-June 2007 *(grams per day).*

Location	Average Flow (cfs)	Total PCBs	Toxaphene
Mainstem			
Easton Dam	936	~0.14†	~0.09†
Ellensburg Water Co. Diversion	4,290	0.28	~0.50†
Roza Dam	2,676	0.33	1.2
Sunnyside Dam	5,143	0.72	2.9
Prosser Dam	4,465	1.5	3.4
Horn Rapids Dam	5,519	1.9	5.0
Tributaries/Returns			
Wilson Creek	545/556*	0.06	0.70
Naches River	3,590	1.6	1.1
Moxee Drain	76	0.01	0.14
Granger Drain	26	0.03	0.06
Sulphur Cr. Wasteway	247	0.48	1.8
Spring Creek	56	0.02	0.05

*In Wilson Creek, PCB data are for 2008 (556 cfs); toxaphene data are for 2007 (545 cfs).
†Not detected; load calculated at half the reporting limit.



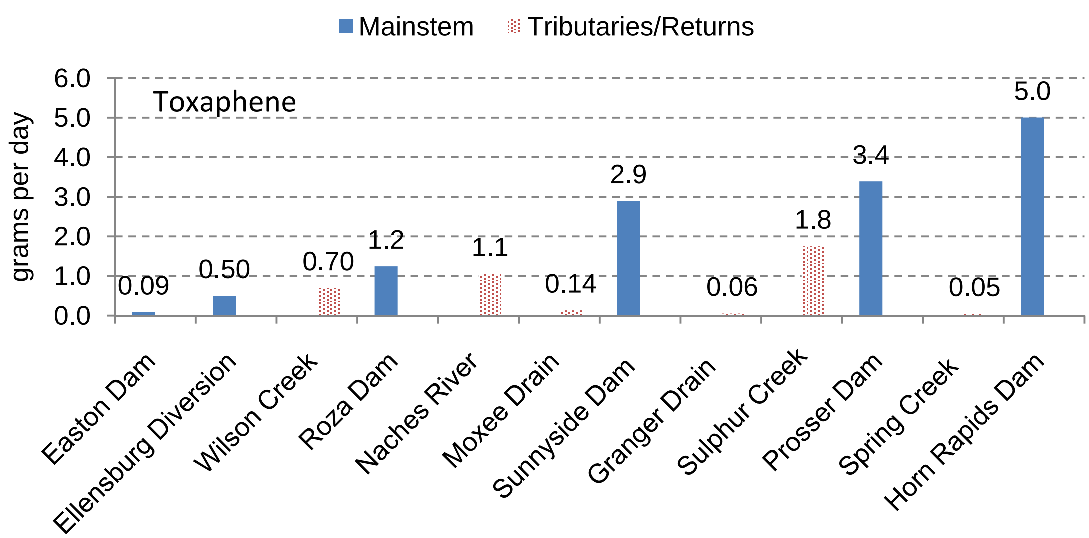


Figure 45. Estimates of PCB and Toxaphene Loads in the Yakima River during May-June, 2007 *(nondetects plotted at half the detection limit, see Table 31).*

Mainstem loads of PCBs and toxaphene increased substantially in the lower river. The PCB loads from the Naches River and Sulphur Creek Wasteway stand out among lower river sources. Sulphur Creek also carried a large toxaphene load compared to the mainstem. The toxaphene load in the Naches River was comparable to the load from the upper Yakima River. The relatively high PCB and toxaphene loads in the Naches are more by virtue of flow than concentration.

Suspended Sediment

Concentrations

This study analyzed suspended sediment as TSS. Routine monitoring results for TSS in surface water are summarized in Table 32 for the 2007 irrigation season, which was the focus of sampling effort. The complete data are in Appendix J.

Table 32. Summary of Results from Monitoring Suspended Sediment (TSS) in the Lower Yakima River during the 2007 Irrigation Season *(mg/L, parts per million; N=13).*

Location	Median	Mean	90th Percentile	Maximum
Mainstem				
Yakima River at Harrison	10	11	17	24
Yakima River at Parker	10	12	16	27
Yakima River at Euclid	14	23	54	67
Yakima River at Kiona	11	19	42	76
Tributaries				
Naches River	7	9	14	29
Moxee Drain	61	73	124	139
Granger Drain	27	67	163	180
Sulphur Creek Wasteway	26	35	73	80
Spring Creek	14	37	85	218

Figure 46 plots the individual TSS results for the lower Yakima mainstem for April 2007 through March 2008. TSS varied directly with flow. Except for the December storm event, the highest concentrations occurred during the first half of the irrigation season. Numerous other studies have shown that suspended sediment in the Yakima River is linked to the irrigation cycle.

After irrigation, TSS levels were generally low in the mainstem, except for the December storm when a concentration of 342 mg/L was recorded at Euclid. The storm samples were taken over a two-day period (12/4-5/08) and not timed to make the results directly comparable among sites. The Harrison TSS sample (6 mg/L) was collected before the storm began to affect the river.

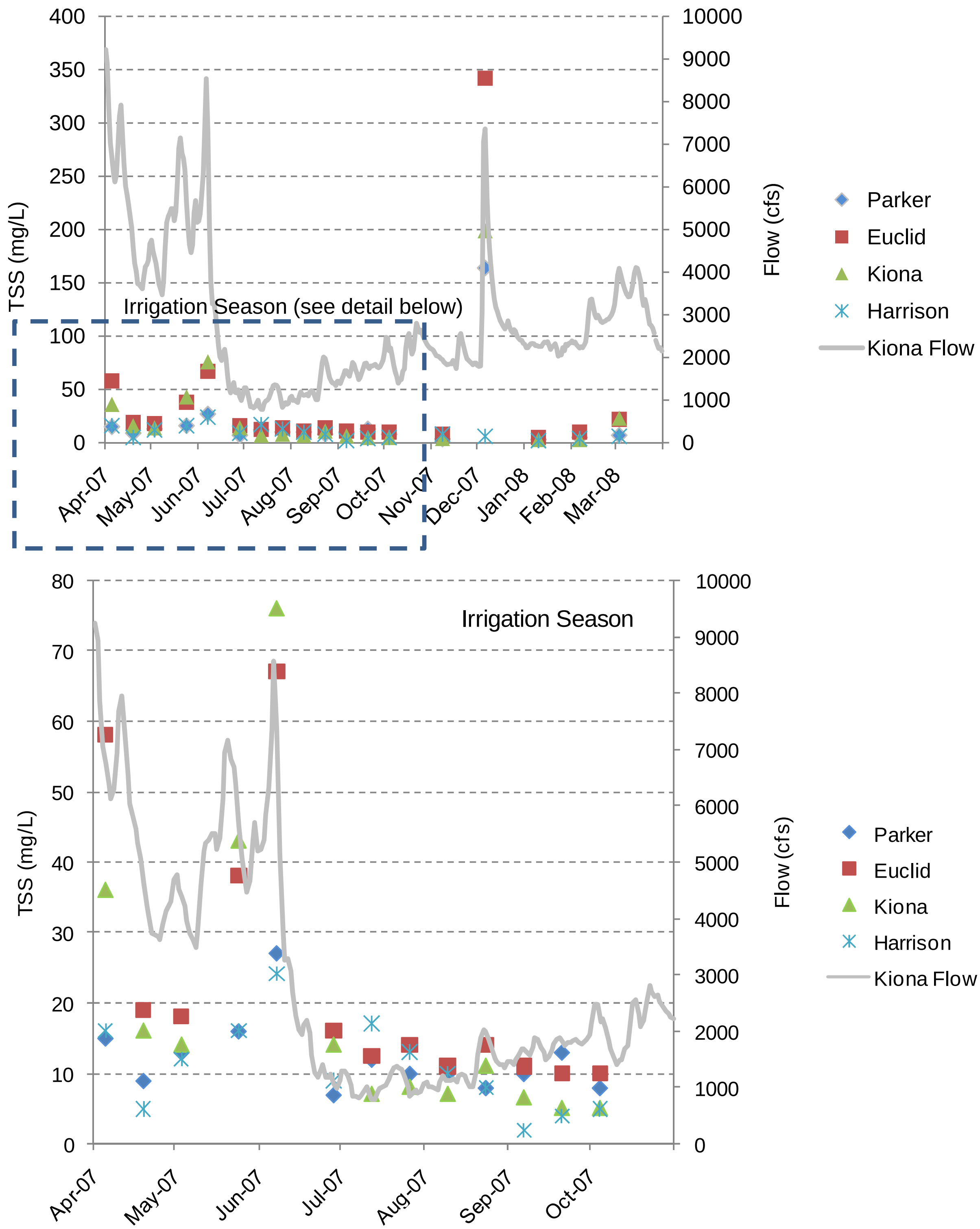


Figure 46. Total Suspended Solids Concentrations in the Mainstem Lower Yakima River during 2007-08, Showing the Flow at Kiona.

Figure 47 illustrates the average TSS concentrations during the 2007 irrigation season. TSS levels at Harrison and the Naches River were generally similar and increased only slightly by Parker. As with other water quality parameters, the major TSS impacts to the river occurred between Parker and Euclid. On average, TSS concentrations in the Yakima River at Euclid (23 mg/L) and at Kiona (19 mg/L) were higher than Harrison (11 mg/L) by about a factor of 2. Maximum TSS levels were recorded on June 6-7, at which time the downstream increase in TSS was by about a factor of 3 (from 24 mg/L to 76 mg/L) (Figure 48).

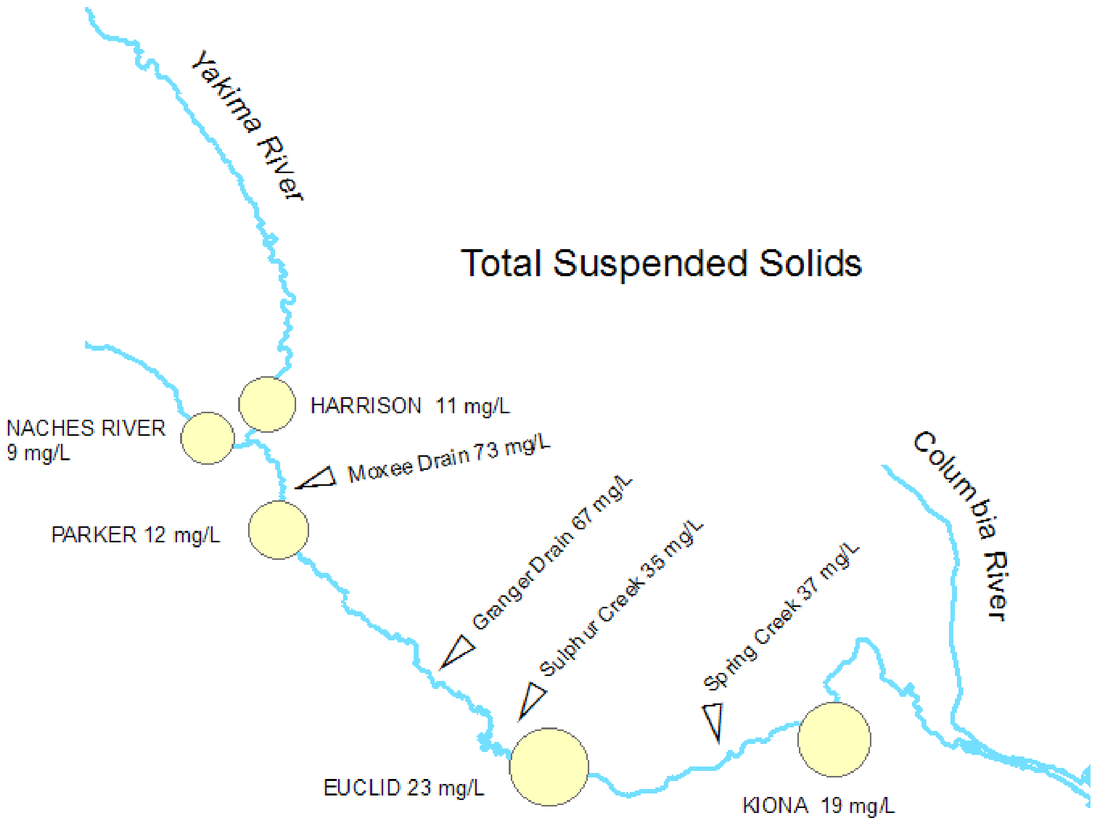


Figure 47. Average Total Suspended Solids Concentrations in the Lower Yakima River during the 2007 Irrigation Season *(mg/L = parts per million; concentrations proportional to circle area).*

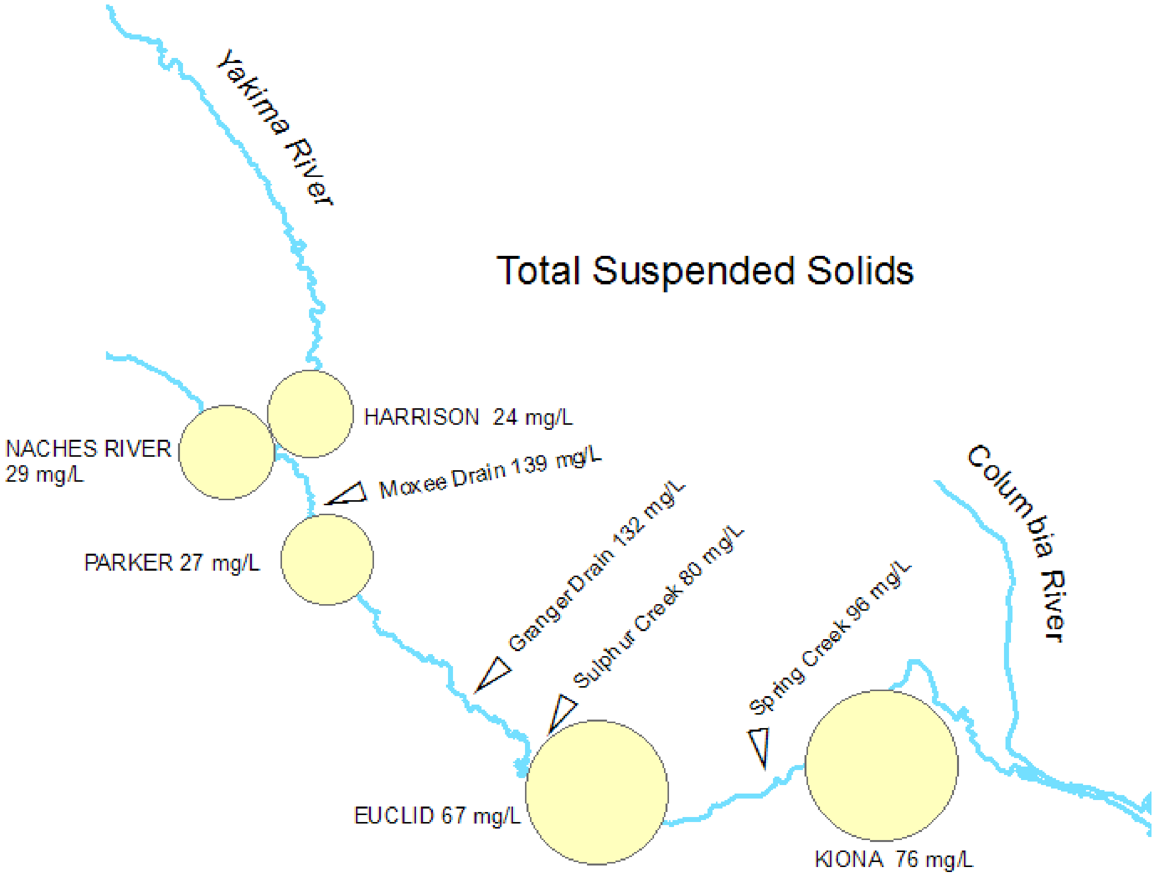


Figure 48. Average Total Suspended Solids Concentrations in the Lower Yakima River on June 6-7, 2007 *(mg/L = parts per million; concentrations proportional to circle area).*

The TSS concentrations measured in the four major returns during 2007-08 are plotted in Figure 49. The highest levels, approaching or exceeding 100 mg/L, occurred when water was being applied to fields early in the irrigation season. Concentrations decreased substantially as the growing season progressed, often dropping to levels at or below those seen during the winter.

TSS was elevated in Granger Drain and Sulphur Creek Wasteway on several occasions during the winter, even though flows were low. Weather records and field notes indicate snow or rain around the time these samples were collected.

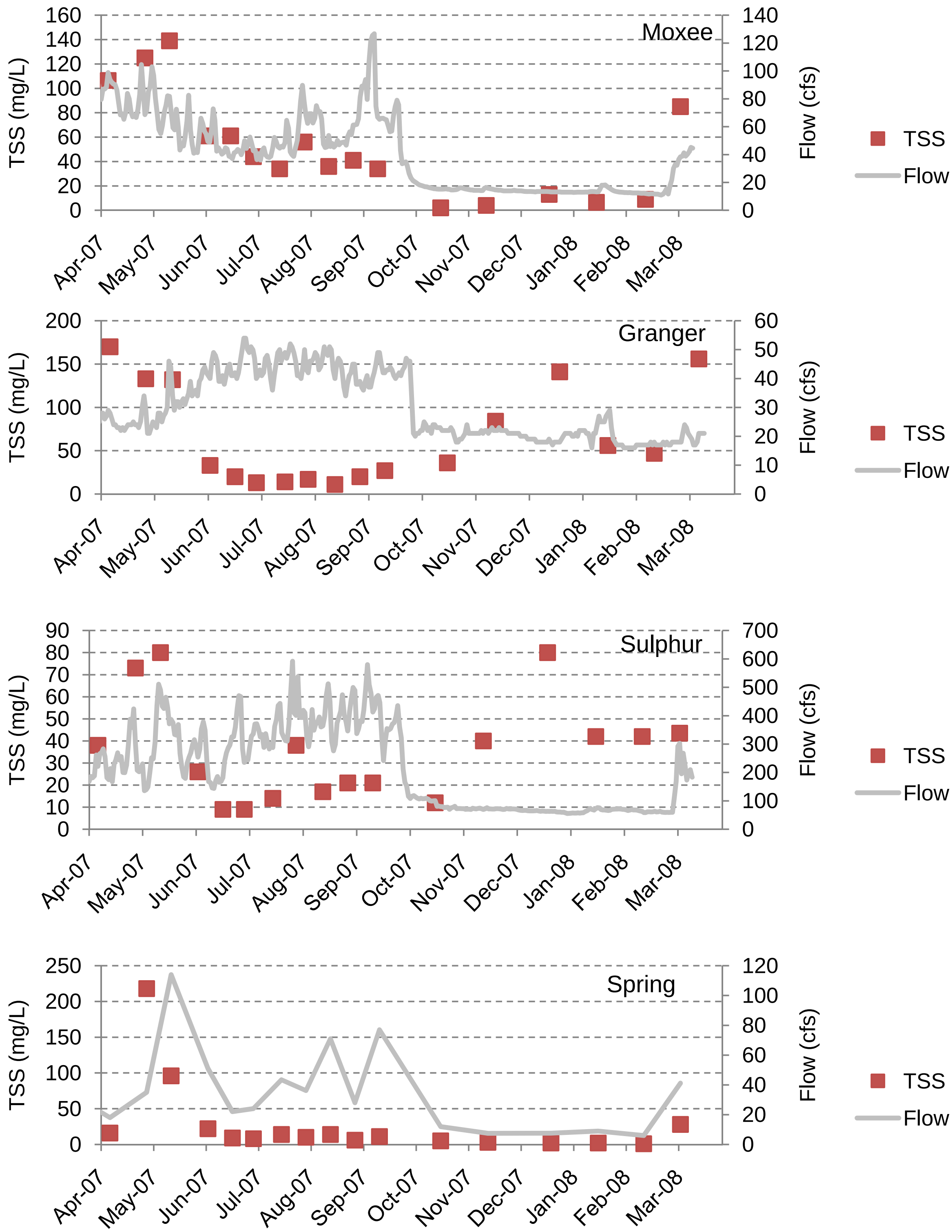


Figure 49. Total Suspended Solids and Flow in Major Lower Yakima River Irrigation Returns during 2007-08.

Loads

Beales ratio estimator (Dolan et al., 1981) was used to calculate suspended sediment loads for the 2007 irrigation season (Table 33, Figure 50). The Beales method uses the ratio of the load to the flow on sampled days, adjusted by the mean flow for that time period (from continuous flow data) to estimate the mean load over the period of interest. This weighting approach avoids missing major components of the load during times when TSS was not measured. Flow data for the calculations were obtained from the USBR (www.usbr.gov/pn/hydromet/) and USGS (http://waterdata.usgs.gov/wa/nwis/sw) websites.

The Beales method was used in the two previous Yakima River suspended sediment and pesticide TMDLs. Beales estimator is not appropriate for the pesticide data because it was not always closely correlated with flow.

Suspended sediment data were not obtained on the Roza Power Return (from the diversion at Roza Dam above Harrison), the Wapato Canal Diversion, or the Sunnyside Canal Diversion, all of which are located between the Naches River and Parker. A significant portion of the mainstem flow is diverted into the Wapato and Sunnyside canals (up to 1,000 to 2,000 cfs, respectively). Therefore the suspended sediment load calculated for Parker cannot be directly compared to the combined load from the Yakima River at Harrison and the Naches River. Previous studies concluded the load from the Roza Return was a third to half the load in the Naches River (Joy and Patterson, 1997; Morace et al., 1999).

Table 33. Estimates of Suspended Sediment Loads in the Mainstem Yakima River, Naches River, and Major Irrigation Returns during the 2007 Irrigation Season.

Location	Average Flow (cfs)	Tons per Day	Tons per Season
Yakima River at Harrison	1,566	58	12,320
Naches River at mouth	1,818	66	14,072
Yakima River at Parker	1,945	89	18,886
Yakima River at Euclid	2,603	263	55,718
Yakima River at Kiona	2,906	236	49,974
Moxee Drain	63	13	2,810
Granger Drain	37	5	1,149
Sulphur Creek Wasteway	306	30	6,449
Spring Creek	46	5	1,161

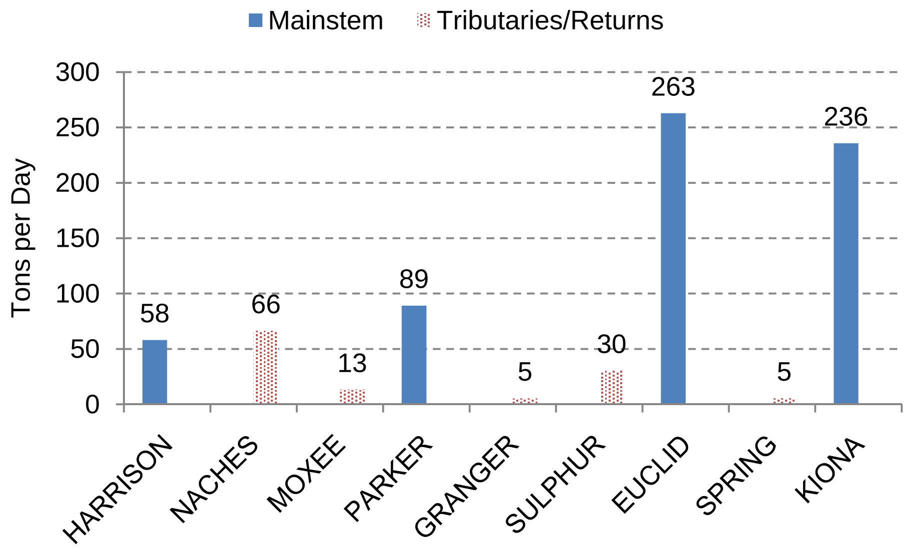


Figure 50. Estimates of Suspended Sediment Loads in the Lower Yakima River during the 2007 Irrigation Season.

The suspended sediment load in Moxee Drain (13 tons per day) was 15% of the Parker load (89 tons per day). Loading between Parker and Euclid increased three-fold, from 89 tons per day to 263 tons per day (18, 886 vs. 55,718 tons over the entire irrigation season). The combined loading from Granger Drain (5 tons per day) and Sulphur Creek Wasteway (30 tons per day) accounted for 35 tons per day to this reach (7,598 tons for the season). Therefore, roughly 20% of the increased loading can be attributed to Granger Drain and Sulphur Creek Wasteway. The remaining 80% was from other sources. USGS attributed a large portion of the suspended sediment load to right-bank tributaries and returns that flow through the Yakama Reservation (Morace et al., 1999).

There was a net suspended sediment loss of approximately 10% between Euclid and Kiona (27 tons per day; 5,700 tons per season). Earlier studies estimated losses of 50-150 tons per day to this reach (Joy and Patterson, 1997; Morace, 1999) and attributed it to sedimentation brought about by the reduced channel velocities between Sunnyside and Prosser. A small portion of the loss can also be attributed to the Kennewick Irrigation District and Kiona Canal diversions (<300 cfs) above Kiona.

The Yakima River at Kiona was transporting approximately 240 tons of suspended sediment per day or about 50,000 tons over the 2007 irrigation season. Under similar conditions of water supply during the 1995 irrigation season, the suspended sediment load at Kiona was estimated to have been more than twice that at 574 tons per day (Joy and Patterson, 1997).

Only two sets of samples (May and August) were collected from other lower Yakima River tributaries and returns during the 2007 irrigation season (Appendix K). Based on these limited data, the average combined TSS load was 48 pounds per day, which is comparable to the combined load of 53 pounds per day from Moxee Drain, Granger Drain, Sulphur Creek

Wasteway, and Spring Creek. Thus, these other discharges appear to contribute a significant share of the sediment load.

These results give an incomplete picture of suspended sediment sources and transport in the lower Yakima River drainage. Detailed mass balances for sediment can be found in the above referenced reports and in Ebbert et al. (2002).

Volatile Suspended Solids

Improved water clarity in the lower Yakima River has led to increased growth of algae and aquatic plants in recent years. Algae and plant fragments form part of the TSS load. A large contribution could potentially lead to the wrong conclusion about suspended sediment sources and reasons for noncompliance with turbidity criteria and TMDL targets.

An analysis for total non-volatile suspended solids (TNVSS) was therefore included in the 2007-08 water quality study to assess the relative importance of plant-derived material in the lower mainstem. Volatile solids (TSS minus TNVSS) were assumed to represent algae and plant fragments. The results are summarized as percent volatile solids in Table 34.

Table 34. Volatile Solids as Percent of Total Suspended Solids in the Yakima River, Naches River, and Four Major Irrigation Returns, 2007-08.

Location	N=	Mean
Yakima River at Harrison	18	25%
Naches River	18	21%
Yakima River at Parker	18	18%
Yakima River at Euclid	18	16%
Yakima River at Kiona	18	16%
Granger Drain	19	11%
Moxee Drain	19	17%
Sulfur Creek Wasteway	19	12%
Spring Creek	19	18%

On average, there was a decrease in relative amounts of volatile solids moving downstream from Harrison Bridge to Kiona, suggesting that algae and plant fragments were a progressively less important part of the suspended sediment load. The volatile solids fraction in the four major irrigation returns was similar to or slightly less than the mainstem at Parker, Euclid, and Kiona. There were no significant differences among sites (Kruskal-Wallis test). Thus, aquatic growths did not appear to be an important factor to take into account in assessing suspended sediment sources and impacts to the Yakima River.

Turbidity

Turbidity was analyzed in conjunction with TSS. The turbidity results for the 2007 irrigation season are summarized in Table 35. As with TSS, turbidity levels were generally low after the end of irrigation. The individual turbidity data are in Appendix J and K.

Table 35. Summary of Results from Monitoring Turbidity in the Lower Yakima River during the 2007 Irrigation Season *(NTU, nephelometric turbidity units; N=13)*.

Location	Median	Mean	90th Percentile	Maximum
Mainstem				
Yakima River at Harrison	4.2	5.1	7.6	12
Yakima River at Parker	5.3	6.6	11	17
Yakima River at Euclid	7.4	10	22	27
Yakima River at Kiona	4.2	8.7	19	32
Tributaries/Returns				
Naches River	6.6	7.6	12	17
Moxee Drain	16	17	22	33
Granger Drain	12	22	41	60
Sulphur Creek Wasteway	9.4	12	18	25
Spring Creek	5.4	12	31	50

Turbidity Criteria and TMDL Targets

The adverse effects of suspended sediment on fish and wildlife, water supplies, and aesthetic enjoyment are addressed through Washington State's turbidity criteria. Turbidity is caused by the presence of suspended matter such as clay, silt, finely divided organic and inorganic matter, and microscopic organisms.

As previously described, the *Lower Yakima River Suspended Sediment and DDT TMDL* set a schedule for meeting numeric turbidity targets in the mainstem, tributaries, and irrigation returns. Milestones to be achieved by 2007 include the following:

- By 2002: "The Yakima River mainstem will comply with the turbidity target of not more than a 5 NTU increase between the confluence of the Yakima and Naches Rivers and the Van Giesan Road bridge at West Richland (RM 8.4)."
- By 2007: "The mouths of all tributaries and drains, and all points within all basin tributaries and drains, will comply with the 90th percentile turbidity target of 25 NTU."

The mainstem turbidity target was based on the criteria in the state standards. The criteria state that turbidity shall not exceed 5 NTU over background when turbidities are 50 NTU or less. When background turbidity is more the 50 NTU, no more than a 10% increase is allowed. The 25 NTU target for tributaries and drains was intended to protect fish and other aquatic organisms, and to assist in compliance with the turbidity target for the mainstem. 25 NTU was derived from a review of EPA guidance, recommendations by the National Academy of Sciences, Idaho's turbidity criteria, and the scientific literature. The 90th percentile is the concentration exceeded by no more than 10% of samples. The 25 NTU target was to be applied to the irrigation season.

Joy and Patterson (1997) assessed the turbidity background in the lower Yakima River during the 1994 and 1995 irrigation seasons by calculating the 90th percentile below the confluence of the Yakima and Naches Rivers. The 90th percentile allows for seasonal variability, supports full beneficial use protection under EPA policy (EPA, 1995), and is adequate for background definition under Ecology policy (Ecology, 1996). Background turbidity was calculated in the same way for the 2007-08 water quality study. Coffin et al. (2006) reported background turbidity during TMDL effectiveness monitoring over the 2003 irrigation season, but based it on samples collected at Terrace Heights Bridge below the Naches River confluence. These four separate determinations of the turbidity background for the lower Yakima River are compared in Table 36.

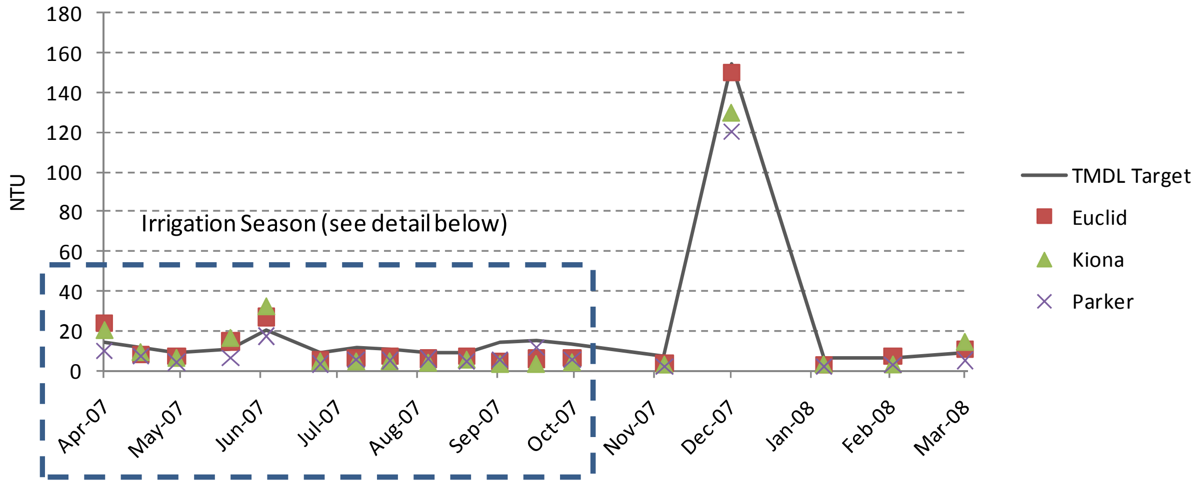
Table 36. Background Turbidity (90th percentile) in the Lower Yakima River: Previous TMDL, Effectiveness Monitoring, and Present Study.

Year	Background Turbidity	Background +5 NTU	Data Source
1994 irrigation season*	5 NTU	10 NTU	Joy & Patterson (1997)
1995 irrigation season*	9 NTU	14 NTU	Joy & Patterson (1997)
2003 irrigation season†	10 NTU	15 NTU	Coffin et al. (2006)
2007 irrigation season**	10 NTU	15 NTU	present study

*June-October samples.
†4/16/03 - 10/15/03 samples.
**4/4/07 - 10/3/07 samples.

During the irrigation season, background turbidity in the lower Yakima River was 5 NTU in 1994, 9 NTU in 1995, and 10 NTU in 2003 and 2007. Less turbidity was experienced in 1994 because river flows were down due to low water supply. Turbidity was essentially the same (9 -10 NTU) during the 1995, 2003, and 2007 irrigation seasons, when flows were comparable and closer to normal. The 1994 and 1995 results might have been higher if the turbidity measurements had included April and May, as in 2003 and 2007.

Figure 51 shows the individual turbidity measurements in the lower Yakima River at Parker, Euclid, and Kiona during 2007-08. The results are compared to the 5 NTU increase over background allowed in the turbidity criteria and set as the TMDL target. Because background turbidity exceeded 50 NTU during the December storm event, the criterion for those results was set for a 10% increase above background.



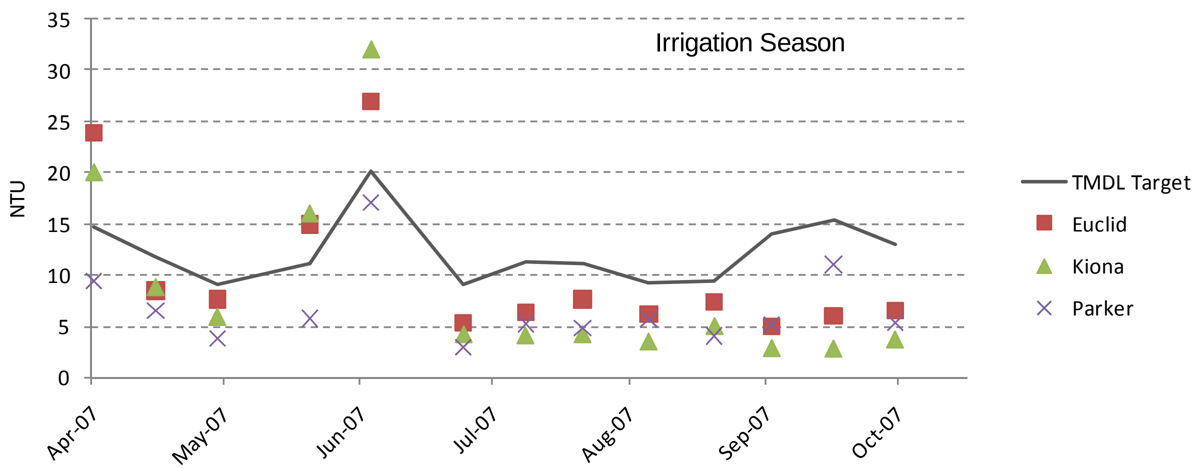


Figure 51. Turbidity in the Lower Yakima River during 2007-08 Compared to the State Turbidity Criteria and 2002 TMDL Target.

Failure to meet the turbidity target in 2007-08 was primarily confined to the first half of the irrigation season and limited to the Yakima River at Euclid and Kiona. The Yakima was always meeting the target at Parker. As with suspended sediment, the area where most of the turbidity increase occurred was between Parker and Euclid. Table 37 summarizes how often turbidity exceeded the TMDL target in the lower Yakima River during 2007-08.

Table 37. Percent of Samples Exceeding the Existing TMDL Turbidity Target in the Mainstem Lower Yakima River during 2007-08.

Time Period	Percent of Samples Exceeding		
	Parker	Euclid	Kiona
2007 Irrigation Season (n=13)	0%	23%	23%
November 07-March 08 (n=5)	0%	40%	20%
2007-08 overall (n=18)	0%	28%	22%

The 40% exceedance of the turbidity target at Euclid during the winter may overstate the extent of the problem. The two samples in question were only marginally above the target (7.7 vs. 6.0 NTU in February and 11 vs. 9.0 NTU in March). Note, however, that sample size during the winter months was small (N=5) and turbidity events may have been missed.

Compliance of the four major returns with the TMDL 90th percentile 25 NTU target for lower Yakima River tributaries and drains is illustrated in Figure 52. During the 2007 irrigation season, the 90th percentile turbidities in Moxee Drain and Sulphur Creek Wasteway were well within the target (22 and 18 NTU, respectively). Granger Drain and, to a lesser extent, Spring Creek exceeded the target (41 and 31 NTU, respectively). Additional turbidity data on these returns for 2007 is discussed starting on page 121.

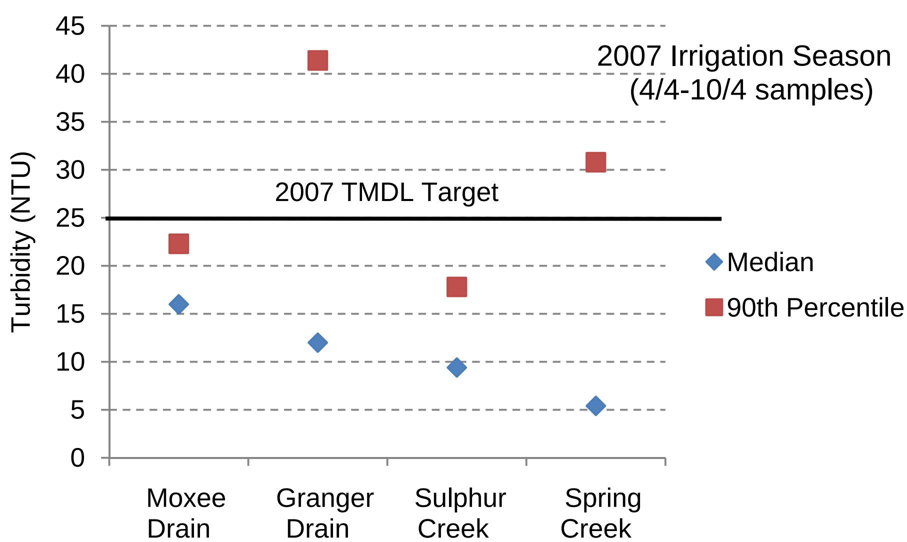
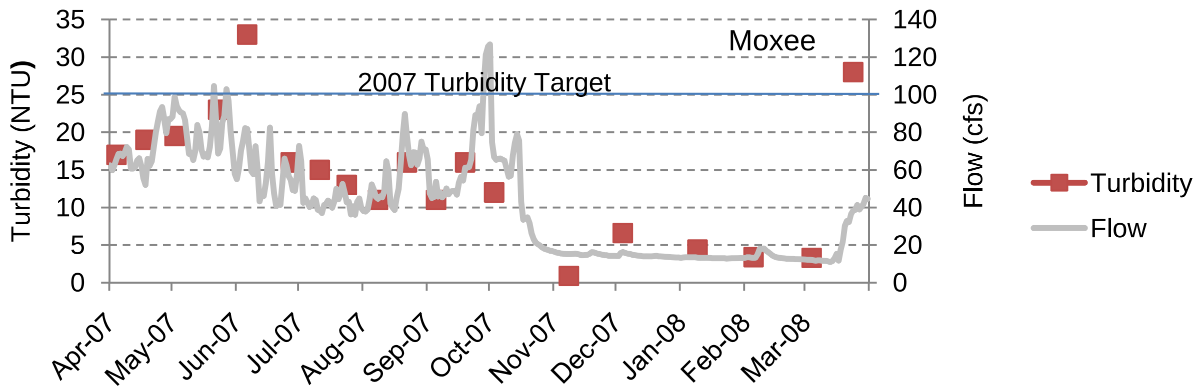


Figure 52. Compliance with the 90th Percentile 25 NTU Turbidity Target in Four Major Irrigation Returns to the Lower Yakima River during the 2007 Irrigation Season. *(N=13)*

The March 2008 results are not included in Figure 52. A turbidity reading of 90 NTU was recorded in Granger Drain on March 28 at the start of the 2008 irrigation season, substantially exceeding the 25 NTU TMDL target. Turbidity in the three other returns ranged from 13-28 NTU on that date.

One significant difference between Sulphur Creek Wasteway and Granger Drain is that Sulphur Creek receives major operational spills from both the Roza and Sunnyside canals, while Granger receives only minor spills from laterals and individual deliveries (Zuroske, 2004). Spill water is unused canal water, typically low in suspended sediment. Spring Creek also receives occasional operational spills (Joy and Patterson, 1997).

Figure 53 shows how turbidity levels fluctuated in the four returns over the course of the 2007 irrigation season into March 2008. Exceedances of 25 NTU were associated with periods of increasing flow, most notably during the early irrigation season. The results for Granger Drain suggest the 25 NTU target was chronically exceeded from April through June, whereas the exceedances appeared to be more sporadic in the other returns.



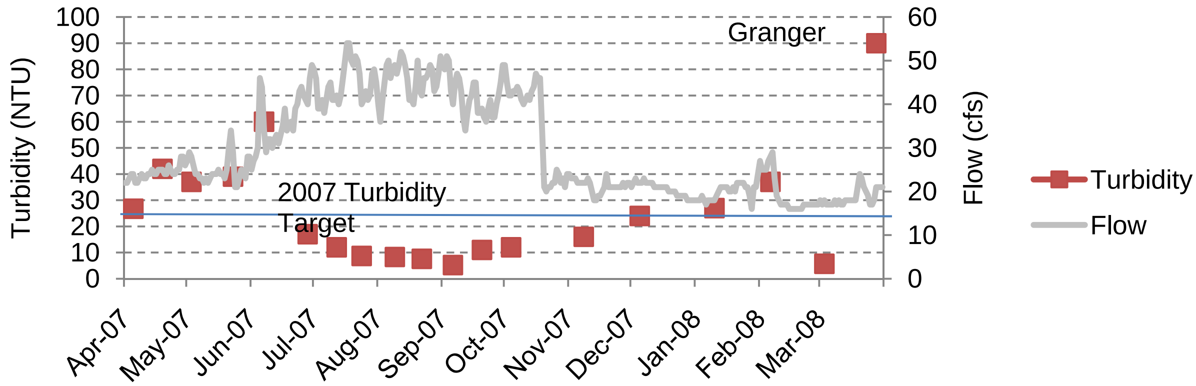
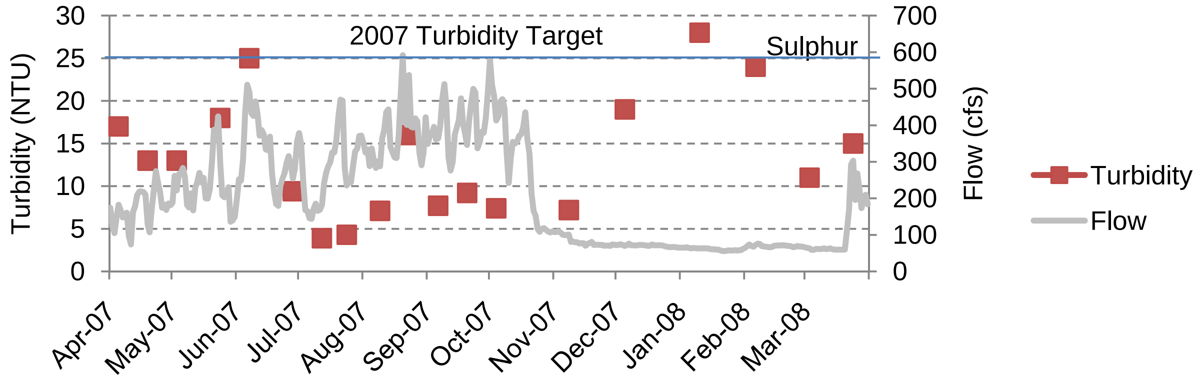


Figure 53. Turbidity and Flow in Four Major Lower Yakima River Irrigation Returns during 2007-08.



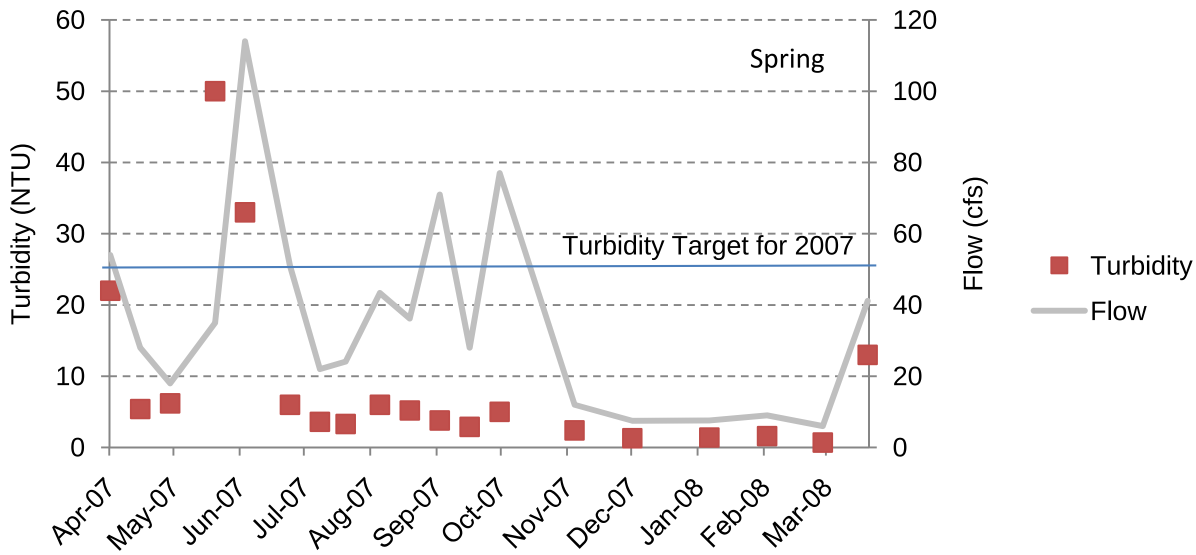


Figure 53. (continued).

Consistent with TSS, turbidity was elevated in Sulphur Creek Wasteway on several occasions during the winter, even though flows were low. A similar but more modest turbidity increase was also seen in Granger Drain. As previously noted, there was snow or rain around the time these samples were collected.

The Roza-Sunnyside Board of Joint Control (RSBOJC) also monitored turbidity in Granger Drain, Sulphur Creek Wasteway, Spring Creek, and Snipes Creek (a Spring Creek tributary) during 2007-08. The RSBOJC Water Quality Laboratory has been collecting samples at these locations since 1997, twice a month during the irrigation season and monthly during the non-irrigation season.

The RSBOJC turbidity data that correspond to the monitoring Ecology did in Granger Drain and Sulphur Creek Wasteway during the 2007-08 water quality study are plotted in Figure 54. The data on all five returns for the 2007 irrigation season are compared in Table 38.

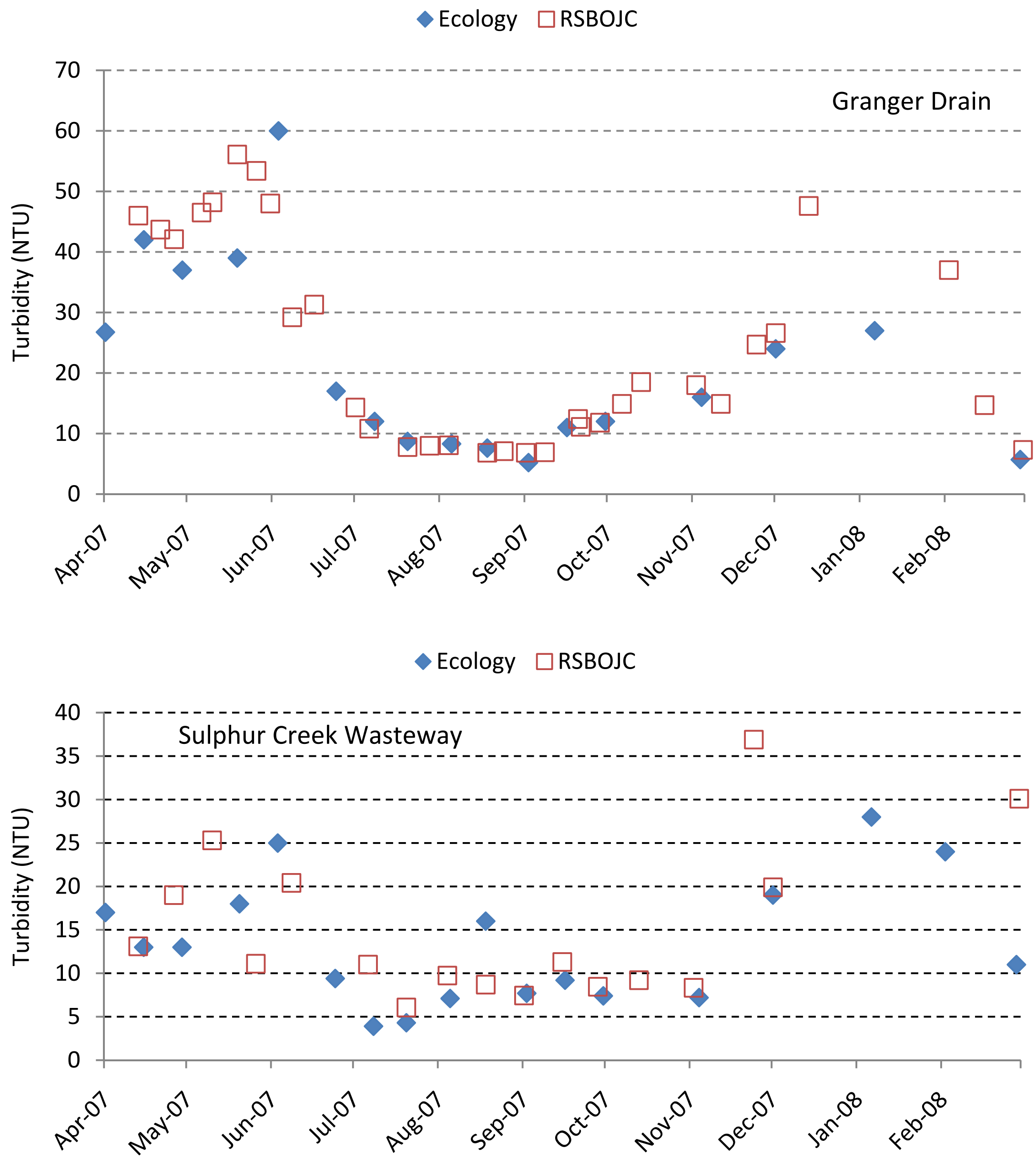


Figure 54. Comparison of Turbidity Data Collected by Ecology and the Roza-Sunnyside Board of Joint Control during 2007-08 *(unpublished RSBOJC data provided by Elaine Brouillard).*

Table 38. Comparison of Turbidity Data Collected by Ecology and the Roza-Sunnyside Board of Joint Control during the 2007 Irrigation Season (NTU).

	Granger Drain		Sulphur Cr. Wasteway		Spring Cr. at mouth	Spring Cr. ab. Snipes	Snipes Cr.
	Ecology	RSBOJC	Ecology	RSBOJC	Ecology	RSBOJC	RSBOJC
N =	14	14	14	13	14	14	14
Minimum	5.2	6.8	3.9	6.1	2.9	2.9	1.5
Median	12	15	9.4	11	5.4	6.8	4.4
Mean	22	25	12	12	12	8.9	9.6
90th	41	48	18	20	31	15	21
Maximum	60	56	25	25	50	21	58

(Unpublished RSBOJC data provided by Elaine Brouillard.)

Except for a few instances when peak turbidity levels occurred on different days, the results for Granger Drain and Sulphur Creek Wasteway are in good agreement and not significantly different (K-S two sample test, p>0.3). For the 2007 irrigation season, both data sets concur in finding that Granger Drain exceeded the 90th percentile TMDL turbidity target of 25 NTU and that Sulphur Creek Wasteway was meeting the target.

Ecology's monitoring site for Spring Creek was near its point of discharge to the Yakima River and below its confluence with Snipes Creek. RSBOJC monitors Spring and Snipes Creeks separately. Ecology recorded two elevated turbidity readings (50 and 33 NTU) for lower Spring Creek in late May (5/24) and early June (6/7) of 2007. These two values were sufficiently high to raise the 90th percentile in Ecology's data set to 31 NTU, which exceeds the 25 NTU target.

RSBOJC sampled Spring and Snipes Creeks two days earlier (5/22 and 6/05). Turbidity was low in Spring Creek on both days, but high in Snipes Creek on 6/05 (58 NTU). The 90th percentile turbidities in RSBOJC's data for the 2007 irrigation season were 15 and 21 NTU, respectively, for Spring and Snipes Creeks. Thus, based on RSBOJC's results both returns were meeting the TMDL turbidity target. Taken in their entirety, the combined Ecology and RSBOJC data indicate the Spring Creek discharge to the Yakima River was meeting the 25 NTU turbidity target during the 2007 irrigation season.

Table 39 summarizes Ecology's turbidity findings and TMDL target compliance for 2007-08 for the lower Yakima River, incorporating RSBOJC's findings for Spring and Snipes Creeks in the conclusions.

The turbidity data for the 23 other lower river tributaries and returns from Ecology's 2007-08 screening survey are plotted in Figure 55. Only one set of samples was collected during the spring when turbidity is typically the highest. Satus 302 (42 and 80 NTU), South Drain (39 NTU), and DID #7 (35 NTU) exceeded the 25 NTU target during the irrigation season. Elevated turbidity was also recorded in the winter in Selah Creek and, marginally, in Selah Ditch. Selah Creek is an intermittent stream. The single sample collected here was taken during a period of snowmelt.

Table 39. Compliance with Turbidity Criteria and TMDL Targets in the Lower Yakima River Drainage during 2007-08.

Waterbody	Meeting Criteria/Target?
Yakima at Parker	Yes
Yakima at Euclid	**No**
Yakima at Kiona	**No**
Naches River	Yes
Moxee Drain	Yes
Granger Drain	**No**
Sulphur Creek Wasteway	Yes
Spring Creek	Yes

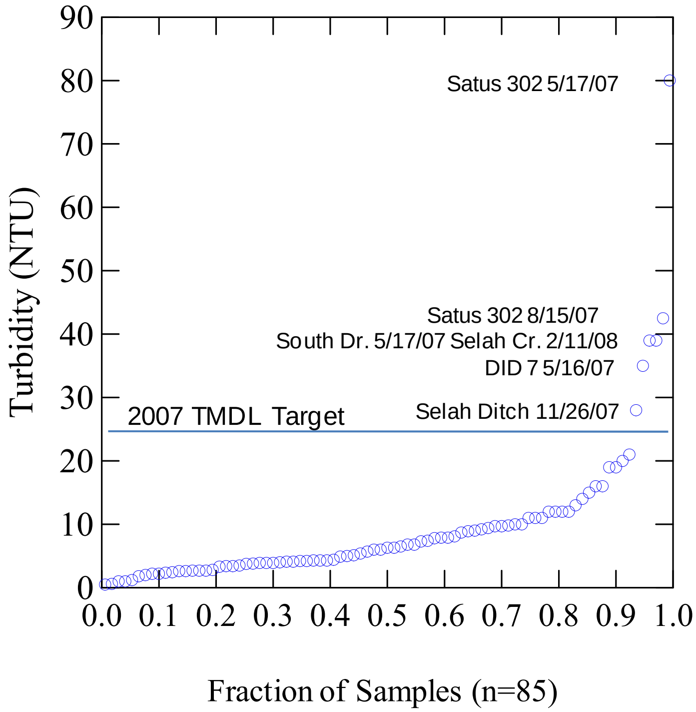


Figure 55. Turbidity in Screening Survey Samples from 23 Other Tributaries and Irrigation Returns to the Lower Yakima River during 2007-08.

Additional turbidity data for a number of the tributaries and returns from the screening survey have been collected by the Yakama Nation, Conservation Districts, Yakima Area Creeks Bacteria TMDL, and USGS. These data were not reviewed for the present report.

Comparison with Historical Turbidity Data

Many farmers along the Yakima River have adopted contemporary soil erosion Best Management Practices (BMPs) to meet the 5- and 10-year targets in the *Lower Yakima River Suspended Sediment and DDT TMDL*. The effectiveness of these measures in reducing turbidity was assessed by Coffin et al. (2006) for the period between 1995 and 2003 and has been widely reported. While it is beyond the scope of the present report to do a comparable assessment, two examples illustrate the magnitude of the water quality improvements that have been realized. A detailed TMDL effectiveness monitoring report drawing on the 2007-08 data will be prepared separately by Ecology.

1. Figure 56 shows the 90th percentile turbidity in the four major irrigation returns to the lower Yakima River during the 1995, 2003, and 2007 irrigation seasons, based on Ecology's monitoring programs.

   Substantial turbidity reductions occurred in all of these returns between 1995 and 2003. By 2003, Moxee Drain, Sulphur Creek Wasteway, and Spring Creek were meeting the 25 NTU target at least 90% of the time. Although falling short of the target, the largest improvement was seen in Granger Drain. Data showing declining turbidity and TSS levels in lower Yakima River irrigation returns are also reported by Ebbert et al. (2002), Zuroske (2004), and Fuhrer et al. (2004).

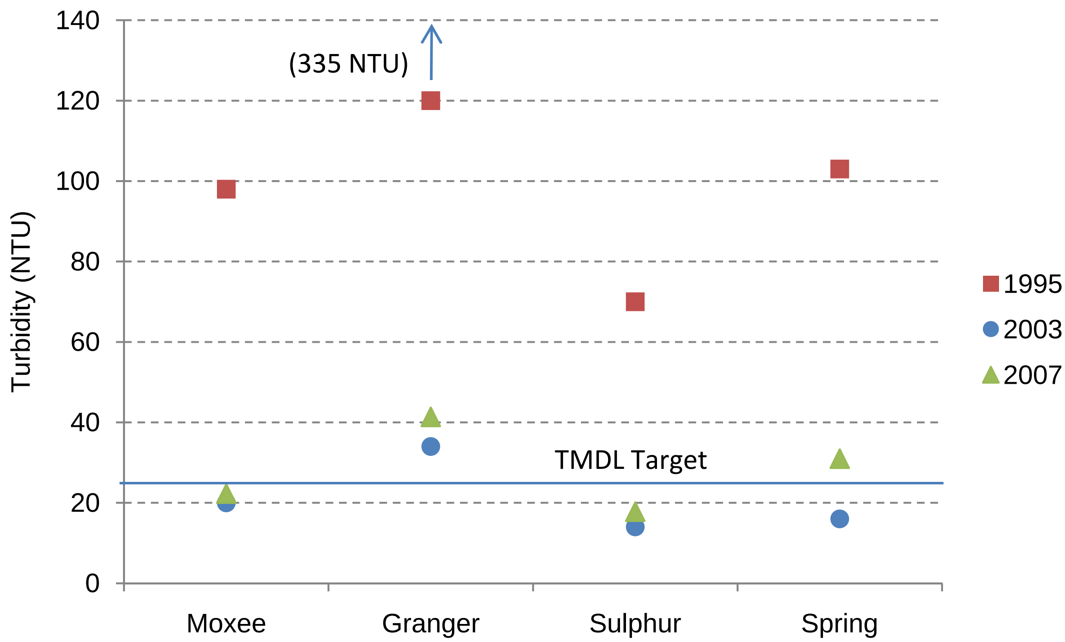


Figure 56. 90th Percentile Turbidity in Four Major Returns to the Lower Yakima River during the 1995, 2003, and 2007 Irrigation Seasons.

2. The Ecology Freshwater Monitoring Unit (FMU) examined trends in the 1995-2008 turbidity data for their ambient monitoring station on the Yakima River at Kiona, using a Seasonal Kendall test (Hallock, 2007). The analysis focused on the irrigation season and only included data from April through October. These data can be found at www.ecy.wa.gov/programs/eap/fw_riv/rv_main.html.

FMU concluded that:

- For the whole period there is a strong ($p<0.01$)[h] decreasing trend in turbidity (Figure 57). This trend is a result of a strong decline in turbidity from the beginning of the period through August 2005.
- Visually, there was a moderate decrease prior to 2000 and a strong decrease in 2000-2005.
- The higher turbidities have been back up since August 2005. In months when turbidity is down, it is still fairly low compared to pre-2001.
- Peak turbidities are highest in April and May and lowest in August through October.
- There is a decreasing trend in flow for the whole period ($p=0.02$).
- Adjusted for flow, there is still a downward trend in turbidity for the full period ($p=0.06$).
- There is significant seasonality in the trend. After adjusting for flow, there is a significant *increasing* trend in April ($p=0.01$). Flow-adjusted turbidity declined in all other months, though the decline was not always significant.

[h] The p-value is the probability that the observed relationship among samples occurred by pure chance. For example, a p-value of .05 (i.e., 1 in 20) indicates there is a 5% probability that the relation is by chance alone.

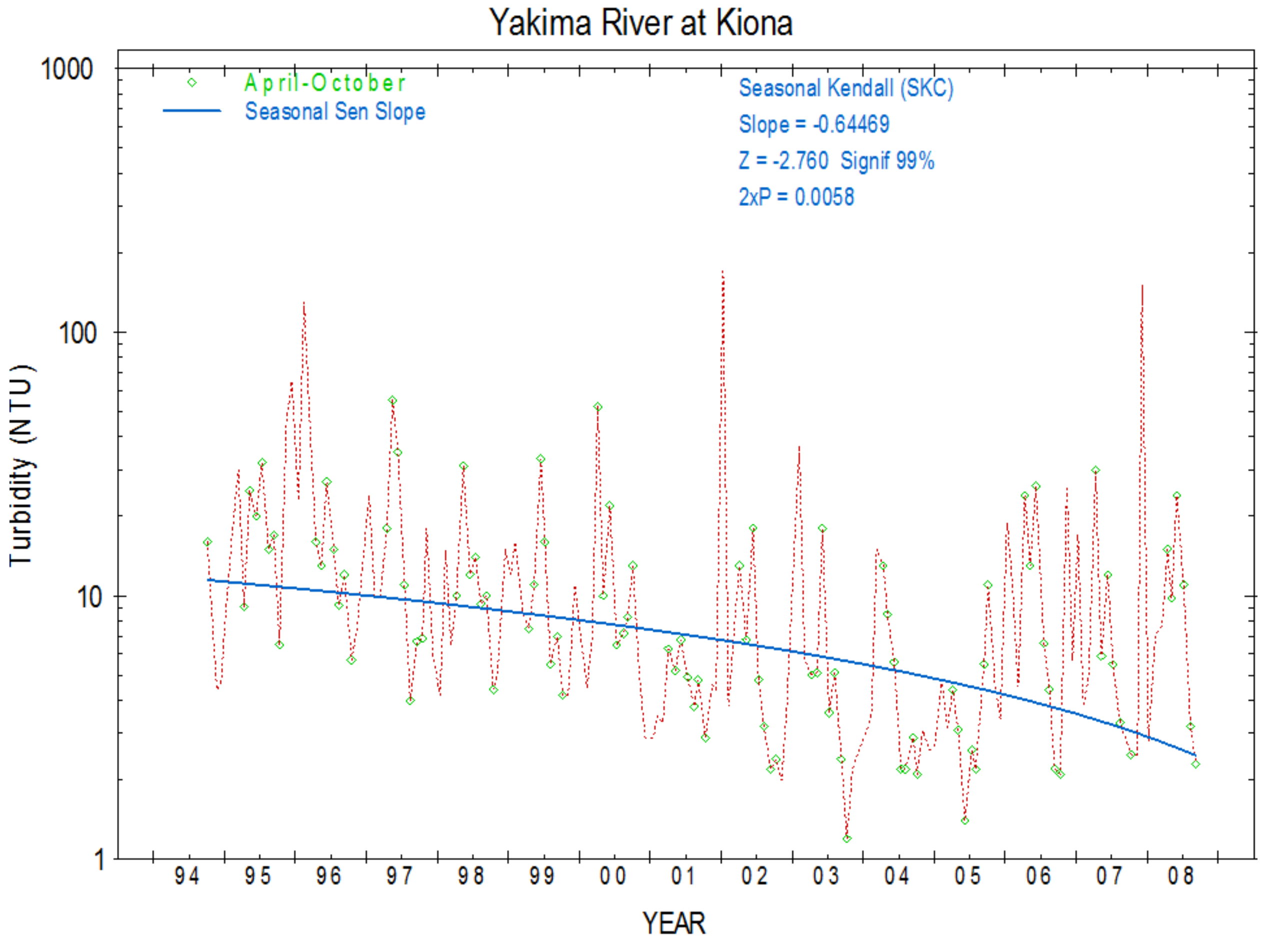


Figure 57. Trend Analysis of Ecology's Ambient Monitoring Data on Turbidity in the Yakima River at Kiona *(Dave Hallock, Ecology FMU).*

Permitted Discharges

Municipal Wastewater Treatment Plants

Eighteen municipal wastewater treatment plants (WWTPs) that discharge to surface waters in the Yakima River basin were monitored quarterly for pesticides, PCBs, TSS, and turbidity between June 2007 and March 2008. Seventy-two sets of samples were analyzed in all. Facility locations were previously shown in Figure 13.

The three Yakama Reservation WWTPs – Wapato, Harrah, and Toppenish – were not sampled as these are under EPA jurisdiction. Ecology lacks regulatory authority to impose wasteload allocations and NPDES discharge limitations on Yakama Nation lands. Pesticides were not analyzed for the three upper river facilities – Cle Elum, Ellensburg, and Kittitas – due to the existing TMDL for these compounds.

Monitoring results for WWTP effluent are summarized in Table 40. The complete data are in Appendix N.

WWTP effluent contains numerous substances that interfere with a pesticide analysis, making it difficult to achieve low detection limits. As a result, pesticide reporting limits in the effluent samples were typically in the range of 2.0 – 5.5 ng/L vs. less than 0.1 ng/L in surface water. The reporting limit for toxaphene in WWTP effluent was 25 – 27 ng/L compared to 3 ng/L for whole surface water samples and about 0.1 ng/L in SPMDs.

The only 303(d) listed pesticides detected in WWTP effluent were the current-use insecticides chlorpyrifos and endosulfan, 33% and 12% of samples, respectively. Toxaphene was also not detected.

Chlorpyrifos was most frequently reported in effluent from the Cowiche, Yakima, Sunnyside, and Mabton WWTPs (75% of samples). Cowiche and Yakima were also the only facilities where endosulfan was detected (100% and 50% of samples, respectively). These details can be seen in Appendix N.

The maximum concentrations recorded were 11 ng/L for chlorpyrifos and 46 ng/L for endosulfan. These concentrations are within human health and aquatic life criteria.

The analytical method employed for PCBs has greater specificity and is less subject to interferences. PCBs were detected in almost every effluent sample (96%). The overall median and average total PCB concentrations were 0.37 and 0.58 ng/L, respectively.

Figure 58 plots the PCB data and compares the data with the human health criterion of 0.17 ng/L. Because the Yakima River approaches or exceeds human health criteria for PCBs it has no excess loading capacity. Therefore the effluent data are compared directly to the criterion, rather than allowing for dilution in the receiving waters.

Table 40. Summary of Results from Monitoring 303(d) Listed Pesticides, PCBs, TSS, and Turbidity in Final Effluents from Wastewater Treatment Plants in the Yakima Basin during 2007-08 *(quarterly samples from 18 facilities).*

	DDT (ng/L)		DDE (ng/L)		DDD (ng/L)		Dieldrin (ng/L)	
No. of Samples	60		60		60		60	
Detection Frequency (%)	0%		0%		0%		0%	
Median Concentration	2.6	U	2.6	U	2.6	U	2.6	U
Mean Concentration	3.1	U	3.1	U	3.1	U	3.1	U
90th Percentile Concentration	5.1	U	5.1	U	5.1	U	5.1	U
Maximum Concentration	5.5	U	5.5	U	5.5	U	5.5	U
	Chlorpyrifos (ng/L)		**Endosulfan (ng/L)**		**Chlordane (ng/L)**		**Alpha-BHC (ng/L)**	
No. of Samples	60		60		60		60	
Detection Frequency (%)	33%		12%		0%		0%	
Median Concentration	3.2	U	2.6	U	2.6	U	2.6	U
Mean Concentration	3.9	U	5.6	U	3.1	U	3.1	U
90th Percentile Concentration	5.7	J	5.4	J	5.1	U	5.1	U
Maximum Concentration	11	J	46	J	5.5	U	5.5	U
	Total PCBs* (ng/L)		**Toxaphene (ng/L)**		**TSS (mg/L)**		**Turbidity (NTU)**	
No. of Samples	72		60		72		72	
Detection Frequency (%)	96%		0%		96%		100%	
Median Concentration	0.37	J	26	U	4		2.2	
Mean Concentration	0.58	J	26	U	20		6.0	
90th Percentile Concentration	0.96	J	27	U	25		6.0	
Maximum Concentration	7.4	J	27	U	555		190	

*Total PCBs is the sum of detected concentrations of the 209 PCB compounds analyzed.
U = not detected at or above reported value.
J = estimated.

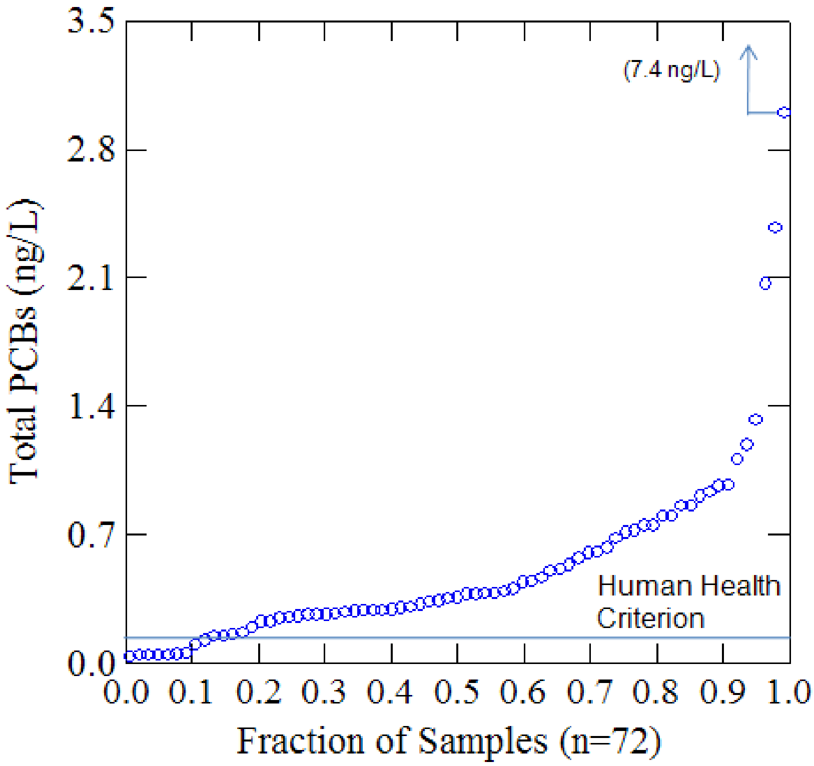


Figure 58. PCB Concentrations in Final Effluents from WWTPs in the Yakima Basin during 2007-08 Compared to Human Health Criterion *(quarterly samples from 18 facilities, ng/L = parts per trillion).*

Eighty-two percent of the effluent samples (59 out of 72) exceeded the PCB human health criterion. Approximately half (52%) exceeded by more than a factor of 2. Substantially elevated concentrations greater than 1.0 ng/L (1.1-7.4 ng/L) were observed sporadically. Except for the occasional spike in concentration, most facilities were discharging a similar level of PCBs (Figure 59)[i].

The June 2007 sample from the Selah WWTP had an unusually high concentration of total PCBs at 7.4 ng/L. PCB levels in subsequent samples were similar to WWTPs in other parts of the basin.

Aquatic life criteria for PCBs are relatively high: 14 ng/L for chronic exposure and 2,000 ng/L for acute exposure. These levels were not approached in any of the WWTP effluents.

[i] In box and whisker plots of this type, 50% of the results fall within the box, the horizontal line representing the median. The whiskers show the range of values that are within a factor of 1.5 of the spread of the box. Asterisks and empty circles (next figure) are outside and far outside values, respectively.

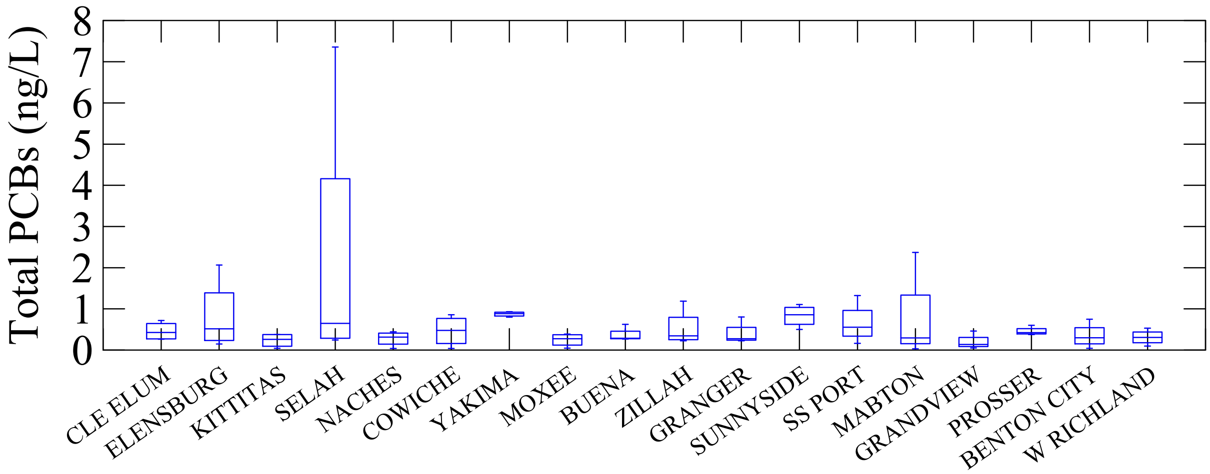


Figure 59. Total PCB Concentrations in Final Effluents from Yakima Basin WWTPs during 2007-08 *(ng/L = parts per trillion).*

The effluents tended to have higher PCB concentrations during the winter compared to the irrigation season (Figure 60). Total PCBs gradually increased from early summer to late winter, with median concentrations going from 0.20 to 0.26 to 0.34 to 0.70 ng/L between June and March. The differences between sampling periods were statistically significant ($p<0.05$, Kruskal-Wallis test). Higher winter concentrations could be due to more surface runoff entering the collection systems. Stormwater samples for the present study showed that urban runoff has elevated PCBs levels (see Urban Stormwater Runoff). Dilution by infiltration of irrigation water during the growing season could be an equally important factor.

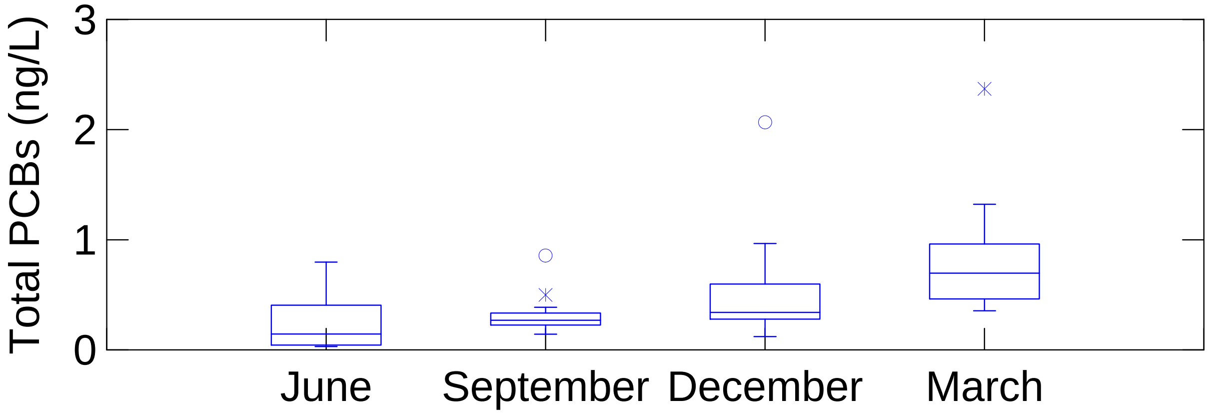


Figure 60. PCB Concentrations in Yakima Basin WWTP Effluents by Month of Sample Collection, 2007-08 *(one outlier excluded: Selah WWTP 7,360 pg/L in June).*

Table 41 summarizes the PCBs, DDT, and dieldrin data that have been reported for WWTP effluents in other parts of Eastern Washington. These results indicate that the PCB concentrations measured at Yakima basin facilities are typical of WWTP effluent. The pesticide data are more limited, but suggest DDT compounds and dieldrin are characteristically low in WWTP effluent, including facilities located in agricultural areas such as the Palouse, Okanogan, and Walla Walla.

Table 41. Summary of Low-Level PCB, DDT, and Dieldrin Data for Eastern Washington WWTP Effluents *(ng/L; parts per trillion; mean values).*

Receiving Water/ WWTP	Year	N=	Total PCBs	Total DDT	Dieldrin	Reference
Palouse River						Lubliner (2009)
Pullman	2007-08	3	1.4	NA	0.27	
Colfax	2007-08	3	0.33	NA	0.20	
Albion	2007-08	1	1.5	NA	<0.03	
Okanogan River						Serdar (2006)
Oroville	2001-02	2-3	<.65	0.9	NA	
Omak	2001-02	2-3	<.65	<1.6	NA	
Okanogan	2001-02	2-3	<.65	1.6	NA	
Walla Walla River						Johnson et al. (2004) Lubliner (2007)
Walla Walla	2002-03	4	0.79	0.23	≤0.25	
	2006-07	3	0.38	NA	NA	
College Place	2002-03	4	1.3	0.08	≤0.21	
	2006-07	3	0.30	NA	NA	
Spokane River						Golding (2002)
Spokane	2001	2	1.8	NA	NA	
Liberty Lake	2001	2	1.7	NA	NA	
Yakima River						present study
18 facility mean	2007-08	72	0.58	<2	<2	

NA = not analyzed.

Estimates of PCB loading from Yakima basin WWTPs are shown in Table 42. Because pesticides were either not detected or were meeting water quality criteria, loads were not calculated.

Table 42. Summary of Total PCB Loads Measured in Final Effluents from Yakima Basin WWTPs during 2007-08.

	Jun-07	Sep-07	Dec-07	Mar-08	Overall Mean
Per WWTP					
Mean Flow (mgd)	1.3	1.3	1.1	1.1	1.2
Mean PCB Concentration (ng/L)	0.67	0.31	0.52	0.81	0.58
Mean PCB Load (mg/day)	4.2	3.0	4.0	3.8	3.7
WWTPs Combined					
Total Flow (mgd)	24	24	20	19	22
Total PCB Load (mg/day)	76	54	71	68	67

mgd = million gallons per day.

The flow reported by each facility was used to calculate the total PCB load for each of the quarterly sampling events. The average facility was discharging approximately 0.6 ng/L total PCBs at a loading rate to the receiving waters of about 4 mg/day. The combined loading from all facilities averaged 67 mg/day.

The loading rates measured during the four monitoring periods were similar. Decreasing effluent flow rates from June through March acted to maintain a similar level of PCB loading even though concentrations were on the increase.

TSS and turbidity levels in Yakima basin WWTP effluents were almost always low, indicating the treatment systems were operating properly. Overall median concentrations were 4 mg/L TSS and 2.2 NTU turbidity at the times these samples were collected (Table 40). Although PCBs have an affinity for particulate matter, there was no evidence of a correlation between total PCBs and TSS (R^2=0.19)[j].

In most instances, TSS concentrations were in compliance with the weekly average limit set by the NPDES permit (typically 45 mg/L). Three of the four effluent samples from the Port of Sunnyside WWTP represent upset conditions with elevated TSS (Appendix N), but the facility was not discharging to surface water at those times. NPDES permits for Yakima basin WWTPs do not contain discharge limits for pesticides or PCBs.

[j] R^2 indicates the percent of the PCB data that is explained by TSS (coefficient of determination).

Figure 61 compares the average effluent flow rate on days of sample collection at each WWTP with the design flow. The NPDES permits state that design flows are not to be exceeded. Most facilities were operating at lower than design flow and thus may have additional treatment capacity. Cases where the sampled flow was at or above design flow were primarily limited to Moxee WWTP (wastewater now goes to Yakima WWTP) and the Port of Sunnyside WWTP (discharge was going to a sprayfield). The larger facilities were always operating well below design flow (10-70% of design).

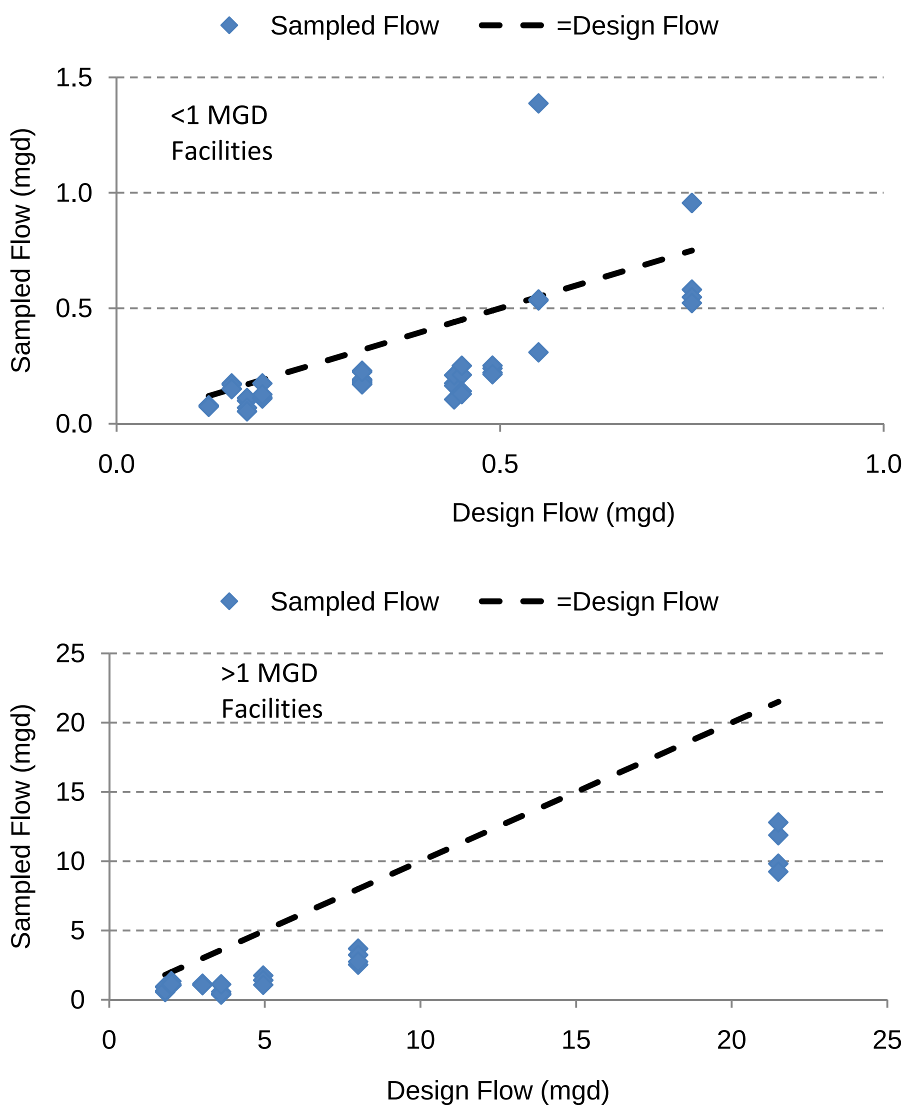


Figure 61. WWTP Effluent Flow during Monitoring Periods in 2007-08 vs. Design Flow *(million gallons per day).*

Fruit Packers and Vegetable Processors

Quarterly monitoring was also conducted at the six fruit packers and vegetable processors that discharge to surface water in the lower Yakima basin. Facility locations were previously shown in Figure 14.

Final effluents were analyzed for pesticides, TSS, and turbidity. Table 43 summarizes the results for 303(d) listed pesticides. Other pesticides were infrequently detected and concentrations were low (Appendix O). PCBs were not analyzed because these types of facilities are not known to be sources of PCBs.

Table 43. Summary of Results from Monitoring 303(d) Listed Pesticides and Toxaphene in Effluents from Six Fruit and Vegetable Processors in the Lower Yakima Basin during 2007-08 *(quarterly samples; concentrations in ng/L, parts per trillion).*

	DDT	DDE	DDD
No. of Samples	24	24	24
Detection Frequency (%)	46%	67%	67%
Median Concentration	0.064 U	0.37 J	0.18 J
Mean Concentration	0.51 J	1.0 J	0.40 J
90th Percentile Conc.	1.6 J	2.9 J	1.0 J
Maximum Concentration	4.6 J	6.8	1.7
	Dieldrin	Endosulfan	Chlorpyrifos
No. of Samples	24	24	24
Detection Frequency (%)	50%	96%	58%
Median Concentration	0.57 J	2.9 J	1.5 J
Mean Concentration	0.73 J	11 J	2.7 J
90th Percentile Conc.	1.7 J	18 J	5.7 J
Maximum Concentration	2.6 J	93 J	19 J
	Chlordane	Alpha-BHC	Toxaphene
No. of Samples	24	24	24
Detection Frequency (%)	13%	25%	0%
Median Concentration	0.063 U	0.063 U	3.1 U
Mean Concentration	0.14 J	0.10 J	6.4 U
90th Percentile Conc.	0.2 J	0.18	16 U
Maximum Concentration	1.3 J	0.35	30 U

U = not detected at or above reported value.
J = estimated concentration.

Because of the likelihood that pesticides were present in these effluents, the samples were analyzed using low-level detection (0.061 – 1.2 ng/L, to 3.1 ng/L for toxaphene). DDT compounds, dieldrin, endosulfan, and chlorpyrifos were routinely detected at most of the facilities (46-96% of samples). Chlordane and alpha-BHC were only occasionally reported (13-25% of samples).

Toxaphene was not detected at reporting limits ranging from 3.1 to 30 ng/L. The higher reporting limits for toxaphene were due to heavy interferences encountered in certain samples.

At the time these samples were collected, the plants were primarily processing apples, potatoes, or their products. Nectarines, peaches, and pears were being processed in a few instances. There was no obvious relationship between what was being processed and pesticide concentrations.

The percentage of effluent samples that exceeded water quality criteria is shown in Table 44 and Figure 62. The results are compared directly to criteria given the exceedances observed in the receiving waters.

Fruit packer and vegetable processor effluent exceeded human health water quality criteria for DDT compounds and dieldrin in 17% and 38% of the samples, respectively. Human health criteria for endosulfan, chlordane, and alpha-BHC were never exceeded.

The chronic aquatic life criterion for total DDT was exceeded in 29% of the effluent samples. Other pesticides were consistently meeting chronic criteria. Acute aquatic life criteria were never exceeded.

Table 44. Percent of Fruit Packer and Vegetable Processor Effluent Samples Exceeding Water Quality Criteria for 303(d) Listed Pesticides during 2007-08. *(N=24)*

	DDT	DDE	DDD	Dieldrin
Human Health Criteria (ng/L)	0.59	0.59	0.83	0.14
Percent of Samples Exceeding	17%	38%	13%	38%
	Endosulfan	Chlorpyrifos	Chlordane	Alpha BHC
Human Health Criteria (ng/L)	930	NA	0.57	3.9
Percent of Samples Exceeding	0%	- -	0%	0%
	Total DDT*	Dieldrin	Endosulfan	
Chronic Aquatic Life Criteria (ng/L)	1.0	1.9	220	
Percent of Samples Exceeding	29%	0%	0%	
	Chlorpyrifos	Chlordane	Alpha BHC	
Chronic Aquatic Life Criteria (ng/L)	41	4.3	NA	
Percent of Samples Exceeding	0%	0%	0%	

* DDT+DDE+DDD.
NA = not applicable (human health criteria have not been adopted for chlorpyrifos).

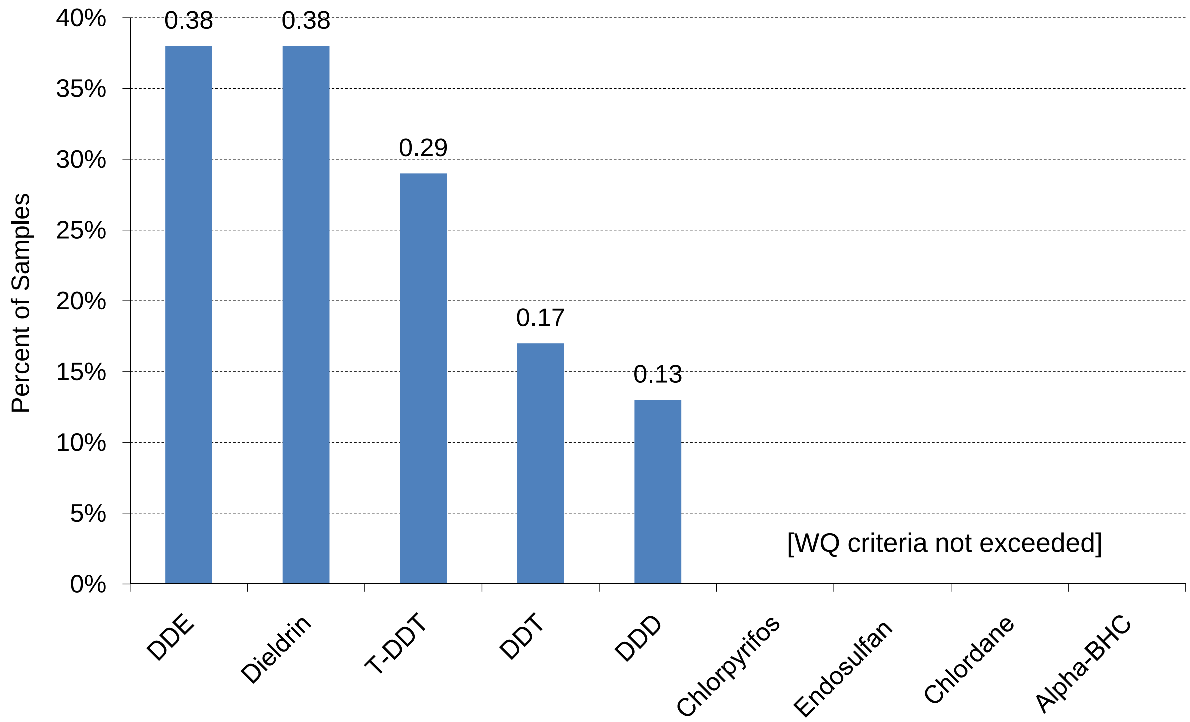


Figure 62. Percent of Fruit Packer and Vegetable Processor Effluent Samples Exceeding Human Health Criteria (DDT compounds and dieldrin) or Chronic Aquatic Life Criteria (total DDT) *(quarterly samples, N=24).*

Effluent flow rates for most of these facilities are less than 0.3 mgd. The combined flow from all six plants ranged from 0.6 – 1.5 mgd (0.9-2.3 cfs) during the four monitoring periods. As a result, pesticide loading to surface water was relatively low, as summarized in Table 45. One of the six facilities, Gilbert Orchards, discharges to ground and was not included in the load calculation. A second, Andrus & Roberts, only discharges to surface water during the winter when the ground is frozen. As noted previously, the Prosser ConAgra plant is scheduled to close in May 2010.

Table 45. Summary of Pesticide Loads Measured in Combined Final Effluents from Fruit Packers and Vegetable Processors that Discharge to Surface Water in the Lower Yakima River Drainage during 2007-08 *(half the detection limit used for non-detects; Gilbert Orchards excluded).*

	T-DDT	Dieldrin	Endosulfan	Chlorpyrifos
Mean Load (mg/day, facilities combined)	1.1	1.3	9.0	5.2

The TSS and turbidity data obtained on the effluents are summarized in Table 46.

Table 46. Summary of Results from Monitoring TSS and Turbidity in Effluents from Six Fruit Packers and Vegetable Processors in the Lower Yakima Basin during 2007-08 *(quarterly samples).*

Parameter	N=	Median	Mean	90th Percentile	Maximum
Total Suspended Solids (mg/L)	24	7.5	26	63	242
Turbidity (NTU)	24	11	20	32	110

The NPDES permits that apply to these facilities stipulate a maximum daily TSS discharge of 30 mg/L (General Permit for the Fresh Fruit Packing Industry) to 180 mg/L (Snokist Growers, Terrace Heights). The effluents were meeting this requirement in most cases.

Two facilities exceeded TSS permit limits: Andrus & Roberts (242 and 86 mg/L on 7/26/07 and 10/10/07) and Gilbert Orchards (51 and 68 mg/L on 9/5/07 and 12/18/07). Visual observations recorded during sample collection indicated effluent turbidity was highly variable at these plants, ranging from cloudy to clear. Andrus & Roberts was discharging to their sprayfield; Gilbert Orchards was discharging to ground.

Where DDT compounds were detectable in fruit processor and vegetable packer effluents, there was a positive relationship between total DDT and TSS (R^2= 0.54, Figure 63). This suggests that the levels of DDT compounds in these effluents could be lowered by reducing TSS.

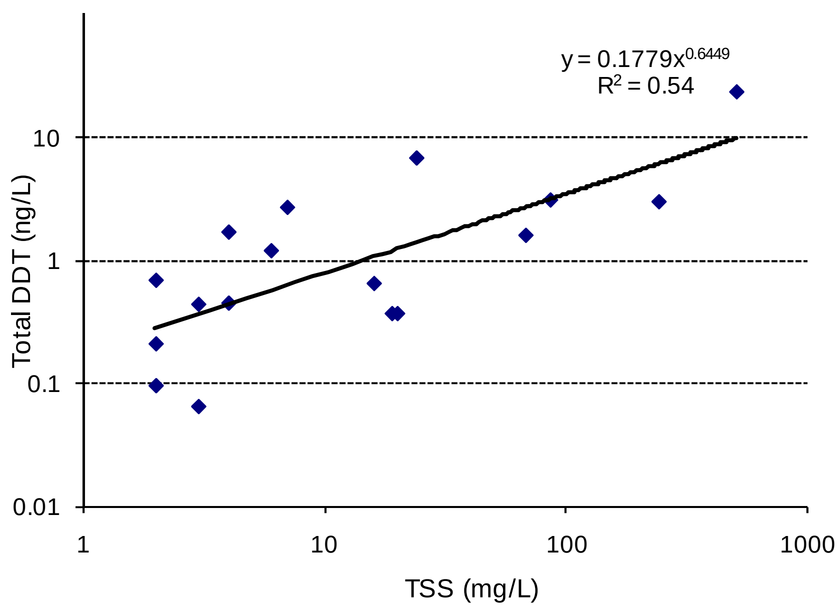


Figure 63. Correlation between Total DDT and Total Suspended Solids in Fruit Packer and Vegetable Processor Effluents.

Urban Stormwater Runoff

Within the Yakima basin, stormwater discharges from the cities of Ellensburg, Selah, Yakima, Union Gap, Sunnyside, West Richland, and Richland come under NPDES requirements of the Phase II Municipal Stormwater Permit for Eastern Washington. Runoff samples were obtained during six rain storms in Yakima and Union Gap, and four storms in Ellensburg, during the winter of 2007-08. For each storm, between two to five storm drains were sampled in each of these two areas (see Figures 15 and 16). Twenty-three samples were analyzed overall, 13 from Yakima/Union Gap and 10 from Ellensburg. As previously noted, similar sampling was not attempted for the other Phase II cities due to infrequent rainfall. West Richland's stormwater goes to the Columbia River.

The stormwater samples were either single grabs or composites of two grabs collected early in the storm once turbid water began to flow in the drains. The Yakima/Union Gap samples were analyzed for pesticides, PCBs, TSS, and turbidity. The same analyses were conducted for Ellensburg except pesticides were not analyzed due to the existing TMDL.

The average annual precipitation in Yakima and Ellensburg is 8 and 10 inches, respectively, with slightly more than half of it falling between November and February. Samples for the water quality study were collected between October and June when 90% of the precipitation occurs.

Precipitation in Yakima during the water quality study is shown in Figure 64, indicating which rain events were sampled. The amount of rainfall preceding sample collection in Yakima is shown in Table 47.

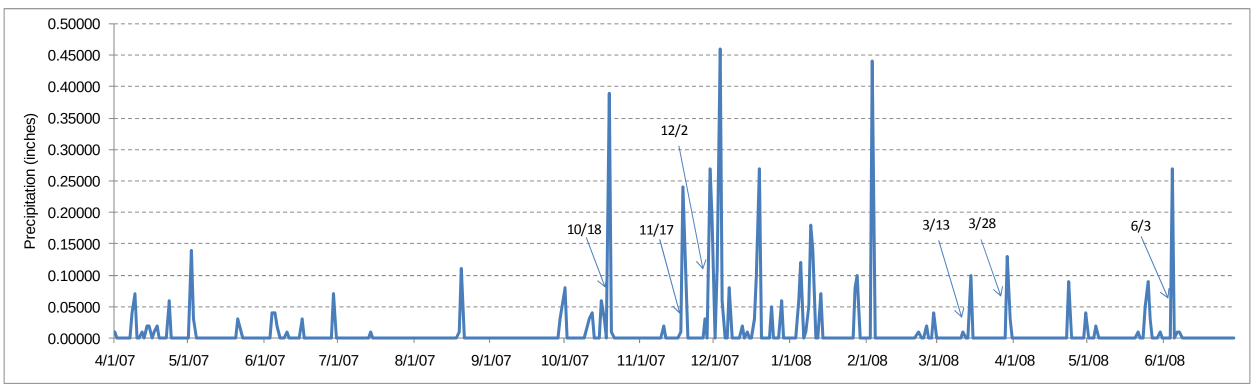


Figure 64. Precipitation in Yakima during the 2007-08 Water Quality Study, Showing When Stormwater Samples Were Collected (Yakima airport).
(www-k12.atmos.washington.edu/k12/grayskies/nw_weather.html)

Table 47. Rainfall Prior To and During Stormwater Sampling in Yakima/Union Gap during 2007-08 (inches).

Sampling Date	Rainfall During Previous 24 hours	Rainfall During Previous Week	Total Rainfall For Storm Event Sampled
10/18/2007	0.03	0.16	0.39
11/17/2007	0	0.02	0.25
12/2/2007	0	0.49	0.57
3/13/2008	0	0.010	0.10
3/28/2008	0	0	0.13
6/3/2008	0	0.01	0.27

Concentrations

Results for 303(d) listed pesticides in Yakima/Union Gap stormwater runoff are summarized in Table 48. Most of the results are qualified as estimates due to interferences.

Table 48. Summary of Results from Analyzing 303(d) Listed Pesticides and Toxaphene in Yakima/Union Gap Stormwater during 2007-08 *(ng/L, parts per trillion).*

	DDT		DDE		DDD	
No. of Samples	13		13		13	
Detection Frequency (%)	77%		92%		38%	
Median Concentration	9.9	J	13	J	2.5	U
Mean Concentration	13	J	17	J	2.8	J
90th Percentile Concentration	28	J	45	J	3.6	J
Maximum Concentration	33	J	54	J	4.1	J
	Dieldrin		Endosulfan		Chlorpyrifos	
No. of Samples	13		13		13	
Detection Frequency (%)	38%		85%		62%	
Median Concentration	2.8	J	17		4.1	J
Mean Concentration	3.7	J	32		33	J
90th Percentile Concentration	6.2	J	87		129	J
Maximum Concentration	7.4	J	107		222	J
	Chlordane		Alpha-BHC		Toxaphene	
No. of Samples	13		13		13	
Detection Frequency (%)	23%		0%		8%	
Median Concentration	2.5	UJ	2.5	UJ	25	UJ
Mean Concentration	3.4	UJ	3	UJ	26	UJ
90th Percentile Concentration	3.5	J	3	UJ	27	UJ
Maximum Concentration	13	J	3.6	UJ	30	J

U = not detected at or above reported value.
J = estimated.

DDT compounds, dieldrin, endosulfan, and chlorpyrifos were routinely detected (38-92% of samples). Chlordane and toxaphene were infrequently detected. Alpha-BHC was not detected.

For detected compounds, the concentrations found were far above those recorded in water samples from other NPDES discharges or in surface water samples, by one-to-two orders of magnitude in most cases. Several additional pesticides or breakdown products were also detected in stormwater. These included endosulfan sulfate, aldrin, heptachlor epoxide, and hexachlorobenzene (Appendix P).

Table 49 has a summary of the PCB data for Yakima/Union Gap and Ellensburg. PCBs were detected in all samples. The levels were generally similar between the two urban areas. As with pesticides, PCB concentrations were high compared to other types of samples collected for the water quality study. The pesticide and PCB concentrations measured in stormwater are compared to other sources later in this report.

Table 49. Summary of Results from Analyzing PCBs in Yakima/Union Gap and Ellensburg Stormwater during 2007-08 *(ng/L, parts per trillion).*

	Total PCBs	
Yakima/Union Gap		
No. of Samples	12	
Detection Frequency (%)	100%	
Median Concentration	9.9	J
Mean Concentration	9.8	J
90th Percentile Concentration	19	J
Maximum Concentration	28	J
Ellensburg		
No. of Samples	10	
Detection Frequency (%)	100%	
Median Concentration	2.1	J
Mean Concentration	6.4	J
90th Percentile Concentration	13	J
Maximum Concentration	33	J

J = estimated.

Figure 65 shows the percentage of Yakima/Union Gap stormwater samples that exceeded human health criteria for the primary compounds of concern in this study. Because most of these chemicals bioaccumulate, even short-term discharge during storms has the potential to contribute to fish consumption concerns. It should be noted that many of these storm drains flow year-round, although at reduced rates.

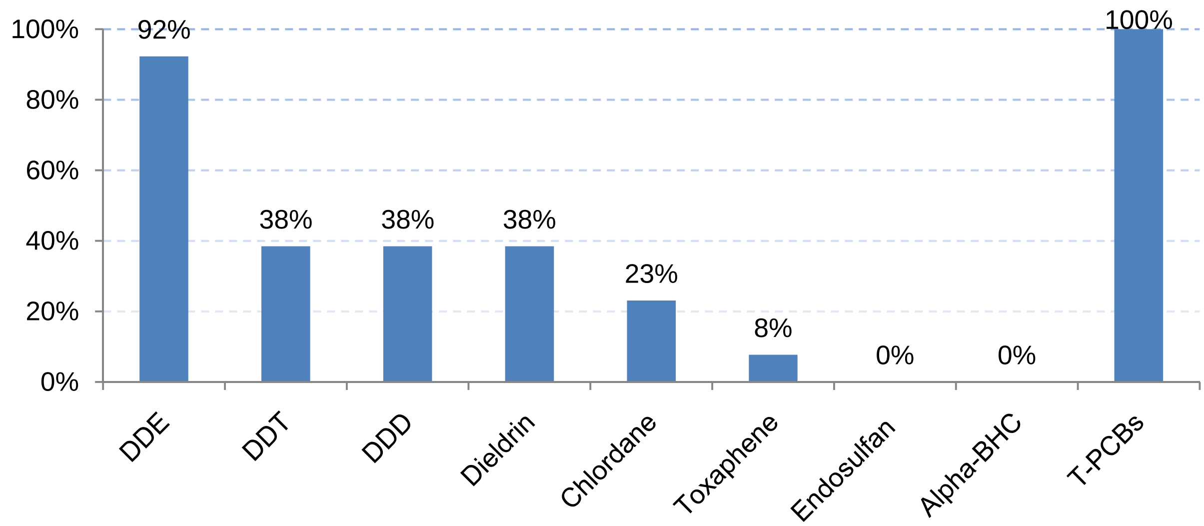


Figure 65. Percent of Yakima/Union Gap Stormwater Samples Exceeding Human Health Criteria for 303(d) Listed Pesticides and PCBs during 2007-08. *(N=13)*

Stormwater exceeded human health criteria for DDE and PCBs in almost all samples and for DDT, DDD, and dieldrin in slightly less than half the samples. The chlordane and toxaphene criteria were also occasionally exceeded. The exceedances were routinely by one-to-two orders of magnitude.

Being short-term phenomena, stormwater discharges are more appropriately compared to acute rather than chronic aquatic life criteria. The acute criteria apply to either an instantaneous or 1-hour average concentrations, while the chronic criteria are for 24-hour or 4-day average concentrations. The stormwater samples did not exceed acute criteria for pesticides or PCBs. Chlorpyrifos was recorded at the acute criterion of 220 ng/L in one instance (Appendix P).

Toxaphene was detected at a very high concentration in one of the Yakima area storm drain samples (29 and 32 ng/L in replicate samples; Appendix P). This concentration substantially exceeds the human health criterion (0.73 ng/L), but not the acute aquatic life criterion (730 ng/L). The detection limit in the other stormwater samples (25-27 ng/L) was too high to assess compliance with water quality criteria.

Several other pesticides or breakdown products also exceeded human health criteria in stormwater but not aquatic life criteria. These included heptachlor epoxide (5 of 13 samples), aldrin (1 of 13 samples), and hexachlorobenzene (1 of 13 samples). These data are also in Appendix P.

A summary of the TSS and turbidity data obtained on stormwater is provided in Table 50. As with other parameters, TSS and turbidity levels were high.

Table 50. Summary of Results from Analyzing TSS and Turbidity in Yakima/Union Gap and Ellensburg Stormwater during 2007-08.

	TSS (mg/L)	Turbidity (NTU)
Yakima/Union Gap		
No. of Samples	15	15
Detection Frequency (%)	93%	100%
Median Concentration	111	230 J
Mean Concentration	225	223 J
90th Percentile Concentration	547	420 J
Maximum Concentration	654	475
Ellensburg		
No. of Samples	13	13
Detection Frequency (%)	100%	100%
Median Concentration	64	120
Mean Concentration	85	132
90th Percentile Concentration	151	230
Maximum Concentration	206	280

mg/L = parts per million.
NTU = nephelometric turbidity units.

Comparison with Other Data

Several other studies have analyzed pesticides and PCBs in stormwater samples from Eastern Washington cities, all in connection with TMDLs. As in the present study, these efforts relied on simple grabs or composite samples from a few grabs. The data are summarized as median values in Table 51.

Table 51. Comparison of 303(d) Pesticide, PCB, and TSS Levels Measured in Urban Stormwater Samples in Eastern Washington *(median values)*.

City:	Pullman	Yakima/ Union Gap	Ellensburg	Spokane	
Sampling Period:	2005-06	2007-08	2007-08	2007	2005
Reference:	Lubliner et al. (2006)	present study	present study	Parsons (2007)	Serdar et al. (2006)
Number of Storms	3	6	4	3	1
Number of Drains	3	up to 5	up to 5	14	4
Number of Samples	9	12	10	37-39	4
Total DDT (ng/L)	3.0	23	na	na	na
Dieldrin (ng/L)	0.53	2.8	na	na	na
Endosulfan (ng/L)	0.74	17	na	na	na
Chlorpyrifos (ng/L)	na	4.1	na	na	na
Chlordane (ng/L)	2.1 U	2.5 UJ	na	na	na
Alpha-BHC (ng/L)	0.20	2.5 UJ	na	na	na
Total PCBs (ng/L)	17	9.9	2.1	6.3	41
TSS (mg/L)	60	111	64	30	75

na = not analyzed.
U = not detected.
J = estimated.

Pesticide data were only available for Pullman. That study found much lower concentrations of total DDT and endosulfan than present study results for Yakima/Union Gap stormwater. Results for other 303(d) listed pesticides were similar between these two areas.

PCBs have been analyzed in both Pullman and Spokane runoff. The PCB levels measured for Yakima/Union Gap and Ellensburg are at the lower end of the concentrations reported for these two cities.

Yakima/Union Gap stormwater samples had much higher TSS levels than Ellensburg, Pullman, or Spokane.

Loads

The Simple Method (Schueler, 1987) was used to estimate the pollutant loads carried by Yakima/Union Gap and Ellensburg stormwater. This unit area model estimates loads of chemical constituents as a product of annual runoff volume and pollutant concentration, according to the formula:

$$L = 0.226 * R * C * A$$

Where:
L = Annual load (lbs)
R = Annual runoff (inches)
C = Pollutant concentration (mg/L)
A = Area (acres)
0.226 = Unit conversion factor

Annual runoff (R) is estimated as the product of rainfall, fraction of events that yield runoff, and a runoff coefficient:

$$R = P * Pj * Rv$$

Where:
R = Annual runoff (inches)
P = Annual rainfall (inches)
Pj = Fraction of annual rainfall events that produce runoff (usually 0.9)
Rv = Runoff coefficient

$$Rv = 0.05+(0.91*\text{Impervious Fraction})$$

The values used for Yakima/Union Gap and Ellensburg in the above equations are given in Table 52. Appendix Q has values for the same parameters for Sunnyside and for that portion of Richland that discharges stormwater to the Yakima River.

Table 52. Values Used to Calculate Stormwater Loads from Yakima/Union Gap and Ellensburg.

Yakima/Union Gap	
Yakima City Limit (acres)	17,486
Union Gap City Limit (acres)	3,224
Selah City Limit (acres)	2,858
Moxee City Limit (acres)	1,020
All City Limit Areas (acres)	24,587
Annual Rainfall (inches)	8.0
Fraction of Runoff	0.90
Impervious Fraction	0.22
Runoff coefficient	0.25
Annual Runoff (inches)	1.79
Ellensburg	
City Limit (acres)	4,279
Annual Rainfall (inches)	10.0
Fraction of Runoff	0.90
Impervious Fraction	0.22
Runoff coefficient	0.25
Annual Runoff (inches)	1.79

The urban areas shown above were the city limits, obtained through Phase I-II stormwater permit area maps www.ecy.wa.gov/programs/wq/stormwater/municipal/maps.html. The area applied to the Yakima/Union Gap stormwater data included Union Gap, Selah, and Moxee.

Annual runoff was based on Figure 4.3.1 in the *Stormwater Management Manual for Eastern Washington* (Ecology, 2004). The average annual precipitation is 10 inches in Ellensburg and 8 inches in Yakima (1961-1990 data).

In the absence of other information, the fraction of annual rainfall events that produce runoff (Pj) is usually assumed to be 0.9. This value has a strong effect on the results and is a potential source of bias in the load estimates.

The equation for Rv is the best fit line for the relationship between the storm runoff coefficient and watershed imperviousness (Schueler, 1987). An impervious fraction of 22% was used to calculate Rv. This value was taken from similar stormwater studies that evaluated land use in the cities of Spokane (Rv=22%) and Pullman (Rv=25%) (Serdar et al., 2006; Lubliner et al., 2006).

Results of the stormwater load calculations are summarized in Tables 53 and 54 for the primary contaminants of concern. Pollutant loads were based on the median concentration among the samples collected. The median was used rather than the mean due to variability in the data.

Table 53. Estimated Loading of 303(d) Listed Pesticides and PCBs in Stormwater Runoff from Yakima/Union Gap and Ellensburg.

Location/ Pollutant	Median Concentration (ng/L)	Daily Load (grams/day)
Yakima/Union Gap		
DDT	9.9 J	0.12
DDD	2.5 U	<0.03
DDE	13 J	0.16
Total DDT	23 J	0.28
Dieldrin	2.8 J	0.03
Chlorpyrifos	4.1 J	0.05
Endosulfan	17 J	0.21
Total PCBs	9.9 J	0.12
Ellensburg		
Total PCBs	2.1 J	0.01

U = not detected at or above reported value
J = estimated value

Table 54. Estimated TSS Loading in Stormwater from Yakima/Union Gap and Ellensburg.

Location	Median Concentration (mg/L)	Daily Load (tons/day)	Annual Load (tons)
Yakima/Union Gap	111	1.5	550
Ellensburg	64	0.19	69

The advantage of using the Simple Method is that it requires a modest amount of information and is considered to provide reasonable estimates of pollutant export from urban areas (www.stormwatercenter.net). It is important, however, not to over emphasize the precision of the results obtained. In addition, the Simple Method only estimates pollutant loads generated during storm events. It does not consider pollutants associated with baseflow volume.

The present study is one of the larger efforts to characterize toxics in stormwater from urban areas in Washington. However, urban stormwater runoff is inherently variable in both quality and quantity. Although a consistently elevated level of contamination was observed in Yakima/Union Gap and Ellensburg stormwater, it should be recognized that spatial and temporal variability in these discharges is still poorly known.

Point and Nonpoint Sources Compared

The results from analyzing 303(d) pesticides, PCBs, TSS, and turbidity in the lower Yakima River basin during 2007-08 are compared as medians in Figure 66. Note that the concentrations are on a log scale (factors of 10).

The following sources stand out in terms of *concentrations*:

- 303(d) pesticides, PCBs, TSS, and turbidity were higher in Yakima/Union Gap stormwater runoff than in other sources, typically by an order of magnitude or more. Similar levels of PCBs, TSS, and turbidity were found in Ellensburg stormwater.
- Sources that ranked second behind stormwater included irrigation returns (DDT compounds and TSS), fruit packer and vegetable processor effluents (dieldrin, chlorpyrifos, and endosulfan), and WWTP effluents (PCBs).
- Comparable data were not obtained on toxaphene. Results point to at least some irrigation returns as having elevated concentrations. A high toxaphene concentration was recorded in one instance in a Yakima area stormwater sample. Reporting limits were not low enough to rule out the presence of significant concentrations in other stormwater samples.

The impacts of these sources on the Yakima River are a function of pollutant concentration and flow (loads), as well as dilution at the point of discharge. The amount of available dilution varies with location and season. However, a general sense of the relative importance of sources can be gained by a simple comparison of loads.

The load estimates for point and nonpoint sources, calculated earlier in this report, are compared in Figure 67. The loads in the lower Yakima River at Kiona and Horn Rapids provide a point of reference.

Reporting limits were high for most pesticides in WWTP effluent and for toxaphene in NPDES discharges in general. To avoid the perception that concentrations were zero, half the reporting limit was used to calculate a load for these chemicals in Figure 67. The true loads are unknown.

In all cases, the largest loads are from the irrigation returns and tributaries, followed by stormwater. When averaged over the entire year, the stormwater loads are only about 1/10 of those calculated for the returns. While the other sources evaluated in this study are continuous discharges, stormwater is released in a series of relatively brief, concentrated pulses. For this reason, stormwater has a greater potential for adverse water quality impacts than the load estimates might suggest. Pollutant concentrations in the storm drains during baseflow conditions are unknown.

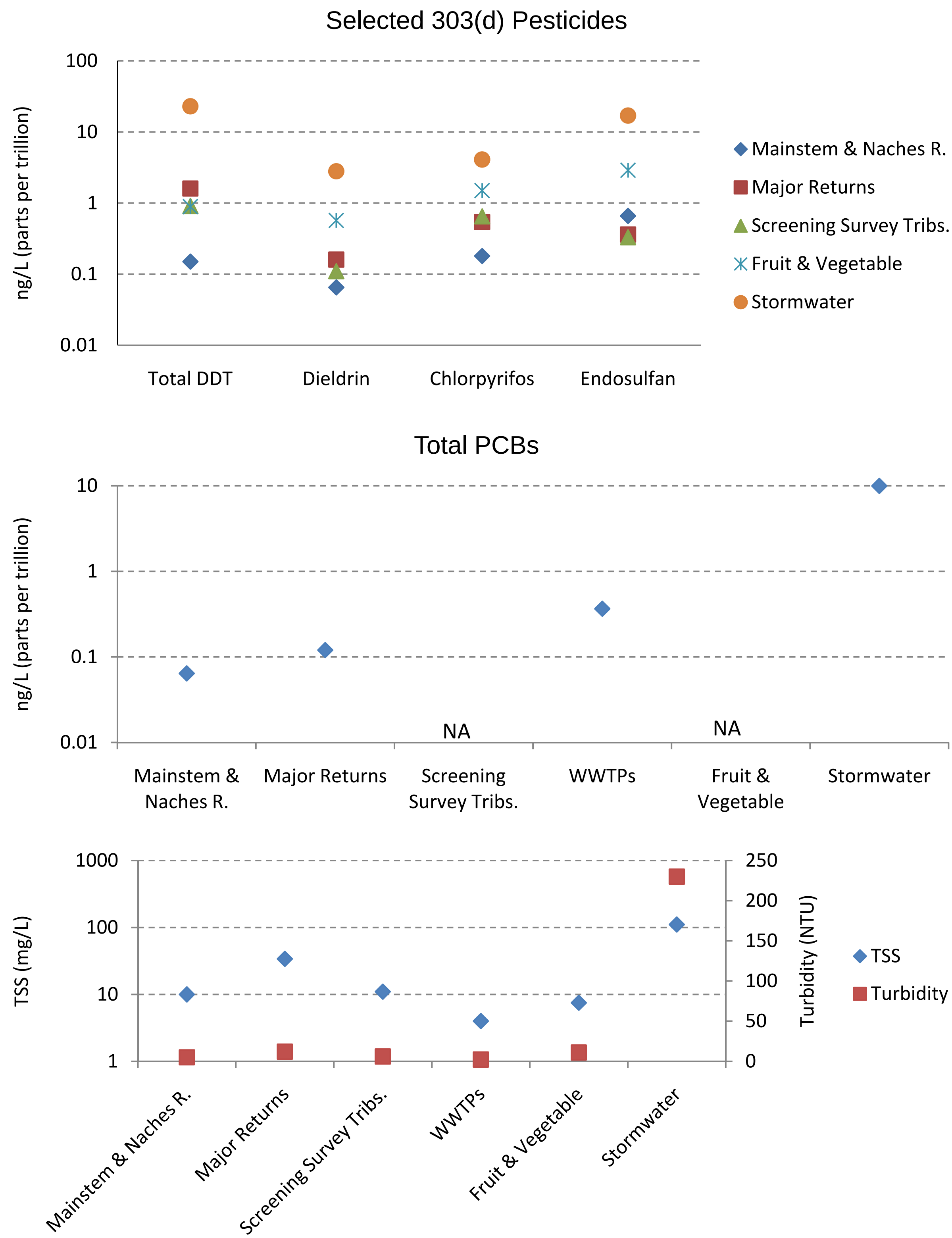


Figure 66. Median Concentrations of Selected Pollutants in the Lower Yakima River Drainage during 2007-08 *(log scale).*

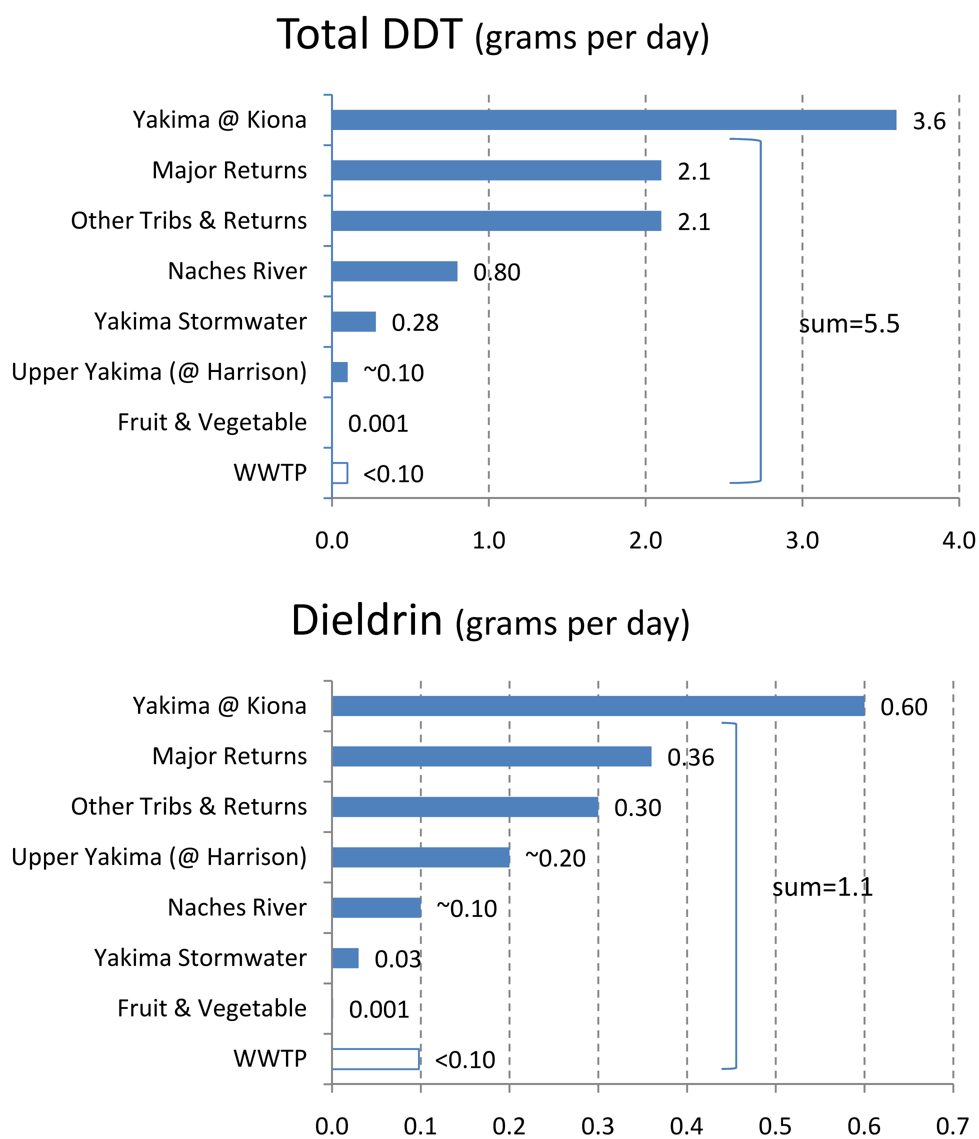


Figure 67. Loading Comparison for Selected Pollutants Analyzed in 2007-08 *(unfilled bars are estimated loads based on half the reporting limit).*

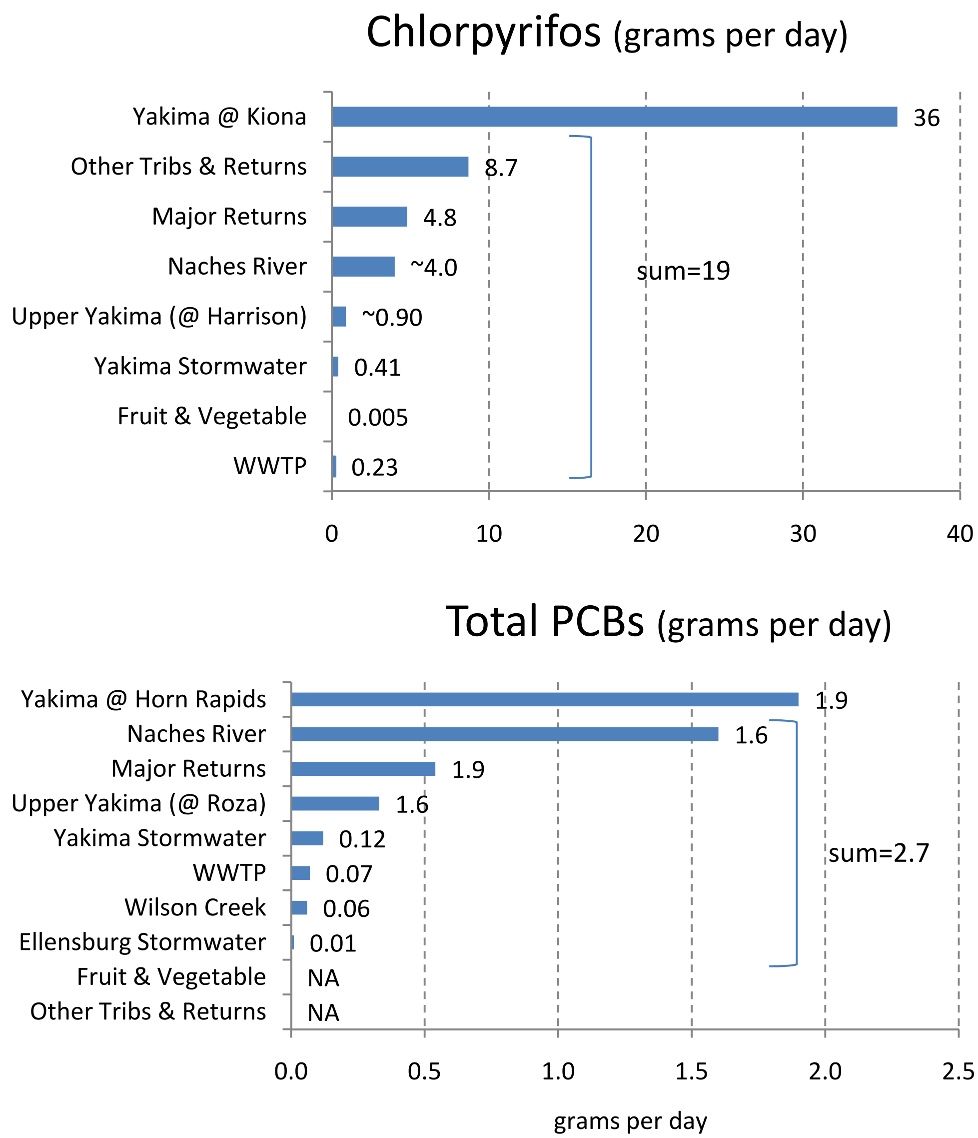
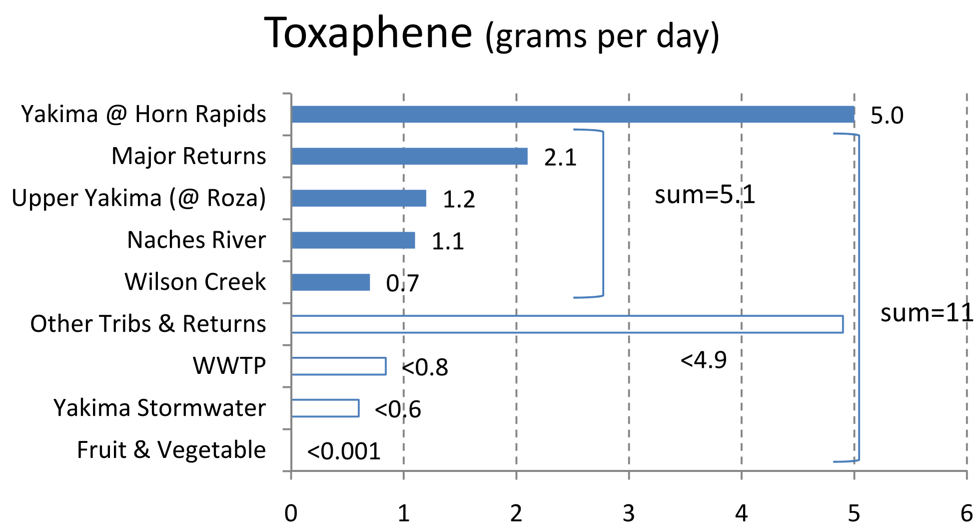


Figure 67. Loading Comparison (continued).



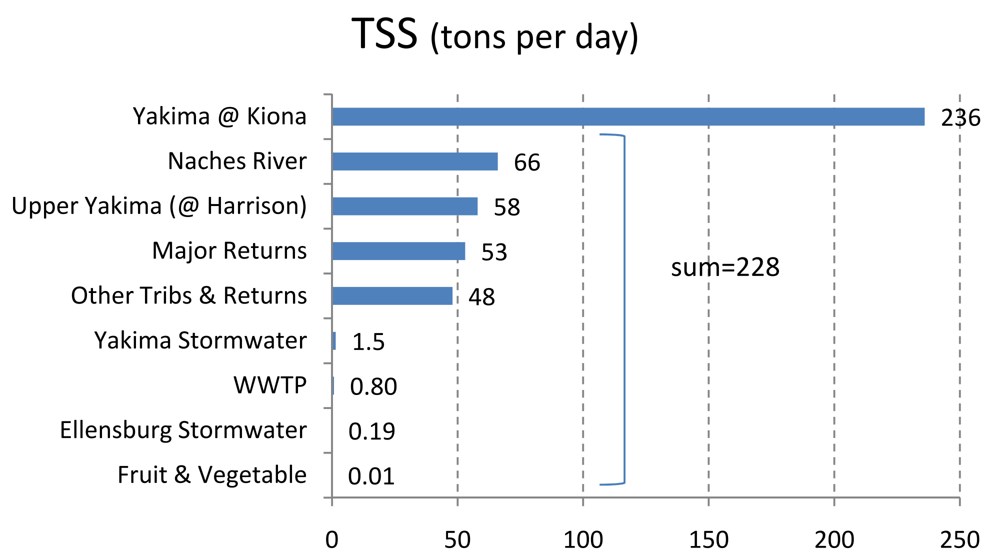


Figure 67. Load Comparison (continued).

Comparing the summed loads in Figure 67 with the downstream loads in the Yakima River at Kiona and Horn Rapids provides a means of gauging how well the water quality study accounted for pollutant loads to the Yakima River.

It was impractical to obtain synoptic data on all these discharges. It is therefore not surprising that the estimates of the incoming and outgoing loads are not always in close correspondence. Overall however, the water quality study does appear to have accounted for the major sources of total DDT, dieldrin, PCBs, toxaphene, and TSS.

The study accounted for only about half of the chlorpyrifos loading to the river. This can probably be attributed to the difficulty of defining the short-term spikes in concentrations that occur during application periods.

Table 55 shows the relative importance of the point and nonpoint sources assessed in the water quality study, in terms of percent of the summed load (from Figure 67). Chlordane was detected too infrequently to compare source loadings.

Table 55. Relative Importance of Point and Nonpoint Loads to Lower Yakima River *(based on loads shown in Figure 67).*

Source	Total DDT (g/day)	Dieldrin (g/day)	Chlorpyrifos (g/day)	Total PCBs (g/day)	Toxaphene (g/day)	TSS (tons/day)
Total Point/ Nonpoint Load	5.5	1.1	19	2.7	5.1 - 11	228
Upper Yakima and Naches Rivers	~17%	~30%	26%	73%	20-45%	54%
Tributaries and Returns	78%	66%	71%	20%*	55-67%	44%
Yakima Area Stormwater	5%	3%	2%	5%	<5% - <12%	1%
Ellensburg Stormwater	NA	NA	NA	<1%	NA	<1%
WWTPs	<2%	<9%	1%	3%†	<7% - <16%	<1%
Fruit & Vegetable	<1%	<1%	<1%	NA	NA	<1%

NA = not analyzed.
*Wilson Creek, Moxee Drain, Granger Drain, Sulphur Creek Wasteway, and Spring Creek only.
†includes Ellensburg, Cle Elum, and Kittitas WWTPs.

Status of 303(d) Listed Chemicals and Toxaphene in the Yakima River

The water quality status of the Yakima River basin with respect to 303(d) listed chemicals and toxaphene is summarized in Tables 56 (reservoirs and mainstem) and 57 (tributaries and returns), based on results from Ecology's 2007-08 water quality study and 2006 fish tissue survey. The determination as to whether a particular waterbody segment did or did not exceed criteria generally follows Ecology's sample size requirements for 303(d) listing (Ecology, 2006):

Water column data: A segment will be placed in Category 5 (i.e., the 303(d) list) due to a toxic pollutant in the water column when two or more samples within a three-year period exceed the applicable criteria.

Tissue data: A segment will be placed in Category 5 if either the mean of three single-fish samples with the highest concentration of a given pollutant or one composite sample made up of at least five fish exceed the applicable criteria.

In some instances, PCBs and toxaphene are highlighted as exceeding water quality criteria based on results from one or two SPMD passive samples (from the data in Table 30). It should be noted that Ecology policy does not address using SPMD data for 303(d) listing purposes. Also, a single sample does not strictly meet the two-sample-per-segment minimum for listing under Category 5. However, as previously discussed, chemical concentrations derived from SPMDs are comparable to other types of low-level water samples. And, because SPMDs measure the long-term average concentration of a chemical, the results should be considered to carry at least as much weight as two separate grab samples.

Table 56. Summary of Water Quality Exceedances in Yakima River Storage Reservoirs, Mainstem Yakima River and Naches River for 303(d) Listed Chemicals and Toxaphene during Ecology's 2006-08 Fish Tissue and Water Quality Studies.
(● = Criteria were exceeded in at least one composite edible fish tissue sample, two whole water samples, or one SPMD passive sample at one or more sampling sites per waterbody. ○ = Criteria were not exceeded.)

Waterbody/ Chemical	Human Health Criterion		Chronic Aquatic Life Criterion	Acute Aquatic Life Criterion
	Fish Tissue	Water Column	Water Column	
Keechelus Lake (WRIA 39)				
PCBs	●	NA	NA	NA
Kachess Lake (WRIA 39)				
PCBs	●	NA	NA	NA
Upper Mainstem (WRIA 39)				
PCBs	●	○	○	○
Dioxin	●	NA	NA/**	NA/**
Naches River (WRIA 38)				
PCBs	NA	●	○	○
Lower Mainstem (WRIA 37)				
DDT	○	○	**	**
DDE	●	●	**	**
DDD	○	○	**	**
Total DDT	**	**	○	○
Dieldrin	●	●	○	○
Chlorpyrifos	**	**	○	○
Chlordane	●	○	○	○
PCBs	●	○	○	○
Toxaphene	●	●	●	○
Dioxin	●	NA	NA/**	NA/**

NA = not analyzed.
** Human health criteria have not been established for total DDT or chlorpyrifos; aquatic life criteria for DDT compounds apply to total DDT only; aquatic life criteria have not been established for dioxin.

Table 57. Summary of Water Quality Exceedances in Tributaries and Irrigation Returns of the Yakima and Naches Rivers for 303(d) Listed Chemicals and Toxaphene.

(● = Criteria were exceeded in <u>at least</u> two whole water samples or one SPMD passive sampler during Ecology's 2007-08 water quality studies. ○ = Criteria were not exceeded. Endosulfan, chlordane, and alpha BHC did not exceed (not shown in table). Dioxin was not analyzed in water samples. Fish samples were not analyzed from these waterbodies.)

Waterbody/ WRIA	Tributary/ Irrigation Return	Human Health Criteria						Aquatic Life Criteria			
								Chronic			Acute
		DDT	DDE	DDD	Dieldrin	PCBs	Toxaphene	Total DDT	Chlorpyrifos	Toxaphene	Chlorpyrifos
Upper Yakima/39	Wilson Creek	- -	- -	- -	- -	○	○	- -	- -	●	- -
Naches/38	Cowiche Creek	○	●	○	○	NA†	○*	●	○	○*	○
Lower Yakima/37	Sulphur Cr. WW	○	●	○	●	●	●	●	●	●	●
	Granger Drain	●	●	○	●	●	●	●	○	●	○
	Moxee Drain	○	●	○	●	○	○	●	○	●	○
	Spring Creek	●	●	○	●	○	○	●	●	●	●
	Grandview Drain	●	●	○	●	NA	○*	●	○	○*	○
	Satus Drain #302	●	●	○	●	NA	○*	●	○	○*	○
	Drain #31	○	●	○	●	NA	○*	●	○	○*	○
	Wide Hollow Cr.	○	●	○	●	NA	○*	●	○	○*	○
	E. Toppenish Dr.	○	●	○	●	NA	○*	●	○	○*	○
	Satus Drain #303	○	●	○	●	NA	○*	●	○	○*	○
	Selah Ditch	○	●	○	○	NA	○*	●	○	○*	○
	Zillah Drain	○	●	○	○	NA	○*	●	○	○*	○
	South Drain	●	●	○	○	NA	○*	●	○	○*	○
	Subdrain 35	○	●	○	○	NA	○*	●	○	○*	○
	DID #7	○	●	○	○	NA	○*	○	○	○*	○
	Marion Drain	○	○	○	○	NA	○*	○	●	○*	●

- - = to be reported separately (TMDL Effectiveness Monitoring).
NA = not analyzed.
* = high reporting limits.
†Currently 303(d) listed based on historical fish tissue data.

Pollutants for which a TMDL or Other Control Plan is Needed

The Clean Water Act requires that a TMDL or other pollution control plan be developed for each 303(d) listed pollutant in a waterbody. Findings from Ecology's 2006-08 studies show 303(d) listings are appropriate for the locations and pollutants shown in Table 58, either due to previously listed chemicals continuing to exceed criteria or new findings. The toxaphene TMDL recommendation for the Lower Yakima River and the PCB recommendation for the Naches River (except for the Cowiche Creek fish tissue listing, Appendix A) are based on SPMD passive samplers, and thus do not strictly meet listing requirements for 303(d).

Table 58. Yakima Basin WRIAs Where a TMDL or Other Pollution Control Plan is Needed.

Keechelus Lake Kachess Lake (WRIA 39)	Upper Yakima River (WRIA 39)	Lower Yakima River (WRIA 37)	Naches River (WRIA 38)
PCBs[hh]	PCBs[hh] Toxaphene[aq*] (Wilson Creek) Dioxin[hh]	PCBs[hh] Toxaphene[hh,aq*] DDE[hh] Total DDT[aq] Chlordane[hh] Dieldrin[hh] Chlorpyrifos[aq] (returns/tributaries) Dioxin[hh]	PCBs[hh] DDE[hh] (Cowiche Creek) Total DDT[aq*] (Cowiche Creek)
Number of 2008 303(d) Listings Addressed			
1	2	78	2

hh = human health criteria at issue.
aq = aquatic life criteria at issue.
*not currently listed.

Previously unlisted impairments identified within these WRIAs are itemized below in Table 59.

Table 59. Potential Unlisted Waterbody Impairments in the Yakima River Drainage

WRIA	Water Body Name	Parameter	Medium
37 Lower Yakima	DID 7	DDE	Water
	Drain #31	DDE	Water
		Dieldrin	Water
		T-DDT	Water
	East Toppenish Drain	DDE	Water
		Dieldrin	Water
		T-DDT	Water
	Grandview Drain	DDE	Water
		T-DDT	Water
		Dieldrin	Water
	Granger Drain	PCBs	Water*
		Toxaphene	Water*
	Moxee Drain	Toxaphene	Water*
	Satus Drain #302	DDE	Water
		T-DDT	Water
		Dieldrin	Water
	Satus Drain #303	DDE	Water
		T-DDT	Water
		Dieldrin	Water
	South Drain	DDE	Water
		T-DDT	Water
	Spring Creek	Dieldrin	Water
		Toxaphene	Water*
	Sub Drain #35	DDE	Water
		T-DDT	Water
	Sulphur Creek Wasteway	PCBs	Water*
		Toxaphene	Water*
	Yakima River @ Sunnyside Dam	Toxaphene	Water*
	Yakima River nr. Prosser	Toxaphene	Water* & Fish Tissue
	Yakima River nr. Horn Rapids	Toxaphene	Water* & Fish Tissue
	Zillah Drain	DDE	Water
		T-DDT	Water
38 Naches	Naches River	PCBs	Water*
	Cowiche Creek	T-DDT	Water
39 Upper Yakima	Kachess Lake	PCBs	Water
	Selah Ditch	DDE	Fish Tissue
		T-DDT	Water
	Wilson Creek	Toxaphene	Water*

*based on SPMD samples.

PCBs, Dioxin, Chlorpyrifos, and Chlordane

Some additional discussion on the occurrence and significance of PCBs, dioxin, chlorpyrifos, and chlordane in the Yakima River follows:

PCBs

Currently, there are 92 individual 303(d) listings in Washington State for PCBs exceeding human health criteria in surface waters. Many of these listings are from lakes and rivers with no obvious local sources of these compounds, Keechelus Lake and Kachess Lake being examples in the Yakima basin.

The PCB analyses in the present water quality study are an integral part of Ecology' plans to address 303(d) water quality concerns in the Yakima River. The PCB assessment identified several opportunities to approach water quality improvements through a direct implementation approach for a contaminant that may not be addressed effectively through a traditional TMDL track. The assessment provides opportunities for direct implementation while working through statewide issues associated with the widespread presence of PCBs in Washington's waterways. Additionally, an updated and thorough assessment of PCBs provides a current benchmark for long-term assessment of implementation actions, even for those not directly targeted at PCB levels, such as efforts to reduce TSS levels in runoff to the Yakima River.

Sulphur Creek Wasteway, Granger Drain, and Yakima area stormwater are examples of elevated PCB contamination where potential sources should be considered and opportunities for targeted cleanups may exist (e.g., transformer storage yards, natural gas drilling, old landfills, or illegal dumpsites existing in the area).

Dioxin

In view of the low dioxin concentrations in Yakima River fish and due to budget constraints, dioxin was not analyzed in the 2007-08 water quality study. Although only a few fish samples from the 2006 survey exceeded human health criteria, 303(d) policy requires listing in instances where even a single composite sample is above criteria. (www.ecy.wa.gov/programs/wq/303d/wqp01-11-ch1Final2006.pdf).

Dioxin is an unintentional byproduct of combustion and certain industrial processes. It has been the subject of source controls locally and nationally, including a TMDL for the Columbia River basin (EPA, 1991a). Dioxin levels are expected to decrease in the Yakima River in the future.

Dioxin will remain on the 303(d) list of contaminants to be addressed in the Yakima basin. Additional water quality work on Yakima River dioxins will be prioritized along with other water quality concerns in the Central Region through Ecology's annual watershed scoping process. Ecology is currently evaluating low-level dioxin contamination through a statewide study on the dioxin and PCB background in fish from Washington rivers and lakes (Johnson et al., 2010). Findings from this study are likely to have implications for addressing 303(d) listings for dioxins and PCBs in the Yakima River.

Ecology plans to address dioxins on a larger scale (possibly region- or state-wide) in the future. Additionally, because dioxins are often carried via air and can pollute sizeable areas not necessarily limited to watersheds, a larger TMDL footprint will likely be more effective and efficient.

Chlorpyrifos

Unlike legacy pesticides, chlorpyrifos is a water quality concern in the Yakima drainage only during the growing season, in and around the times it is applied. Chlorpyrifos and other organophosphorus insecticides have faster breakdown rates, lower affinity for sorption and bioaccumulation, and greater solubility. Aquatic life criteria are the primary concern with chlorpyrifos, rather than human health concerns prominently associated with legacy pollutants.

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) governs the sale and use of chlorpyrifos by directing EPA to regulate pesticides through a registration process. A pesticide may not be sold or used in the U.S. unless it is registered by EPA and has an approved label authorizing a given use. Additionally, FIFRA requires product labels to specify where and how pesticide products may be used and applied. EPA must periodically review the registration to ensure compliance with FIFRA and other federal laws. The Washington State Department of Agriculture (WSDA) has legal authority to impose any of these restrictions.

The National Oceanic and Atmospheric Administration (NOAA, 2008) recently issued findings that chlorpyrifos jeopardizes the survival of Pacific salmon listed as threatened or endangered in the West. A recent decision in a lawsuit brought by environmental and commercial fishing groups expanded buffers to 1,000 feet from streams for aerial spraying, 500 feet for ground spraying, plus a 20-foot strip of grass or brush. Chlorpyrifos cannot be sprayed when the wind is blowing or when a major storm might wash it into rivers and streams. The old buffers were 300 feet for aerial spraying and 60 feet for ground spraying, with no vegetation strip required.

EPA has one year to implement these findings. When put into effect, the new requirements will be considered an implementation activity for chlorpyrifos under the TMDL statute. Inclusion of chlorpyrifos in the TMDL will provide assurance that that they will be implemented and their effectiveness monitored.

Chlorpyrifos should remain part of this TMDL. Actions by other Federal and State agencies may create the implementation requirements to bring about water quality compliance, but could be aimed at some other regulatory criteria. Inclusion in the TMDL provides the ability to track the implementation of the developing rules and the application and compliance with those rules to determine if they succeed in achieving and assuring compliance with water quality standards.

Ecology has an ongoing monitoring program for current-use pesticides in the lower Yakima basin that includes chlorpyrifos (the previously mentioned *Surface Water Monitoring Program for Pesticides in Salmonid-Bearing Streams* www.ecy.wa.gov/programs/eap/toxics/pesticides.htm). WSDA and Ecology are engaging growers in the watershed for help in determining less toxic and less mobile pesticides through a series of presentations. Application methods, integrated pest management, and meteorological planning are included to help prevent off-site transport.

Chlordane

Ecology's 2006 fish tissue study showed human health criteria exceedances for chlordane were limited to carp analyzed in the vicinity of Prosser and that the exceedances were marginal. This is the same general location for the existing 303(d) listing on edible fish tissue (whitefish samples from 1998, reported in EPA (2002a)).

Extensive water sampling in 2007-08 failed to identify a single instance of chlordane exceeding either human health or aquatic life criteria in the Yakima mainstem, tributaries, or irrigation returns. One of the Yakima/Union Gap stormwater samples did however substantially exceed human health criteria for chlordane.

The evidence suggests chlordane has been reduced to low levels in the Yakima system and is now an insignificant concern for human health and aquatic life in almost all areas.

Pollutants Not Exceeding Standards

If it is determined that water quality standards are being met for a particular pollutant throughout the year, taking into account seasonal variations and critical conditions, and are not expected to be exceeded by the next 303(d) listing cycle, then a TMDL is not required. The Yakima River was listed for alpha-BHC, endosulfan, chlordane, and dioxin based on older data. The 2006-08 studies show that alpha-BHC and endosulfan are now meeting water quality criteria. Chlordane is meeting criteria in all but one area. Dioxin is now meeting criteria in Keechelus Lake.

Chlordane and alpha-BHC are no longer used, having been banned by EPA in the 1970s and 80s. Extensive monitoring of endosulfan in the lower Yakima River drainage has failed to detect a single recent violation of water quality criteria. The use of endosulfan is governed by FIFRA, EPA, and the WSDA. Chlordane, alpha-BHC, and endosulfan levels are not expected to exceed standards in the Yakima River in the future. A similar conclusion applies to dioxin, as previously discussed. For these reasons, TMDLs are no longer required for these chemicals for the WRIAs shown in Table 60.

Table 60. Locations and Pollutants Where a TMDL is No Longer Required.

Keechelus Lake (WRIA 39	Upper Yakima River (WRIA 39)	Lower Yakima River (WRIA 37)
Dioxin	Chlordane	Endosulfan Alpha-BHC
Number of 2008 303(d) Listings Removed		
1	1	8

Numeric TMDL Targets

Numeric water quality targets must be identified in a TMDL. The targets identify the specific instream goals or criteria for the TMDL, which equate to attainment of water quality standards. In most cases targets are set equal to the water quality criteria.

Pesticide and PCB Targets

Applicable water quality criteria for all 303(d) listed chemicals in the Yakima basin were previously listed in Table 3. Compliance with a subset of these criteria has been identified as a major water quality issue. These criteria provide numeric targets for the *Pesticides and PCBs TMDL* (Table 61).

Table 61. Numeric TMDL Targets (Water Quality Criteria) for Pesticides and PCBs That Currently Exceed Standards in the Yakima River, Tributaries, or Irrigation Returns *(ng/L = parts per trillion).*

Pollutant	Numeric Target (ng/L)	Protective of:
DDT	0.59	Human health for the average fish consumer
DDE	0.59	Human health for the average fish consumer
DDD	0.83	Human health for the average fish consumer
Total DDT	1.0	Aquatic life for chronic exposure
Dieldrin	0.14	Human health for the average fish consumer
Chlordane	0.57	Human health for the average fish consumer
Chlorpyrifos	41	Aquatic life for chronic exposure
	83	Aquatic life for acute exposure
Total PCBs	0.17	Human health for the average fish consumer
Toxaphene	0.20	Aquatic life for chronic exposure
	0.73	Human health for the average fish consumer

Suspended Sediment and Turbidity Targets

Numeric targets for turbidity and TSS have been set by the existing Yakima River suspended sediment and pesticide TMDLs (Table 62).

The 7 mg/L TSS target for the lower Yakima River was intended to meet the 1 ng/L chronic aquatic life criterion for total DDT. Seven mg/L was derived by correlating total DDT concentrations with the corresponding TSS concentrations, using data collected during the irrigation season from 1988-1995. Recognizing that the relationship between DDT and TSS was likely to change as soil erosion was brought under control, the TMDL stipulated the target should be re-evaluated in 2007. A TSS target of 7 mg/L equates to less than 4 NTU, which is below background for the lower Yakima River.

Table 62. Existing TMDL Targets for Turbidity and Total Suspended Solids in the Yakima River.

Pollutant	Numeric Target	Applies To:	Intent
Upper Yakima River			
Turbidity	< 10 NTU over background	Mainstem and selected tributaries (2006 target)	Compliance with state turbidity standards
	<5 NTU over background	Mainstem and selected tributaries (2011 target)	
Lower Yakima River			
Turbidity	<5 NTU over background	Mainstem (2002 target; extended to 2003)	Compliance with state turbidity standards
	25 NTU (90th percentile)	All points within all tributaries and drains (2007 target)	Protect fish and other aquatic organisms; assist with turbidity compliance in mainstem
Total Suspended Solids	7 mg/L (1 ng/L total DDT)	Mainstem, tributaries, and drains (2012 target; re-evaluate in 2007)	Achieve total DDT chronic aquatic life criterion

A USGS study in 1999-2000 found the amount of total DDT associated with suspended sediment had indeed decreased in the lower Yakima River compared to the pre-TMDL period (Fuhrer et al., 2004). Fuhrer suggests several possible reasons for the decline: (1) degradation of total DDT in soils and bed sediments; (2) dilution of suspended sediment with uncontaminated eroded soils; or (3) use of PAM (polyacrylamide) in the flocculation and sedimentation of fine-grained, organically enriched soil particles that tend to sorb total DDT. The report concluded that "*…the total DDT criterion could be met when concentrations of suspended sediment are well above 7 mg/L".*

The total DDT:TSS correlation observed in 1988-1995 is shown in Figure 68 and compared to similar data from the 2007 irrigation season. The original correlation was based on pooled data for the mainstem, tributaries, and irrigation returns (N= 71). The same or similar locations were used to assess the correlation for 2007 (N= 95).

As shown in this figure, total DDT and TSS concentrations had shifted downward by an order of magnitude in 2007 compared to 1988-1995. Total DDT had commonly been seen in the range of 10-100 ng/L, but now rarely exceeds 5 ng/L. Whereas TSS once approached 1,000 mg/L, current levels are below 200 mg/L. Total DDT and suspended sediment concentrations have obviously decreased to a substantial extent.

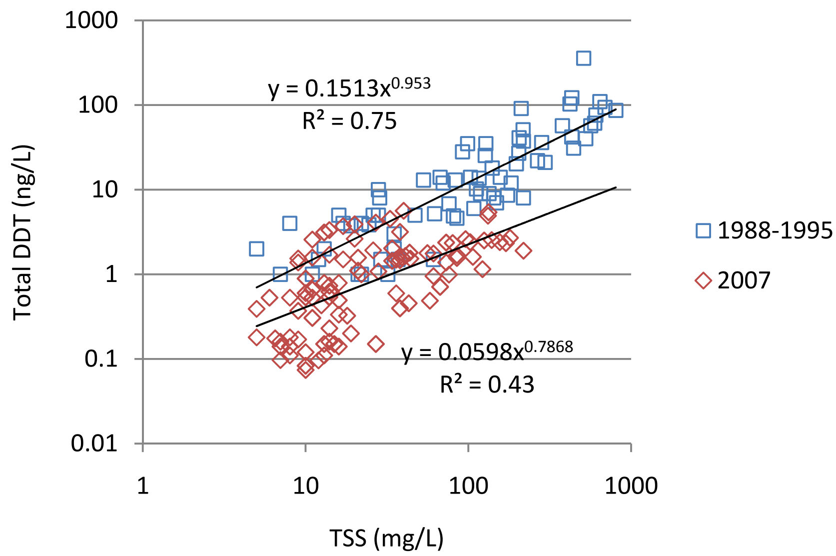


Figure 68. Total DDT:TSS Correlation in the Lower Yakima River Drainage: 1988-1995 vs. 2007 Irrigation Seasons.

The R^2 values in these relationships indicate the percent of the DDT data that is explained by TSS (coefficient of determination). The correlation was not as strong in 2007 because the data now cover a much narrower range of concentrations, with many of the results being close to the detection limit and thus more scatter in the data.

A stronger correlation ($R^2 = 0.50$) results when the 2007 and 2008 data are pooled (Figure 69, N= 144). The mainstem data for the December 2007 storm were excluded here because the TSS concentrations were extreme outliers that had an undue influence on the correlation. Yakima at Harrison Bridge data were not used because DDT compounds were never detected.

Solving this regression equation for 1 ng/L total DDT gives 32 mg/L TSS, a value four times higher than the original 7 mg/L target. While there is more uncertainty associated with this new value, the 2007-08 data represent an improvement over what was available in 1988-95 with respect to sample size and equitable distribution across the study area.

Based on the TSS and turbidity data collected in 2007-08, 32 mg/L equates to 13 NTU (Figure 70). The existing TMDL target for meeting the state turbidity criteria in the lower Yakima mainstem is background + 5 NTU. Background is typically at or below 10 NTU (see Table 36). Thus, the target would normally be 15 NTU or less. Therefore, the existing TMDL turbidity target of background + 5 NTU should be effective for the mainstem in both meeting a total DDT-based TSS target of 32 mg/L and in achieving compliance with the turbidity criteria.

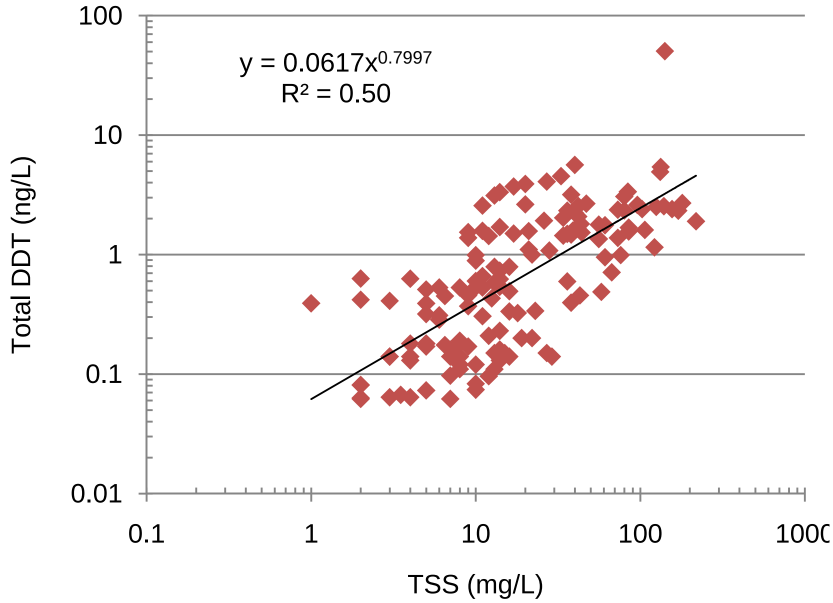


Figure 69. Total DDT:TSS Correlation in the Lower Yakima River Drainage, April 2007-March 2008.

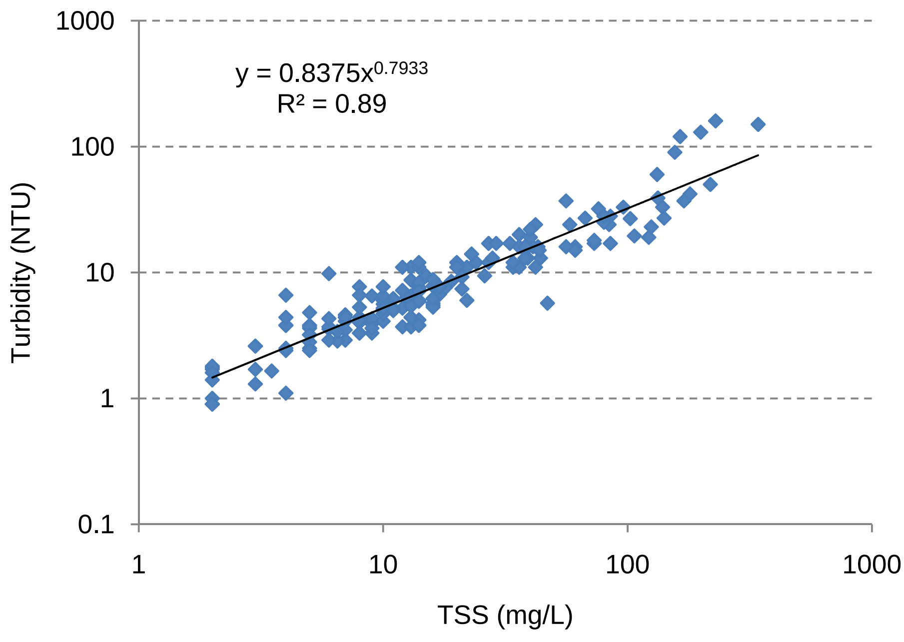


Figure 70. Relationship between Turbidity and Total Suspended Solids in the Lower Yakima River Drainage during 2007-08 *(pooled results from monthly monitoring of the Yakima mainstem, Naches River, and the four major irrigation returns, N = 167).*

A 32 mg/L target would be under-protective for irrigation returns since these sometimes exceed the total DDT criterion at lower TSS levels. There was a good correlation between total DDT and TSS in Moxee Drain (R^2=0.76) and in Spring Creek (R^2= 0.59) during 2007-08 (Figure 71). The data indicate that TSS concentrations of 29 and 19 mg/L, respectively, correspond to the 1 ng/L total DDT criterion. These concentrations equate to turbidities of 11 and 8 NTU, respectively. Thus, a turbidity target of 10 NTU appears to be appropriate for these discharges.

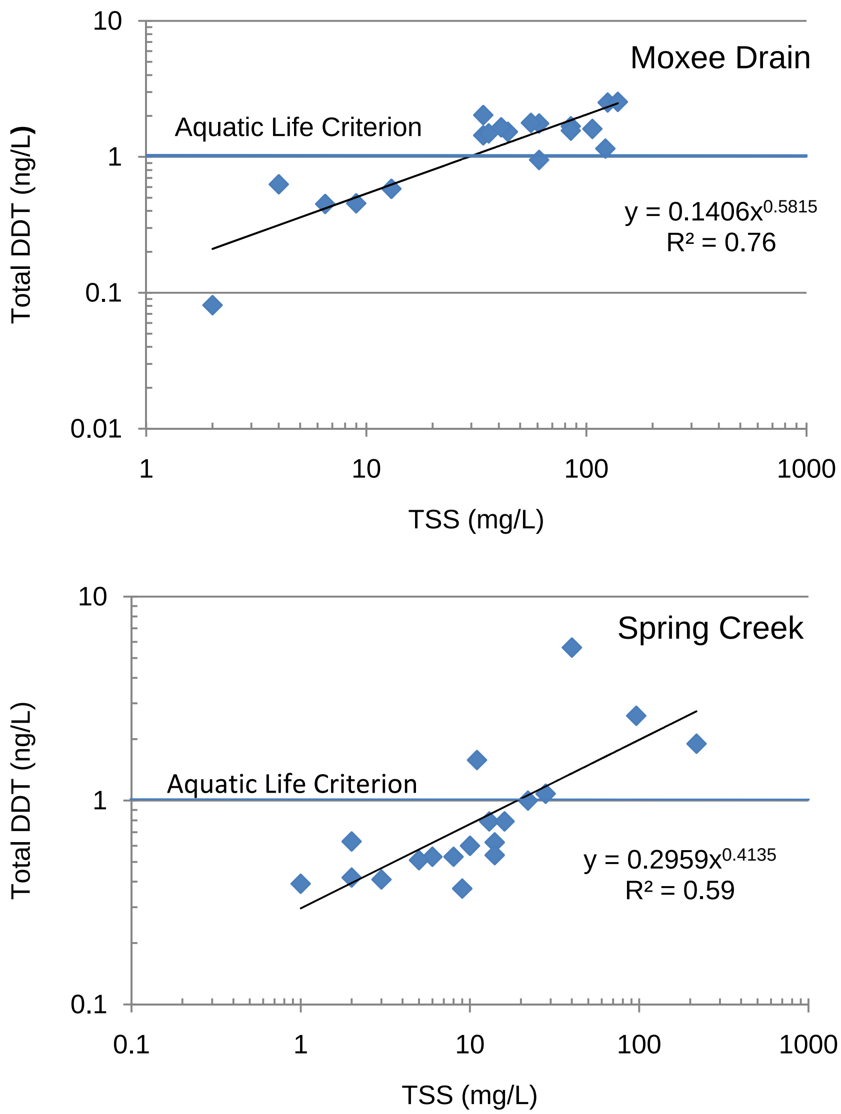


Figure 71. Total DDT:TSS Correlation in Moxee Drain and Spring Creek during April 2007-March 2008.

Total DDT also increased with TSS in Sulphur Creek Wasteway, although concentrations varied widely at higher TSS levels, reducing the strength of the correlation (Figure 72). Under conditions of 10 NTU (~25 mg/L TSS) total DDT concentrations were always less than 2 ng/L. Therefore, a 10 NTU target for Sulphur Creek also looks reasonable at the present time.

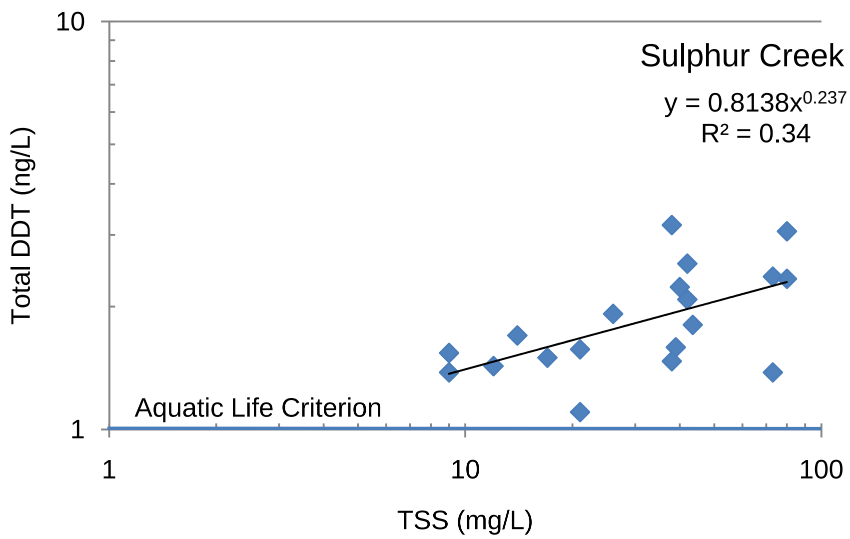


Figure 72. Total DDT:TSS Correlation in Sulphur Creek Wasteway during April 2007-March 2008.

Granger Drain consistently exceeded the 1 ng/L criterion by factors of 2 to 4 or more, and there was no clear relationship between total DDT and TSS (Figure 73). The absence of even a modest correlation suggests that source areas within the drainage have substantially different total DDT:TSS signatures and that these areas are active at different times of the year.

It is uncertain what reductions in TSS would be required to meet the total DDT criterion in Granger Drain. Turbidity exceeded 10 NTU most of the time during 2007-08 (74% of samples). Therefore, a 10 NTU target for Granger Drain would be a useful interim goal for improving water quality and bringing this discharge closer into compliance with the total DDT criterion.

The DDE human health criterion is 40% lower than the total DDT aquatic life criterion (0.59 vs. 1.0 ng/L). There was a consistent relationship between DDE and total DDT across the study area (Figure 74). This correlation indicates that when the total DDT concentration is 1 ng/L, DDE should be in the neighborhood of 0.7 ng/L. In other words, when the aquatic life criterion is being achieved ($\leq$ 1 ng/L), the human health criterion should be achieved or close to being achieved as well ($\leq$0.7 ng/L vs. 0.59 ng/L). Therefore the turbidity targets proposed here should be adequate to gauge progress toward meeting both criteria. A similar conclusion applies to the human health criterion specific to DDT since it is the same as the DDE criterion and ambient concentrations of DDT are lower than DDE.

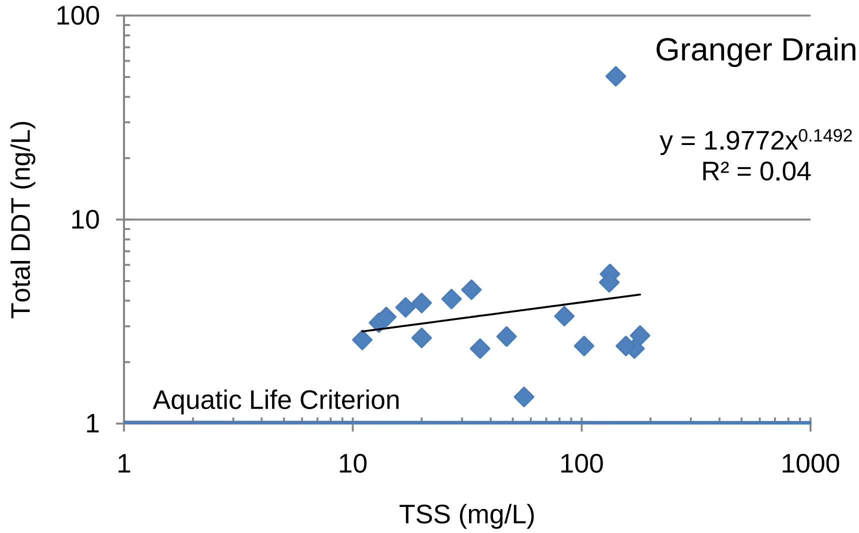


Figure 73. Total DDT:TSS Correlation in Granger Drain during April 2007-March 2008.

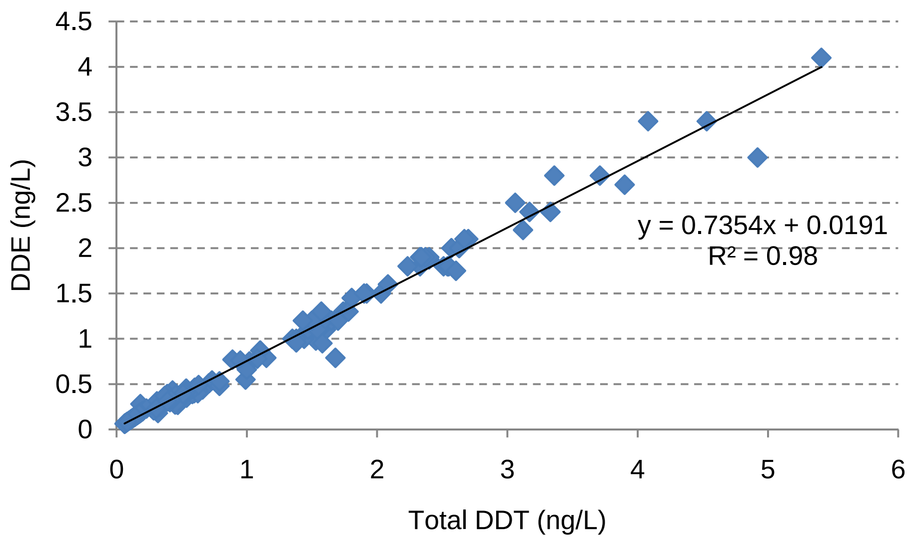


Figure 74. Relationship Between DDE and Total DDT in the Yakima River, Tributaries, and Irrigation Returns during 2007-08 *[excluded data: Yakima River at Harrison Bridge and high DDT outliers for Granger Drain (1/10/08) and Spring Creek (4/5/07)]*.

Not enough samples were collected from other lower Yakima River tributaries and irrigation returns to have confidence in determining appropriate turbidity targets to meet water quality criteria for DDT compounds. The amount of total DDT associated with suspended matter is relatively high in some of these discharges. Figure 75 shows how total DDT compares to a turbidity target of 10 NTU at the 12 screening survey sites where the 1 ng/L was exceeded on at least one occasion. Approximately 30% of the samples exceeded 1 ng/L at 10 NTU or less. Under current conditions, turbidities less than 5 NTU might be required to meet the criterion. For sake of consistency, an interim TMDL target of 10 NTU is proposed for irrigation returns basin-wide, recognizing that the total DDT:TSS ratio will decrease over time as erosion is brought under further control.

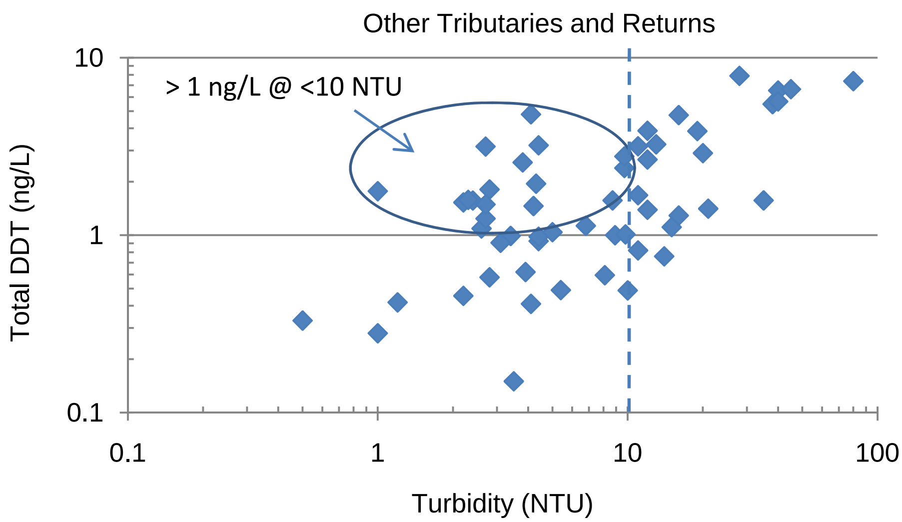


Figure 75. Total DDT vs. Turbidity in Selected Tributaries and Irrigation Returns from the 2007-08 Screening Survey, Highlighting Low Turbidity Samples that Exceeded the 1 ng/L Total DDT Criterion.

Based on the preceding analysis, a revised set of TMDL targets is proposed for turbidity in the lower Yakima River (Table 63). They include a significant easing of restrictions put in place by the previous TMDL.

In keeping with the previous TMDL, the turbidity targets for tributaries and irrigation returns would be applied to the 90th percentile. In this way, only 10% of the turbidities should exceed the target, and the average turbidity should be below the target. Compliance could be assessed separately for the irrigation season and non-irrigation season.

Table 63. Revised TMDL Targets Proposed for Turbidity in the Lower Yakima River.

Existing Target	Revised Target	Applies To:	Intent
≤5 NTU over background	(no change)	Mainstem	Compliance with state turbidity standards
25 NTU (90th percentile)		All points within all tributaries and drains	Protect fish and other aquatic organisms; assist with turbidity compliance in mainstem
7 mg/L TSS (~4 NTU)	Increase to ≤5 NTU over background	Mainstem	Compliance with total DDT chronic aquatic life criterion and DDT/DDE human health criteria
	Increase to 10 NTU (90th percentile)	Mouths of all tributaries and drains	

Similar targets could not be derived or are not appropriate for the other 303(d) listed chemicals or for toxaphene. Except for Spring Creek ($R^2 = 0.58$), dieldrin was weakly correlated or inversely correlated with TSS and appears to occur primarily in dissolved form. The previous TMDL concluded that establishing TSS or turbidity goals for dieldrin would not be suitable (Joy and Patterson, 1997).

Endosulfan and chlorpyrifos concentrations are a function of how and when they are used. The levels encountered in surface water are unrelated to TSS.

The PCB and toxaphene data obtained on surface water were limited to measuring long-term average concentrations which cannot be correlated with TSS. PCBs, however, have an affinity for suspended matter that is equal to or greater than DDT compounds. Thus, achieving the turbidity targets could also be an effective control measure for PCBs.

Toxaphene does not sorb as strongly to suspended matter. The toxaphene problem in the lower Yakima River drainage could be the result of localized contamination rather than wide-spread soil contamination as with DDT and dieldrin. Thus, source investigation is indicated as a first step toward reducing toxaphene levels.

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Loading Capacity

Determining a waterbody's loading capacity for a pollutant is the basis for developing a TMDL. Loading capacity is the maximum amount of a pollutant that can be delivered to a waterbody and still achieve water quality standards.

The portion of a receiving water's loading capacity assigned to a particular source is a load (nonpoint sources) or wasteload (point sources) allocation. By definition, a TMDL is the sum of the allocations, which must not exceed the loading capacity. Load and wasteload allocations for the chemicals of concern in this TMDL will be addressed in a separate Water Quality Improvement Report to EPA, to be prepared by the Ecology Water Quality Program at a later date.

Loading capacity can be calculated by multiplying streamflow by the pollutant's water quality criterion. For carcinogens, EPA recommends using the long-term harmonic mean flow, since the adverse impacts to fish consumers are realized over a lifetime of exposure (EPA, 1991). Harmonic mean is the appropriate measure of central tendency when dealing with rates, in this case rates of flow. The harmonic mean is less than the arithmetic mean and is expressed as $Q_{hm} = n/\sum(1/Q_i)$, where n is the number of recorded flows and $\sum(1/Q_i)$ is the sum of the reciprocals of the flows.

As noted by EPA (1991a), the harmonic mean "provides a more reasonable estimate than the arithmetic mean to represent long-term average river flow. Flood periods in rivers bias the arithmetic mean above the flows typically measured. This overstates available dilution. The calculation of the harmonic mean, however, dampens the effect of peak flows. As a result, bias is reduced. The harmonic mean is also an appropriate conservative estimate of long-term average flow in highly regulated river basins, such as the Columbia. In a regulated river basin, the harmonic mean and the arithmetic average are often much closer numerically."

Loading capacities to meet human health criteria in the mainstem Yakima River are calculated for DDE, dieldrin, chlordane toxaphene, and total PCBs in Table 64. The formula is: loading capacity (grams per day) = harmonic mean flow (cfs) x concentration (ng/L) x .00245. The human health criteria apply individually to DDT, DDE, and DDD (there is no human health criterion for total DDT). Among these, DDE is the primary concern for fish consumption.

Loading capacity was assessed for four points in the system: Keechelus Lake, Kachess Lake, the upper Yakima River near Umtanum (Yakima Canyon above the city of Yakima), and the lower Yakima River at Kiona. Keechelus Lake has a separate 303(d) listing for PCBs. Kachess Lake qualifies for a PCB listing based on results of Ecology's 2006 fish tissue survey. Umtanum represents the loading capacity of the Yakima River as it enters the lower Yakima basin. Kiona is the mainstem site with a long-term record of flow that is furthest downstream from the major pesticide and PCB inputs to the lower river.

Table 64. Loading Capacity Estimates for Meeting Human Health Criteria for DDT Compounds, Dieldrin, Chlordane, Toxaphene, and PCBs in the Yakima River.

Waterbody and Location	Mean Flow (cfs)	Loading Capacity (grams per day)					
		Pollutant:	DDE	Dieldrin	Chlordane	Toxaphene	Total PCBs
		Criterion (ng/L):	0.59	0.14	0.57	0.73	0.17
Keechelus Lake	338†		*	*	*	*	0.14
Kachess Lake	292†		*	*	*	*	0.12
Yakima River near Umtanum (r.m. 140.5)	1,548††		2.2	0.53	2.2	2.8	0.64
Yakima River at Kiona (r.m. 29.9)	2,279††		3.3	0.78	3.2	4.2	0.95

*Human health criterion not exceeded in Keechelus or Kachess Lakes.
†Arithmetic mean (Yakima River at Martin, 1994-2007 and Kachess Lake Reservoir).
††Harmonic mean (1994-2007).

Loading capacity was not calculated for DDT compounds, dieldrin, or toxaphene in Keechelus or Kachess Lakes because water quality criteria are currently being met. The previous TMDLs calculated loading capacities for TSS in the upper and lower Yakima River.

Flow data were obtained from the USBR Yakima Project Hydromet website (www.usbr.gov/pn/hydromet/yakima.html). 1994-2007 was selected as the period of interest. Instream flow limits for the lower Yakima River were established in 1994. Complete flow data were available through 2007, as of this writing.

The loading capacity for PCBs in Keechelus Lake and Kachess Lake was based on the flow at the outlet (Yakima River at Martin and Kachess Lake Reservoir). Outflow was assumed equal to inflow. This ignores loss of PCBs due to evaporation and sedimentation, resulting in a conservative estimate of loading capacity. The arithmetic rather than harmonic mean was used here because mixing of inflows within a lake is an averaging process.

The loading capacity of the Yakima River for DDE and dieldrin is estimated at 2.2 and 0.53 grams per day, respectively, at Umtanum, increasing to 3.3 and 0.78 grams per day by Kiona. For chlordane, loading capacities at these points are 2.2 and 3.2 grams per day. The estimates for total PCBs range from 0.12 grams per day in Kachess Lake to 0.95 grams per day at Kiona. Loading capacities of 2.8 – 4.2 grams per day were estimated for toxaphene.

Loading capacity for meeting the chronic aquatic life criteria for total DDT and toxaphene was calculated in a similar fashion (Table 65). While minimums are often used as the design flow for aquatic life criteria, low flow is not the critical period for these chemicals. During 2007-08, the lower river approached or exceeded the total DDT criterion only when flows and TSS were up, either in the first part of the irrigation season or during the winter. Higher toxaphene concentrations were recorded early in the irrigation season than after the end of irrigation. Therefore, loading capacities for compliance with the chronic aquatic life criteria for total DDT and toxaphene were based on the long-term harmonic mean flow, for additional reasons explained above.

Table 65. Loading Capacity Estimates for Meeting Chronic Aquatic Life Criteria for Total DDT and Toxaphene in the Yakima River.

Waterbody and Location	Mean Flow (cfs)	Loading Capacity (grams per day)		
		Pollutant:	Total DDT	Toxaphene
		Criterion (ng/L):	1.0	0.2
Yakima River near Umtanum (r.m. 140.5)	1,548†		3.8	0.76
Yakima River at Kiona (r.m. 29.9)	2,279†		5.6	1.1

†Harmonic mean (1994-2007).

Because of its lower persistence and minimal bioaccumulation potential, chlorpyrifos is a water quality concern only during the growing season, in and around the times it is applied. In contrast to total DDT and toxaphene, the Yakima River is most vulnerable to the adverse impacts of chlorpyrifos during the minimum flows of late summer and fall. For toxic wasteload allocation studies in which the hydrologically-based method is used, EPA recommends 7Q10 (seven-day, 10-year, low flow) as the design flow for the chronic criteria and the 1Q10 (one-day, 10-year, low flow) as the design flow for the acute criteria (EPA, 1991b).

Therefore, loading capacities for chlorpyrifos were based on the 7Q10 and 1Q10. Flow statistics were calculated using EPA's DFLO 3.1 tool http://epa.gov/waterscience/models/dflow/. Flow data for 1994-2007 were downloaded from the USGS website http://waterdata.usgs.gov/wa/nwis/sw . Results are shown in Tables 66 and 67. Loading capacity estimates for chlorpyrifos range from 54 – 112 grams per day.

Table 66. Loading Capacity Estimates for Meeting *Chronic* Aquatic Life Criterion for Chlorpyrifos in the Yakima River.

Waterbody and Location	7Q10 Flow* (cfs)	Loading Capacity (grams per day)	
		Pollutant:	Chlorpyrifos
		Criterion (ng/L):	41
Yakima River near Umtanum (r.m. 140.5)	538		54
Yakima River at Kiona (r.m. 29.9)	636		64

*Seven-day, 10-year low flow, 1994-2007.

Table 67. Loading Capacity Estimates for Meeting *Acute* Aquatic Life Criterion for Chlorpyrifos in the Yakima River.

Waterbody and Location	1Q10 Flow* (cfs)	Loading Capacity (grams per day)	
		Pollutant:	Chlorpyrifos
		Criterion (ng/L):	83
Yakima River near Umtanum (r.m. 140.5)	514		105
Yakima River at Kiona (r.m. 29.9)	551		112

*One-day, 10-year low flow, 1994-2007.

The loading capacity for chemicals of concern in the Naches River, lower Yakima River, and their tributaries and irrigation returns will be determined in the Water Quality Improvement Report scheduled to be completed by the Ecology Water Quality Program at a later date.

Pollutant Reductions Needed

Reductions in pollutant levels will be needed to meet water quality standards and TMDL targets for turbidity, pesticides, and PCBs in the Yakima River. Estimates of the percent reductions needed for the mainstem are provided below. The reductions required for point and nonpoint discharges to the Yakima River will be addressed in the TMDL Water Quality Improvement Report to EPA.

Turbidity

The turbidity reductions needed in the lower Yakima River mainstem to meet the target set by the existing TMDL are shown in Table 68. During the first part of the 2007 irrigation season, the higher turbidities recorded for the Yakima River at Euclid and at Kiona exceeded the TMDL target by 4-12 NTU. These turbidity levels would need to be reduced by 26-39% to meet the target. The river was consistently meeting the turbidity target further upstream at Parker.

Table 68. Percent Reductions Needed to Meet the Existing TMDL Turbidity Target in the Lower Yakima River Mainstem during the 2007 Irrigation Season.

Location/ Waterbody	Existing TMDL Target	Range of Values Exceeding Target During 2007 Irrigation Season	Percent Reduction Needed
Yakima R. at Euclid	Background + 5 NTU	15-27 NTU	26-39%
Yakima R. at Kiona		16-32 NTU	26-37%

Pesticides and PCBs

Because of variability in the water quality data, the pesticide and PCB reductions needed for the lower mainstem (Table 68) were based on water column concentrations estimated from the 2006 fish tissue survey and EPA bioconcentration factors. Fish integrate pollutant levels in the water over time and, thus, can provide a more representative estimate of ambient concentrations. Median concentrations for the edible fish tissue samples collected from Toppenish to Horn Rapids were used in the estimates (N=29, see Table 7). The reduction for chlordane is for Prosser carp, the only location and species that exceeded criteria.

Reductions needed to meet human health criteria in lower Yakima River fish are estimated to be in the range of 31-68% for DDE, dieldrin, and total PCBs. 10% and 19% reductions are indicated for toxaphene and chlordane, respectively. Greater or lesser reductions than those indicated in Table 69 would be required depending on species and location. Year-to-year differences in water supply, which affects dilution, will also influence pesticide and PCB residues in Yakima River fish.

Table 69. Estimates of Loading Reductions Needed in the Mainstem Lower Yakima River to Meet Human Health Criteria of DDE, Dieldrin, Chlordane, Toxaphene, and Total PCBs
[Based on edible fish tissue data in Johnson et al. (2007).]

Pollutant	Median Fish Tissue Concen-tration (ug/Kg)	EPA Bioconcen-tration Factor (L/Kg)	Estimated Water Column Concen-tration (ng/L)	Estimated Load @ Kiona* (grams/day)	Loading Capacity (grams/day)	Difference (grams/day)	Percent Reduction Needed
DDE	91	53,600	1.7	9.5	3.3	6.2	65%
Dieldrin	1.0	4,670	0.21	1.2	0.78	0.4	33%
Chlordane	10	14,100	0.71	4.0	3.2	0.8	19%
Toxaphene	11	13,100	0.84	4.7	4.2	0.5	10%
Total PCBs	17	31,200	0.54	3.0	0.95	2.1	69%

*at 2,279 cfs (1994-2007 harmonic mean flow).

PCBs also exceed human health criteria in the mainstem upper Yakima River, as well as the Keechelus and Kachess reservoirs. By the same calculation as above, a 60% reduction in the load appears to be needed for PCBs in the upper mainstem. A similar reduction (59%) applies to PCB levels in fish in the storage reservoirs. DDE, dieldrin, chlordane, and toxaphene were either meeting or close to meeting water quality criteria in both the upper river and storage reservoirs (Table 7).

Chlorpyrifos is not a human health concern in Yakima River fish tissue. Although substantial increases in chlorpyrifos concentrations were observed in water samples from the mainstem lower Yakima River during the 2007 irrigation season, exceedances of aquatic life criteria were only observed in irrigation returns. Reductions needed for chlorpyrifos will be addressed in the TMDL Water Quality Improvement Report.

Conclusions

Results of this 2007-08 study support the following conclusions:

- Despite significant reductions in soil erosion, irrigation returns continue to discharge elevated levels of suspended sediment that contribute to exceedances of Washington State turbidity and pesticide criteria in the lower Yakima River.

- A first-time effort to characterize chemical contaminants in urban stormwater discharges to the Yakima River found high levels of pesticides, PCBs, TSS, and turbidity in runoff from the cities of Yakima, Union Gap, and Ellensburg (pesticides not analyzed).

- The lower Yakima River and some of its tributaries and irrigation returns fail to meet (exceed) Washington State human health criteria for fish consumption for DDE, dieldrin, toxaphene, PCBs, and, marginally, chlordane.

- Toxaphene sometimes exceeds aquatic life criteria in the lower Yakima River and certain of its tributaries, and irrigation returns.

- Peak chlorpyrifos concentrations in some of the same returns exceed aquatic life criteria during the spring and fall when this insecticide is being applied.

Irrigation returns are the predominant cause of degraded water quality in the Yakima River. These are the most important sources to control for reducing the adverse effects of elevated turbidity, pesticides, and PCBs. Urban stormwater runoff also appears to be a significant source of these same pollutants and follows in the priority of sources that need to be reduced.

This study found that reductions are also needed for PCBs in wastewater treatment plant (WWTP) effluent and several pesticides in fruit packer and vegetable processor effluent, if these facilities are to meet water quality criteria at the point of discharge. However, these are relatively low volume discharges. Except for the current use insecticides chlorpyrifos and endosulfan, pesticides were not analyzed to a low enough level in WWTP effluent to rule out exceedances of water quality criteria. Thus, some further reductions could ultimately be needed.

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Recommendations

303(d) Listings/TMDL

1. The current (2008) Water Quality Assessment 303(d) listings are appropriate for total DDT, DDE, dieldrin, chlordane, chlorpyrifos, PCBs, and dioxin for those areas indicated in Table 58.

2. DDT compounds, dieldrin, chlordane chlorpyrifos, toxaphene, and PCBs should be addressed in the TMDL Water Quality Improvement Report to EPA.

3. Following approval of the TMDL, toxaphene should be added to the Category 4A (has an approved TMDL) listings for the Yakima River watershed.

4. The next water quality assessment process should remove endosulfan and alpha-BHC from the 303(d) list for the lower Yakima River (WRIA 37) and placed them in Category 1 (Meets Standards).

5. The 303(d) listing for chlordane in the upper Yakima River (WRIA 39) should be removed and placed in Category 1.

6. The 303(d) listing for dioxin in Keechelus Lake (WRIA 39) should be removed and placed in Category 1.

Source Tracing

7. Work with city and county officials to identify sources of pesticides, PCBs, suspended sediment, and turbidity in stormwater from Yakima, Union Gap, Selah, and Ellensburg (PCBs only). Improving current understanding of spatial and temporal variability should be among the first steps in this effort.

8. Identify sources of toxaphene to Wilson Creek, Moxee Drain, Granger Drain, and, especially, Sulphur Creek Wasteway. Screen other tributaries and irrigation returns for the presence of toxaphene.

9. Identify PCB sources to Sulphur Creek Wasteway and Granger Drain.

Monitoring

10. Characterize dry weather discharge (winter and irrigation season) of pesticides, PCBs, suspended sediment, and turbidity from Yakima area storm drains.

11. Work with the U.S. Bureau of Reclamation, the Yakama Nation, irrigation districts, conservation districts, and other interested parties to continue and, where appropriate, expand turbidity monitoring of priority irrigation returns identified through the present study.

12. Explore the possibility of installing a continuous turbidity monitor in the Yakima River at Kiona.

13. Continue chlorpyrifos monitoring in Sulphur Creek Wasteway, Spring Creek, and Marion Drain through Ecology's *Surface Water Monitoring Program for Pesticides in Salmonid-Bearing Streams*.

14. Periodically monitor lower Yakima River fish for DDE, dieldrin, chlordane, toxaphene, PCBs, and dioxin to assess progress toward meeting human health criteria and the need to continue the fish consumption advisory for PCBs.

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Appendices

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Appendix A. Yakima Basin 303(d) Listings Based on Edible Fish Tissue Samples (2008 list)

Water Body	Approximate Location	Listing ID	Parameter
Upper Yakima River (WRIA* 39)			
Keechelus Lake	Near inlet	43146	Total PCBs
Keechelus Lake	Near inlet	43128	Dioxin
Yakima River	Umtanum	20182	Chlordane
Yakima River	Umtanum	20219	Total PCBs
Yakima River	Umtanum	34889	Dioxin
Naches River (WRIA 38)			
Cowiche Creek	Near mouth	17214	4,4'-DDE
Cowiche Creek	Near mouth	52833	Total PCBs
Lower Yakima River (WRIA 37)			
Yakima River	Union Gap	14253	4,4'-DDT
Yakima River	Union Gap	14257	4,4'-DDE
Yakima River	Union Gap	14255	4,4'-DDD
Yakima River	Union Gap	14259	Alpha-BHC
Yakima River	Union Gap	14261	Total PCBs
Yakima River	Zillah	7351	4,4'-DDT
Yakima River	Zillah	8874	4,4'-DDE
Yakima River	Zillah	8875	Dieldrin
Yakima River	Granger	19595	4,4'-DDE
Yakima River	Granger	19597	4,4'-DDE
Yakima River	Granger	19616	4,4'-DDT
Yakima River	Granger	19618	4,4'-DDT
Yakima River	Granger	20047	Total PCBs
Yakima River	Granger	20045	Total PCBs
Yakima River	Granger	34905	Dioxin
Yakima River	Granger	34913	Dioxin
Yakima River	Grandview	16430	4,4'-DDD
Yakima River	Prosser	19598	4,4'-DDE
Yakima River	Prosser	19619	4,4'-DDT
Yakima River	Prosser	19705	Chlordane
Yakima River	Prosser	34887	Dioxin
Yakima River	Benton City	8897	4,4'-DDT
Yakima River	Benton City	14252	4,4'-DDT
Yakima River	Benton City	19602	4,4'-DDE
Yakima River	Benton City	14256	4,4'-DDE
Yakima River	Benton City	8893	4,4'-DDE

Water Body	Approximate Location	Listing ID	Parameter
Yakima River	Benton City	14254	4,4'-DDD
Yakima River	Benton City	14258	Alpha-BHC
Yakima River	Benton City	7350	Total PCBs
Yakima River	Horn Rapids	19622	4,4'-DDT
Yakima River	Horn Rapids	19601	4,4'-DDE
Yakima River	Horn Rapids	8861	4,4'-DDE
Yakima River	Horn Rapids	8902	Dieldrin
Yakima River	Horn Rapids	8864	Total PCBs
Yakima River	Horn Rapids	8863	Total PCBs
Yakima River	Near mouth	19614	4,4'-DDT
Yakima River	Near mouth	19592	4,4'-DDE

*Water Resource Inventory Area.

Appendix B. Yakima Basin 303(d) Listings Based on Water Samples (2008 list)

Waterbody	Listing ID	Parameter
Lower Yakima River (WRIA* 37)		
Yakima River @ Union Gap	8876	DDT
Yakima River @ Union Gap	8877	4,4'-DDE
Yakima River, Blue Slough	7377	4,4'-DDD
Yakima River, Blue Slough	7376	4,4'-DDE
Yakima River, Blue Slough	7378	Chlorpyrifos
Yakima River, Blue Slough	7380	DDT
Yakima River, Blue Slough	7383	Endosulfan
Yakima River bw. Granger	8854	Dieldrin
Yakima River bw. Granger	8873	DDT
Yakima River nr. Grandview	8889	4,4'-DDD
Yakima River nr. Grandview	8891	4,4'-DDE
Yakima River bw. Spring Cr.	8896	DDT
Yakima River @ Kiona	8860	DDT
Yakima River @ Kiona	8862	4,4'-DDD
Yakima River @ Kiona	8865	Endosulfan
Yakima River @ Kiona	8871	Dieldrin
Yakima River @ Kiona	8890	4,4'-DDE
Yakima River bw. Kiona	12868	4,4'-DDE
Wide Hollow Creek	8849	4,4'-DDD
Wide Hollow Creek	8848	4,4'-DDE
Wide Hollow Creek	8855	DDT
Wide Hollow Creek	8856	Dieldrin
Wide Hollow Creek	8857	Endosulfan
Marion Drain	52838	Chlorpyrifos
Moxee (Birchfield) Drain	7373	DDT
Moxee (Birchfield) Drain	7374	Dieldrin
Moxee (Birchfield) Drain	7375	Endosulfan
Granger Drain	7362	4,4'-DDD
Granger Drain	7361	4,4'-DDE
Granger Drain	7360	DDT
Granger Drain	7363	Dieldrin
Granger Drain	7364	Endosulfan
Sulphur Creek Wasteway	8906	4,4'-DDD
Sulphur Creek Wasteway	7385	4,4'-DDE
Sulphur Creek Wasteway	8909	DDT

Waterbody	Listing ID	Parameter
Sulphur Creek Wasteway	7384	DDT
Sulphur Creek Wasteway	8911	Dieldrin
Sulphur Creek Wasteway	8908	Endosulfan
Sulphur Creek Wasteway	52842	Chlorpyrifos
Snipes Creek	7369	4,4'-DDD
Snipes Creek	7367	4,4'-DDD
Snipes Creek	7370	4,4'-DDE
Snipes Creek	7366	4,4'-DDE
Snipes Creek	7365	DDT
Spring Creek	7355	4,4'-DDD
Spring Creek	7357	4,4'-DDD
Spring Creek	7354	4,4'-DDE
Spring Creek	7358	4,4'-DDE
Spring Creek	7353	DDT
Spring Creek	52841	Chlorpyrifos

*Water Resource Inventory Area.

Appendix C. Use Designations for WRIA 37- Lower Yakima River, WRIA 38-Naches River, and WRIA 39-Upper Yakima River
(www.ecy.wa.gov/programs/wq/swqs/reference_files/table-602.pdf.)

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TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
1. Temperature shall not exceed a 1-DMax of 20.0°C due to human activities. When natural conditions exceed a 1-DMax of 20.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time, exceed t = 34/(T + 9).																		
2. The following two notes apply:																		
(a) Below Clearwater River (river mile 139.3). Temperature shall not exceed a 1-DMax of 20.0°C due to human activities. When natural conditions exceed a 1-DMax of 20.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time, exceed t = 34/(T + 9). Special condition - special fish passage exemption as described in WAC 173-201A-200 (1) (f).																		
(b) Above Clearwater River (river mile 139.3). Temperature shall not exceed a 1-DMax of 20.0°C due to human activities. When natural conditions exceed a 1-DMax of 20.0°C, no temperature increases will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time, exceed 0.3°C due to any single source or 1.1°C due to all such activities combined.																		
WRIA 36 Esquatzel Coulee																		
There are no specific waterbody entries for this WRIA																		
WRIA 37 Lower Yakima																		
Ahtanum Creek North Fork's unnamed tributaries at latitude 46.5465 longitude -120.8857	✓							✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Ahtanum Creek North Fork's unnamed tributaries at latitude 46.5395 longitude -120.9851	✓							✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Ahtanum Creek, between junction with South Fork and junction of North and Middle Forks (including tributaries) except where designated Char.		✓						✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Ahtanum Creek, North Fork, and Middle Fork Ahtanum Creek: All waters (including tributaries) above the junction.	✓							✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Ahtanum Creek, South Fork, and all tributaries	✓							✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Carpenter Gulch and all tributaries	✓							✓		✓	✓	✓	✓	✓	✓	✓	✓	✓

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Foundation Creek and all tributaries	✓							✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Nasty Creek and all tributaries	✓							✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Sulphur Creek				✓					✓		✓	✓	✓	✓	✓	✓	✓	✓
Yakima River from mouth to Cle Elum River (river mile 185.6) except where specifically designated otherwise in Table 602.[1]			✓					✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Notes for WRIA 37:																		
1. Temperature shall not exceed a 1-DMax of 21.0°C due to human activities. When natural conditions exceed a 1-DMax of 21.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time, exceed t = 34/(T + 9).																		
WRIA 38 Naches																		
American River and all tributaries	✓						✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Barton Creek and all tributaries	✓						✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Bumping Lake's unnamed tributaries at latitude 46.8850 longitude -121.2779	✓						✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Bumping River's unnamed tributaries at latitude 46.9317 longitude -121.2067(outlet of Flat Iron Lake).	✓						✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Bumping River and tributaries downstream of the upper end of Bumping Lake (except where designated Char)		✓					✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Bumping River (and tributaries) upstream of Bumping Lake.	✓						✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Cedar Creek and all tributaries	✓						✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Clear Creek and tributaries (including Clear Lake)	✓						✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Crow Creek and all tributaries	✓						✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Deep Creek and all tributaries	✓						✓			✓	✓	✓	✓	✓	✓	✓	✓	✓

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Goat Creek and all tributaries	✓						✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Granite Creek and all tributaries	✓						✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Indian Creek and all tributaries	✓						✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Little Naches River and Bear Creek: All waters (including tributaries) above the junction	✓						✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Little Naches River, South Fork and all tributaries	✓						✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Naches River and tributaries from latitude 46.7640 longitude -120.8286 (just upstream of Cougar Canyon) to Snoqualmie National Forest boundary (river mile 35.7) (except where designated Char).		✓						✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Naches River from Snoqualmie National Forest boundary (river mile 35.7) to headwaters (except where designated Char).		✓					✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Pileup Creek and all tributaries	✓						✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Quartz Creek and all tributaries	✓						✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Rattlesnake Creek: All waters above the junction with North Fork Rattlesnake Creek	✓						✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Rattlesnake Creek, North Fork, all waters above latitude 46.8107 longitude 121.0694 (from and including the unnamed tributary just above junction with mainstem).	✓						✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Sand Creek and all tributaries	✓						✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Sunrise Creek (latitude 46.9042 longitude -121.2431) and all tributaries.	✓						✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Tieton River and tributaries (except where otherwise designated).		✓					✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Tieton River, North Fork (including tributaries) above the junction at Clear Lake	✓						✓			✓	✓	✓	✓	✓	✓	✓	✓	✓

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Tieton River, South Fork, and all tributaries	✓						✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
WRIA 39 Upper Yakima																		
Cle Elum River from mouth to latitude 47.3805 longitude -121.0983 (above Little Salmon la Sac Creek)		✓					✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Cle Elum River and all tributaries from junction with unnamed tributary at and latitude 47.3805 longitude -121.0983 to headwaters.	✓						✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Indian Creek and tributaries downstream of Wenatchee National Forest boundary below		✓						✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Indian Creek and tributaries in or above national forest boundary		✓					✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Jack Creek and tributaries downstream of Wenatchee National Forest boundary below	✓							✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Jack Creek and tributaries in or above national forest boundary	✓						✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Little Kachess Lake (narrowest point dividing Kachess Lake from Little Kachess Lake) and all tributaries	✓						✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Manastash Creek: All waters above the Junction of the North and South Forks that are downstream of the Wenatchee National Forest boundary.		✓						✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Manastash Creek: All waters above the Junction of the North and South Forks that are in or above the Wenatchee National Forest.		✓					✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Manastash Creek mainstem from mouth to junction of North and South Forks		✓						✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Manastash Creek, tributaries to mainstem, between the mouth and the junction of North and South Forks			✓					✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Swauk Creek mainstem from mouth to junction with First Creek		✓						✓		✓	✓	✓	✓	✓	✓	✓	✓	✓

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Swauk Creek from junction with First Creek to Wenatchee National Forest (including tributaries)		✓						✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Taneum Creek, tributaries to mainstem, from mouth to Wenatchee National Forest boundary			✓				✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Taneum Creek mainstem from mouth to Wenatchee National Forest boundary		✓						✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Teanaway River mainstem from mouth to West Fork Teanaway River		✓						✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Teanaway River, tributaries to mainstem, from mouth to West Fork Teanaway River			✓					✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Teanaway River, West Fork, and tributaries downstream of the Wenatchee National Forest		✓						✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Teanaway River, West Fork, and tributaries upstream of the Wenatchee National Forest		✓						✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Teanaway River, North Fork, and tributaries from junction with West Fork to Jungle Creek that are downstream of the Wenatchee National Forest boundary (except where designated otherwise).		✓						✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Teanaway River, North Fork, and tributaries from junction with West Fork to Jungle Creek that are in or above the Wenatchee National Forest boundary (except where designated otherwise).		✓					✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Teanaway River, North Fork, and all tributaries above and including Jungle Creek	✓						✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Yakima River mainstem from mouth to Cle Elum River (river mile 185.6) except where specifically designated otherwise in Table 602.[1]			✓					✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Yakima River and tributaries from Cle Elum River (river mile 185.6) to headwaters (except where designated otherwise).		✓					✓			✓	✓	✓	✓	✓	✓	✓	✓	✓

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Yakima River and tributaries above the unnamed tributary (latitude 47.2927 longitude -121.2971) entering the Yakima River in Sect.25 T21NR12E.	✓						✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Notes for WRIA 39:																		
1. Temperature shall not exceed a 1-DMax of 21.0°C due to human activities. When natural conditions exceed a 1-DMax of 21.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time, exceed t = 34/(T + 9).																		
WRIA 40 Alkaki-Squilchuck																		
There are no specific waterbody entries for this WRIA																		
WRIA 41 Lower Crab																		
Crab Creek and tributaries				✓					✓		✓	✓	✓	✓	✓	✓	✓	✓
WRIA 42 Grand Coulee																		
Crab Creek and tributaries				✓					✓		✓	✓	✓	✓	✓	✓	✓	✓
WRIA 43 Upper Crab-Wilson																		
Crab Creek and tributaries				✓					✓		✓	✓	✓	✓	✓	✓	✓	✓
WRIA 44 Moses Coulee																		
There are no specific waterbody entries for this WRIA																		
WRIA 45 Wenatchee																		
Chiwaukum Creek from junction with Skinney Creek to headwaters (including tributaries)	✓						✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Chiwawa River from mouth to Chickamin Creek (including tributaries)		✓					✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Chiwawa River (and all tributaries) above and including Chickamin Creek	✓						✓			✓	✓	✓	✓	✓	✓	✓	✓	✓

Appendix D. 2006 Fish Tissue Data

Table D-1. Chlorinated Pesticide Concentrations in Yakima River Fish Fillet Samples, 2006 (ug/Kg, wet weight; parts per billion).

Reach	Sample No.	Species	Lipids (%)	4,4'-DDD	4,4'-DDE	4,4'-DDT	Total DDT	Cis-Chlordane	Cis-Nonachlor	Oxychlordane	Trans-Chlordane	Trans-Nonachlor	Total Chlordane	Methoxychlor	Alpha-BHC	Beta-BHC	Delta-BHC	Gamma-BHC (Lindane)	Aldrin	Dieldrin	Endrin
Keechelus Lake	6394088	LSS	2.08	0.37 U	**2.8**	**0.5**	**3.3**	0.37 U	0.83 UJ	0.37 U	0.37 U	0.37 U	0.37 U	0.37 UJ	0.37 U	0.37 U	0.37 UJ	0.37 U	0.37 U	0.37 U	0.37 U
Keechelus Lake	6394089	LSS	1.56	0.38 U	**2.4**	**0.4**	**2.8**	0.38 U	0.74 UJ	0.38 U	0.38 U	0.38 U	0.38 U	0.38 UJ	0.38 U	0.38 U	0.38 UJ	0.38 U	0.38 U	0.38 U	0.38 U
Keechelus Lake	6394090	LSS	1.6	0.38 U	**1.3**	0.38 U	**1.3**	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 UJ	0.38 U	0.38 U	0.38 UJ	0.38 U	0.38 U	0.38 U	0.38 U
Keechelus Lake	6394092	NPM	1.13	0.4 U	**1.8**	0.4 U	**1.8**	0.4 U	0.88 UJ	0.4 U	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 U	0.4 U	0.4 UJ	0.4 U	0.4 U	0.4 U	0.4 U
Keechelus Lake	6394093	NPM	1.09	0.37 U	**3.3**	0.37 U	**3.3**	0.37 U	1.1 UJ	0.37 U	0.37 U	0.37 U	0.37 U	0.37 UJ	0.37 U	0.37 U	0.37 UJ	0.37 U	0.37 U	0.37 U	0.37 U
Keechelus Lake	6394095	KOK	2.54	**0.41**	**2.4**	**0.83**	**3.6**	0.37 U	0.49 UJ	0.37 U	0.37 U	**0.72**	**0.72**	0.37 UJ	0.37 U	0.37 U	0.37 UJ	0.37 U	0.37 U	0.37 U	0.37 U
Keechelus Lake	6394096	KOK	2.78	0.4 U	**2**	**0.79**	**2.8**	0.4 U	0.42 UJ	0.4 U	0.4 U	**0.6**	**0.6**	0.4 UJ	0.4 U	0.4 U	0.4 UJ	0.4 U	0.4 U	0.4 UJ	0.4 UJ
Keechelus Lake	6394097	KOK	3.33	**0.47**	**2.1**	**0.87**	**3.4**	0.39 U	0.5 UJ	0.39 U	0.39 U	**0.78**	**0.78**	0.39 UJ	0.39 U	0.39 U	0.39 UJ	0.39 U	0.39 U	0.39 U	0.39 U
Keechelus Lake	6394099	CTT	1.86	0.39 U	**0.77**	**0.28 J**	**1.1 J**	0.39 U	**0.23 J**	0.39 U	0.39 U	0.39 U	**0.23 J**	0.39 U	0.39 U	0.39 U	0.39 UJ	0.39 U	0.39 U	0.39 U	0.39 U
Keechelus Lake	6394100	CTT	1.36	0.39 U	**0.61**	0.39 U	**0.6**	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 UJ	0.39 U	0.39 U	0.39 U	0.39 U
Keechelus Lake	6394101	CTT	1.09	0.39 U	**0.44**	0.39 U	**0.4**	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 UJ	0.39 U	0.39 U	0.39 U	0.39 U
Keechelus Lake	6394103	MWF	2.55	0.39 U	**0.59**	0.39 U	**0.6**	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 UJ	0.39 U	0.39 U	0.39 UJ	0.39 U	0.39 U	0.39 U	0.39 U
Keechelus Lake	6394104	MWF	2.96	0.39 U	**0.87**	0.39 U	**0.9**	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 UJ	0.39 U	0.39 U	0.39 UJ	0.39 U	0.39 U	0.39 U	0.39 U
Kachess Lake	6394080	LSS	0.69	0.4 U	**0.76**	0.4 U	**0.76**	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 U	0.4 U	0.4 U	0.4 U
Kachess Lake	6394081	LSS	0.48	0.4 U	**0.87**	0.4 U	**0.87**	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 U	0.4 U	0.4 U	0.4 U
Kachess Lake	6394082	LSS	0.55	0.39 U	**0.86**	0.39 U	**0.86**	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 UJ	0.39 U	0.39 U	0.39 UJ	0.39 U	0.39 U	0.39 UJ	0.39 UJ
Kachess Lake	6394084	NPM	0.58	0.4 U	**2.7**	0.4 U	**2.7**	0.4 U	0.57 UJ	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 U	0.4 U	0.4 U	0.4 U
Kachess Lake	6394085	NPM	0.86	0.37 U	**4.2**	0.37 U	**4.2**	0.37 U	0.92 UJ	0.37 U	0.37 U	**0.63**	**0.63**	0.37 U	0.37 U	0.37 U	0.37 UJ	0.37 U	0.37 U	0.37 U	0.37 U
Kachess Lake	6394086	NPM	0.6	0.39 U	**4.2**	0.39 U	**4.2**	0.39 U	0.98 UJ	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 UJ	0.39 U	0.39 U	0.39 U	0.39 U
Cle Elum	6414068	MWF	4.24	**0.27 J**	**6.6**	**0.8**	**8 J**	0.39 U	**0.56**	0.39 U	0.39 U	**0.37 J**	**0.93 J**	0.39 UJ	0.39 U	0.39 U	0.39 UJ	0.39 U	0.39 U	0.39 UJ	0.39 UJ
Cle Elum	6414069	MWF	5.09	**0.54**	**5.7**	**3.1**	**9**	**0.32 J**	**0.96**	**0.21 J**	0.39 U	**1.6**	**3.09 J**	0.39 UJ	0.39 U	0.39 U	0.39 UJ	0.39 U	0.39 U	0.39 UJ	0.39 UJ
Cle Elum	6414070	MWF	4.42	**0.49**	**18**	**2**	**20**	**0.21 J**	**0.74**	0.4 U	0.4 U	**1.1**	**2.05 J**	0.4 UJ	0.4 U	0.4 U	0.4 UJ	0.4 U	0.4 U	**0.29 J**	0.4 UJ
Cle Elum	6414072	BLS	4.03	**0.45**	**9.1**	**1.4**	**11**	0.38 U	**0.38**	0.38 U	0.38 U	**0.28**	**0.66**	0.38 UJ	0.38 U	0.38 U	0.38 UJ	0.38 U	0.38 UJ	0.38 UJ	0.38 UJ
Cle Elum	6414073	BLS	2.8	**0.3 J**	**5.1**	**0.77**	**6 J**	0.39 U	**0.28 J**	0.39 U	0.39 U	**0.29 J**	**0.57 J**	0.39 U	0.39 U	0.39 U	0.39 UJ	0.39 U	0.39 U	0.39 U	0.39 U
Cle Elum	6414074	BLS	2.51	**0.81**	**9.4**	**1.2**	**11**	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 U	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 UJ	0.4 UJ
Cle Elum	6414076	NPM	1.98	**0.71**	**12**	0.39 U	**13**	0.39 U	0.41 UJ	0.39 U	0.39 U	**0.57**	**0.57**	0.39 UJ	0.39 U	0.39 U	0.39 U	0.39 U	0.39 UJ	**0.24 J**	0.39 UJ
Cle Elum	6414077	NPM	1.73	**0.43**	**12**	0.38 U	**12**	0.38 U	0.38 U	0.38 U	0.38 U	**0.53**	**0.53**	0.38 UJ	0.38 U	0.38 U	0.38 U	0.38 U	0.38 UJ	**0.29 J**	0.38 UJ
Cle Elum	6414078	NPM	1.27	**0.62**	**8.8**	0.39 U	**9**	0.39 U	0.39 U	0.39 U	0.39 U	**0.61**	**0.61**	0.39 UJ	0.39 U	0.39 U	0.39 U	0.39 U	0.39 UJ	**0.12 J**	0.39 UJ
Yakima Canyon	6414050	MWF	4.51	**1.2**	**41**	**3.9**	**46**	**0.4**	**0.95**	0.4 U	0.4 U	**1.5**	**2.85**	0.4 UJ	0.4 U	0.4 U	0.4 UJ	0.4 U	0.4 U	**0.22 J**	0.4 UJ
Yakima Canyon	6414051	MWF	5.43	**0.7**	**23**	**2**	**26**	0.39 U	**0.84**	0.39 U	0.39 U	**0.87**	**1.71**	0.39 UJ	0.39 U	0.39 U	0.39 UJ	0.39 U	0.39 U	**0.24 J**	0.39 UJ
Yakima Canyon	6414052	MWF	4.67	**1.1**	**40**	**3.7**	**45**	**0.53**	**1.1**	**0.22 J**	**0.21 J**	**2.1**	**4.16**	**0.4 J**	0.4 U	0.4 U	0.4 UJ	0.4 U	0.4 U	**0.51**	0.4 U
Yakima Canyon	6414057	NPM	2.87	**1.4**	**45**	**1.4**	**48**	**0.27 J**	**1.5**	0.4 U	0.4 U	**1.7**	**3.47 J**	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 U	0.4 U	**0.49**	0.4 U
Yakima Canyon	6414058	NPM	2.04	**1.1**	**34**	**0.36 J**	**35 J**	**0.21 J**	**0.79**	0.38 U	0.38 U	**1.4**	**2.4 J**	0.38 U	0.38 U	0.38 U	0.38 UJ	0.38 U	0.38 U	**1.1**	0.38 U
Yakima Canyon	6414059	NPM	1.76	**0.56**	**15**	**0.2 J**	**16 J**	0.39 U	**0.53**	0.39 U	0.39 U	**0.9**	**1.43**	0.39 U	0.39 U	0.39 U	0.39 UJ	0.39 U	0.39 U	**0.72**	0.39 U
Yakima Canyon	6414061	BLS	4.72	**1.3**	**26**	**3.9**	**31**	**0.58**	**0.77**	**0.21 J**	**0.2 J**	**1.3**	**3.06**	0.38 U	0.38 U	0.38 U	0.38 UJ	0.38 U	0.38 U	**0.63**	0.38 U
Yakima Canyon	6414062	BLS	2.16	**0.52**	**5.1**	**0.97**	**7**	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 UJ	0.37 U	0.37 U	**0.86**	0.37 U
Yakima Canyon	6414063	BLS	2.93	**0.34 J**	**5.1**	**0.84**	**6 J**	0.4 U	0.4 U	0.4 U	0.4 U	**0.34 J**	**0.34 J**	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 U	0.4 U	**1.3**	0.4 U
Wapato-Toppenish	6484230	LSS	3.33	**3.8**	**55**	**4.9**	**64**	0.39 U	0.43 UJ	0.39 U	0.39 U	**0.53**	**0.53**	1.6 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	**0.99 J**	1.6 U
Wapato-Toppenish	6484231	LSS	2.92	**5.1**	**61**	**4**	**70**	0.39 U	0.49 UJ	0.39 U	0.39 U	**0.66**	**0.66**	0.77 UJ	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	**0.72 J**	0.77 U
Wapato-Toppenish	6484232	LSS	3.25	**8.2**	**71**	**4.9**	**84**	0.4 U	0.51 UJ	0.4 U	0.4 U	**0.61**	**0.61**	1.6 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	**1.5 J**	1.6 U
Wapato-Toppenish	6484234	NPM	1.06	**3**	**53**	0.4 U	**56**	0.4 U	0.63 UJ	0.4 U	0.4 U	**0.61**	**0.61**	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	**1**	0.4 U
Wapato-Toppenish	6484235	NPM	1.1	**4.2**	**130**	**0.48**	**135**	0.4 U	0.4 U	0.4 U	0.4 U	**0.42**	**0.42**	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	**0.6**	0.4 U
Wapato-Toppenish	6484236	NPM	1.35	**8.2**	**160**	0.4 U	**168**	0.4 U	1.7 UJ	0.4 U	0.4 U	**1.2**	**1.2**	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	**0.83**	0.4 U
Wapato-Toppenish	6484238	MWF	3.15	**8.5**	**110**	**7.9**	**126**	**0.71**	1 UJ	0.39 U	0.39 U	**1.9**	**2.61**	1.6 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	**1.5 J**	1.6 U
Wapato-Toppenish	6484239	MWF	2.9	**7.4**	**110**	**7.1**	**125**	**0.59**	1.1 UJ	0.38 U	0.38 U	**1.7**	**2.29**	0.77 UJ	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	**1.4**	0.77 U
Wapato-Toppenish	6484240	MWF	3.02	**5.6**	**80**	**6**	**92**	0.4 U	0.79 UJ	0.4 U	0.4 U	**1**	**1**	1.6 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	**1 J**	1.6 U

Table D-1 continued.

Reach	Sample No.	Species	Lipids (%)	4,4'-DDD	4,4'-DDE	4,4'-DDT	Total DDT	Cis-Chlordane	Cis-Nonachlor	Oxychlordane	Trans-Chlordane	Trans-Nonachlor	Total Chlordane	Methoxychlor	Alpha-BHC	Beta-BHC	Delta-BHC	Gamma-BHC (Lindane)	Aldrin	Dieldrin	Endrin
Prosser	6454105	CRP	4.31	**25**	**380**	**3.4**	**408**	**1**	**4.1**	**0.27 J**	**0.4**	**2.7**	**8.47 J**	0.39 UJ	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 UJ	0.39 UJ
Prosser	6454106	CRP	7.14	**38**	**750**	**7**	**795**	**1.7**	**7.8**	**0.55**	**0.75**	**5**	**15.8**	0.39 UJ	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	**0.74 J**	0.39 UJ
Prosser	6454107	CRP	3.71	**21**	**360**	**2.6**	**384**	**1.2**	**6**	**0.31 J**	**0.58**	**3.7**	**11.8 J**	0.39 UJ	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	**0.65 J**	0.39 UJ
Prosser	6444234	SMB	0.62	**2.5**	**32**	**0.93**	**35**	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 UJ	**1.4**	0.39 U
Prosser	6444235	SMB	0.66	**3.3**	**43**	**2.3**	**49**	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 UJ	**1.1**	0.38 U
Prosser	6444236	SMB	0.3	**3**	**17**	**0.46**	**20**	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 UJ	**0.46**	0.4 U
Prosser	6444238	LSS	1.77	**11**	**99**	**4.8**	**115**	0.39 U	0.77 UJ	0.39 U	0.39 U	**0.73**	**0.73**	0.39 UJ	0.39 U	0.39 U	0.39 U	0.39 U	0.39 UJ	**2.2 J**	0.39 UJ
Prosser	6444239	LSS	2.01	**10**	**100**	**3.7**	**114**	0.39 U	0.73 UJ	0.39 U	0.39 U	**0.71**	**0.71**	0.39 UJ	0.39 U	0.39 U	0.39 U	0.39 U	0.39 UJ	**2 J**	0.39 UJ
Prosser	6444240	LSS	2.41	**21**	**100**	**4.3**	**125**	0.39 U	1.4 UJ	0.39 U	0.39 U	**0.61**	**0.61**	0.39 UJ	0.39 U	0.39 U	0.39 U	0.39 U	0.39 UJ	**2.6 J**	0.39 UJ
Horn Rapids	6444230	CRP	7.94	**41**	**990**	**7**	**1038**	**1.6**	11 UJ	**0.64**	0.4 U	**5.8**	**8.04**	1.6 UJ	0.4 U	0.4 U	0.4 U	0.4 U	0.4 UJ	**1.6 J**	1.6 UJ
Horn Rapids	6444231	CRP	9.17	**25**	**500**	**4.3**	**529**	**1.1**	7.2 UJ	**0.57**	0.39 U	**3.9**	**5.57**	1.6 UJ	0.39 U	0.39 U	0.39 U	0.39 U	0.39 UJ	**1.3 J**	1.6 UJ
Horn Rapids	6444232	CRP	5.83	**17**	**380**	**4.2 J**	**401 J**	0.39 U	3.9 UJ	0.39 U	0.39 U	**1.9**	**1.9**	0.79 UJ	0.39 U	0.39 U	0.39 U	0.39 U	0.39 UJ	**0.8 J**	0.79 UJ
Horn Rapids	6444242	NPM	1.08	**5.2**	**65**	0.38 U	**70**	0.38 U	0.96 UJ	0.38 U	0.38 U	**0.73**	**0.73**	0.38 UJ	0.38 U	0.38 U	0.38 U	0.38 U	0.38 UJ	**1.4 J**	0.38 UJ
Horn Rapids	6444243	NPM	1.41	**4.8**	**60**	0.39 U	**65**	0.39 U	0.89 UJ	0.39 U	0.39 U	**0.51**	**0.51**	0.39 UJ	0.39 U	0.39 U	0.39 U	0.39 U	0.39 UJ	**1.9 J**	0.39 UJ
Horn Rapids	6444244	NPM	1.3	**6.7**	**110**	**0.41**	**117**	0.4 U	0.58 UJ	0.4 U	0.4 U	**0.45**	**0.45**	0.4 UJ	0.4 U	0.4 U	0.4 U	0.4 U	0.4 UJ	**4.7 J**	0.4 UJ
Horn Rapids	6454108	SMB	1.37	**3.8**	**78**	**1.3**	**83**	0.39 U	**0.66**	0.39 U	0.39 U	**0.46**	**1.12**	0.39 UJ	0.39 U	0.39 U	**0.54**	0.39 U	0.39 U	**0.62 J**	0.39 UJ
Horn Rapids	6454109	SMB	1.01	**3.3**	**59**	**0.89**	**63**	0.38 U	**0.57**	0.38 U	0.38 U	**0.62**	**1.19**	0.38 UJ	0.38 U	0.38 U	**0.38**	0.38 U	0.38 U	**1 J**	0.38 UJ
Horn Rapids	6454110	SMB	0.95	**1.9**	**37**	**1.1**	**40**	0.39 U	**0.36 J**	0.39 U	0.39 U	**0.31 J**	**0.67 J**	0.39 UJ	0.39 U	0.39 U	**0.48**	0.39 U	0.39 U	**0.76 J**	0.39 UJ
Horn Rapids	6454111	LSS	2.79	**5.3**	**57**	**2.4**	**65**	**0.22 J**	**0.62**	0.4 U	0.4 U	**0.54**	**1.38 J**	0.4 UJ	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	**0.74 J**	0.4 UJ
Horn Rapids	6454112	LSS	4.65	**6.2**	**79**	**3.1**	**88**	**0.3 J**	**0.87**	**0.2 J**	0.4 U	**0.76**	**2.13 J**	0.4 UJ	0.4 U	0.4 U	**0.4 J**	**0.4 J**	**0.4 J**	**0.92 J**	0.4 UJ
Horn Rapids	6454113	LSS	3.56	**7.7**	**110**	**5.8**	**124**	0.39 U	**1.2**	0.39 U	0.39 U	**0.8**	**2**	0.39 UJ	0.39 U	0.39 U	0.53	0.39 U	0.39 U	**1.2 J**	0.39 UJ

(--) Not analyzed for
U = The analyte was not detected at or above the reported result.
J = The analyte was positively identified. The associated numerical result is an estimate.
UJ = The analyte was not detected at or above the reported estimated result.
NJ = There is evidence that the analyte is present. The associated numerical result is an estimate.

BLS = bridgelip sucker
CRP = common carp
CTT = cutthroat trout
KOK = kokanee
LSS = largescale sucker
MWF = mountain whitefish
NPM = northern pikeminnow
SMB = smallmouth bass

Table D-1 continued.

Reach	Sample No.	Species	Endrin Aldehyde	Endrin Ketone	Heptachlor	Heptachlor Epoxide	Hexachloro-benzene	Endosulfan I	Endosulfan II	Endosulfan Sulfate	Toxaphene
Keechelus Lake	6394088	LSS	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 UJ	--
Keechelus Lake	6394089	LSS	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 UJ	--
Keechelus Lake	6394090	LSS	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 UJ	--
Keechelus Lake	6394092	NPM	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 UJ	--
Keechelus Lake	6394093	NPM	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 UJ	--
Keechelus Lake	6394095	KOK	0.37 U	0.37 U	0.37 U	0.37 U	**0.55**	0.37 U	0.37 U	0.37 UJ	--
Keechelus Lake	6394096	KOK	0.4 UJ	0.4 UJ	0.4 U	0.4 UJ	**0.5**	0.4 UJ	0.4 UJ	0.4 UJ	--
Keechelus Lake	6394097	KOK	0.39 U	0.39 U	0.39 U	0.39 U	**0.59**	0.39 U	0.39 U	0.39 UJ	--
Keechelus Lake	6394099	CTT	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	2 U
Keechelus Lake	6394100	CTT	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	2 U
Keechelus Lake	6394101	CTT	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	2 U
Keechelus Lake	6394103	MWF	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 UJ	--
Keechelus Lake	6394104	MWF	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 UJ	--
Kachess Lake	6394080	LSS	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 UJ	--
Kachess Lake	6394081	LSS	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 UJ	--
Kachess Lake	6394082	LSS	0.39 UJ	0.39 U	0.39 U	0.39 U	0.39 U	0.39 UJ	0.39 UJ	0.39 UJ	--
Kachess Lake	6394084	NPM	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 UJ	--
Kachess Lake	6394085	NPM	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 UJ	--
Kachess Lake	6394086	NPM	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 UJ	--
Cle Elum	6414068	MWF	0.39 UJ	0.39 UJ	0.39 U	0.39 UJ	**0.25 J**	0.39 UJ	0.39 UJ	0.39 UJ	1.9 U
Cle Elum	6414069	MWF	0.39 UJ	0.39 UJ	0.39 U	0.39 UJ	**0.51**	0.39 UJ	0.39 UJ	0.39 UJ	1.9 U
Cle Elum	6414070	MWF	0.4 UJ	0.4 UJ	0.4 U	0.4 UJ	**0.45**	0.4 UJ	0.4 UJ	0.4 UJ	2 U
Cle Elum	6414072	BLS	0.38 UJ	0.38 UJ	0.38 U	0.38 UJ	**0.24 J**	0.38 UJ	0.38 UJ	0.38 UJ	1.9 UJ
Cle Elum	6414073	BLS	0.39 U	0.39 U	0.39 U	0.39 U	**0.24 J**	0.39 U	0.39 U	0.39 U	2 U
Cle Elum	6414074	BLS	0.4 UJ	0.4 UJ	0.4 U	0.4 UJ	0.4 U	0.4 UJ	0.4 UJ	0.4 UJ	4.9 U
Cle Elum	6414076	NPM	0.39 UJ	0.39 UJ	0.39 U	0.39 UJ	0.39 U	0.39 UJ	0.39 UJ	0.39 UJ	4.9 U
Cle Elum	6414077	NPM	0.38 UJ	0.38 UJ	0.38 U	0.38 UJ	0.38 U	0.38 UJ	0.38 UJ	0.38 UJ	0.38 U
Cle Elum	6414078	NPM	0.39 UJ	0.39 UJ	0.39 U	0.39 UJ	0.39 U	0.39 UJ	0.39 UJ	0.39 UJ	4.9 U
Yakima Canyon	6414050	MWF	0.4 UJ	0.4 UJ	0.4 U	0.4 UJ	**0.26 J**	0.4 UJ	0.4 UJ	0.4 UJ	2 U
Yakima Canyon	6414051	MWF	0.39 UJ	0.39 UJ	0.39 U	0.39 UJ	**0.46**	0.39 UJ	0.39 UJ	0.39 UJ	2 U
Yakima Canyon	6414052	MWF	0.4 UJ	0.4 UJ	0.4 U	0.4 U	**0.53**	0.4 U	0.4 U	0.4 U	2 U
Yakima Canyon	6414057	NPM	0.4 UJ	0.4 U	0.4 U	0.4 U	**0.28 J**	0.4 U	0.4 U	0.4 U	2 U
Yakima Canyon	6414058	NPM	0.38 UJ	0.38 U	0.38 U	0.38 U	**0.23 J**	0.38 U	0.38 U	0.38 U	1.9 U
Yakima Canyon	6414059	NPM	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	**6.5 NJ**
Yakima Canyon	6414061	BLS	0.38 U	0.38 U	0.38 U	0.38 U	**0.47**	0.38 U	0.38 U	0.38 U	**50 NJ**
Yakima Canyon	6414062	BLS	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	1.9 U
Yakima Canyon	6414063	BLS	0.4 U	0.4 U	0.4 U	0.4 U	**0.21 J**	0.4 U	0.4 U	0.4 U	2 U
Wapato-Toppenish	6484230	LSS	1.6 U	1.6 U	0.39 U	1.6 U	0.39 U	1.6 U	1.6 U	1.6 U	4.8 U
Wapato-Toppenish	6484231	LSS	0.77 UJ	0.77 UJ	0.39 U	0.77 U	0.39 U	0.77 U	0.77 U	0.77 UJ	0.39 U
Wapato-Toppenish	6484232	LSS	1.6 U	1.6 U	0.4 U	1.6 U	0.4 U	1.6 U	1.6 U	1.6 U	5 U
Wapato-Toppenish	6484234	NPM	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	5 U
Wapato-Toppenish	6484235	NPM	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	4.9 U
Wapato-Toppenish	6484236	NPM	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	**10 J**
Wapato-Toppenish	6484238	MWF	1.6 U	1.6 U	0.39 U	1.6 U	0.57 UJ	1.6 U	1.6 U	1.6 U	**11 J**
Wapato-Toppenish	6484239	MWF	0.77 UJ	0.77 UJ	0.38 U	0.77 U	0.57 UJ	**1.6**	0.77 U	0.77 UJ	**10 J**
Wapato-Toppenish	6484240	MWF	1.6 UJ	1.6 U	0.4 U	1.6 U	0.4 U	1.6 U	1.6 UJ	1.6 UJ	**11 J**

Table D-1 continued.

Reach	Sample No.	Species	Endrin Aldehyde	Endrin Ketone	Heptachlor	Heptachlor Epoxide	Hexachloro-benzene	Endosulfan I	Endosulfan II	Endosulfan Sulfate	Toxaphene
Prosser	6454105	CRP	**0.46 J**	0.39 UJ	0.39 U	0.39 UJ	**0.52**	0.39 UJ	**0.21 J**	0.39 UJ	**55 J**
Prosser	6454106	CRP	**0.35 J**	0.39 UJ	0.39 U	0.39 UJ	**1.3**	0.39 UJ	**0.22 J**	**0.53 J**	**63 J**
Prosser	6454107	CRP	**0.35 J**	0.39 UJ	0.39 U	0.39 UJ	0.39 U	0.39 UJ	**0.3 J**	**0.82 J**	**49 J**
Prosser	6444234	SMB	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	4.9 U
Prosser	6444235	SMB	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	4.7 U
Prosser	6444236	SMB	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	4.9 U
Prosser	6444238	LSS	0.39 UJ	0.39 UJ	0.39 U	0.39 U	0.39 U	0.39 U	0.39 UJ	0.39 UJ	**10 J**
Prosser	6444239	LSS	0.39 UJ	0.39 UJ	0.39 U	0.39 U	0.39 U	0.39 U	0.39 UJ	0.39 UJ	4.9 U
Prosser	6444240	LSS	0.39 UJ	0.39 UJ	0.39 U	0.39 U	0.39 U	0.39 U	0.39 UJ	0.39 UJ	**11 J**
Horn Rapids	6444230	CRP	1.6 UJ	1.6 UJ	0.4 U	1.6 UJ	**0.79**	1.6 UJ	1.6 UJ	**1.7 J**	**59 J**
Horn Rapids	6444231	CRP	1.6 UJ	1.6 UJ	0.39 U	1.6 UJ	**0.91**	1.6 UJ	1.6 UJ	**2.1 J**	**25 J**
Horn Rapids	6444232	CRP	0.79 UJ	0.79 UJ	0.39 U	0.79 UJ	**0.56**	0.79 UJ	0.79 UJ	**0.93 J**	**43 J**
Horn Rapids	6444242	NPM	0.38 UJ	0.38 UJ	0.38 U	0.38 U	0.38 U	0.38 U	0.38 UJ	0.38 UJ	**10 J**
Horn Rapids	6444243	NPM	0.39 UJ	0.39 UJ	0.39 U	0.39 U	0.39 U	0.39 U	0.39 UJ	0.39 UJ	4.8 U
Horn Rapids	6444244	NPM	0.4 UJ	0.4 UJ	0.4 U	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 UJ	**14 J**
Horn Rapids	6454108	SMB	**0.21 J**	0.39 UJ	0.39 U	0.39 UJ	0.39 U	**0.28 J**	0.39 UJ	**0.2 J**	1.9 U
Horn Rapids	6454109	SMB	**0.37 J**	0.38 UJ	0.38 U	0.38 UJ	0.38 U	0.38 UJ	0.38 UJ	0.38 UJ	1.9 U
Horn Rapids	6454110	SMB	**0.25 J**	0.39 UJ	0.39 U	0.39 UJ	0.39 U	0.39 UJ	0.39 UJ	0.39 UJ	1.9 U
Horn Rapids	6454111	LSS	**0.33 J**	0.4 UJ	0.4 U	0.4 UJ	**0.23 J**	0.4 UJ	0.4 UJ	0.4 UJ	**9.1 J**
Horn Rapids	6454112	LSS	**0.28 J**	0.4 UJ	0.4 U	0.4 UJ	**0.31 J**	0.4 UJ	0.4 UJ	0.4 UJ	**10 J**
Horn Rapids	6454113	LSS	**0.3 J**	0.39 UJ	0.39 U	0.39 UJ	**0.24 J**	**0.33 J**	0.39 UJ	0.39 UJ	**12 J**

(--) Not analyzed for
U = The analyte was not detected at or above the reported result.
J = The analyte was positively identified. The associated numerical result is an estimate.
UJ = The analyte was not detected at or above the reported estimated result.
NJ = There is evidence that the analyte is present. The associated numerical result is an estimate.

BLS = bridgelip sucker
CRP = common carp
CTT = cutthroat trout
KOK = kokanee
LSS = largescale sucker
MWF = mountain whitefish
NPM = northern pikeminnow
SMB = smallmouth bass

Table D-2. PCBs Concentrations in Yakima River Fish Fillet Samples, 2006 (ug/Kg, wet weight, parts per billion).

Reach	Sample No.	Species	Lipids (%)	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Aroclor 1262	Aroclor 1268	Total PCB Aroclors
Keechelus Lake	6394088	LSS	2.08	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	**7.4 J**	**9 J**	7.5 UJ	1.9 U	**16 J**
Keechelus Lake	6394089	LSS	1.56	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	**8.1 J**	**7.8 J**	6.6 UJ	1.9 U	**16 J**
Keechelus Lake	6394090	LSS	1.6	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	**3.6 J**	**4.4 J**	3.8 UJ	1.9 U	**8 J**
Keechelus Lake	6394092	NPM	1.13	2 U	2 U	2 U	2 U	2 U	**6 J**	**8.9 J**	7.9 UJ	2 U	**15 J**
Keechelus Lake	6394093	NPM	1.09	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	**8 J**	**11 J**	9.3 UJ	1.9 U	**19 J**
Keechelus Lake	6394095	KOK	2.54	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	**11 J**	**4.6 J**	5.6 UJ	1.9 U	**16 J**
Keechelus Lake	6394096	KOK	2.78	2 U	2 U	2 U	2 U	2 U	**9.2 J**	**3.7 J**	4 UJ	2 U	**13 J**
Keechelus Lake	6394097	KOK	3.33	2 U	2 U	2 U	2 U	4.9 UJ	**12 J**	**5.8 J**	3.9 UJ	2 U	**18 J**
Keechelus Lake	6394099	CTT	1.86	2 U	2 U	2 U	2 U	2 U	**5.8**	**2.3**	--	2 U	**8**
Keechelus Lake	6394100	CTT	1.36	2 U	2 U	2 U	2 U	2 U	**3.8**	**1.4 J**	--	2 U	**5 J**
Keechelus Lake	6394101	CTT	1.09	2 U	2 U	2 U	2 U	2 U	**2.5**	**0.48 J**	--	2 U	**3 J**
Keechelus Lake	6394103	MWF	2.55	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2.6 UJ	2 U	2 U
Keechelus Lake	6394104	MWF	2.96	2 U	2 U	2 U	2 U	2 U	**6.3 J**	**3.3 J**	3.9 UJ	2 U	**10 J**
Kachess Lake	6394080	LSS	0.69	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Kachess Lake	6394081	LSS	0.48	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Kachess Lake	6394082	LSS	0.55	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Kachess Lake	6394084	NPM	0.58	2 U	2 U	2 U	2 U	5 UJ	**13 J**	**4.5 J**	5 UJ	2 U	**18 J**
Kachess Lake	6394085	NPM	0.86	1.8 U	1.8 U	1.8 U	1.8 U	4.6 UJ	**19 J**	**6.6 J**	5.5 UJ	1.8 U	**26 J**
Kachess Lake	6394086	NPM	0.6	2 U	2 U	2 U	2 U	4.9 UJ	**15 J**	**7.2 J**	5.9 UJ	2 U	**22 J**
Cle Elum	6414068	MWF	4.24	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	**12**	1.9 U	--	1.9 U	**12**
Cle Elum	6414069	MWF	5.09	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	**19**	**7.8**	--	1.9 U	**27**
Cle Elum	6414070	MWF	4.42	2 U	2 U	2 U	2 U	2 U	**14**	**5.7**	--	2 U	**20**
Cle Elum	6414072	BLS	4.03	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	**7.6**	**3.6**	--	1.9 U	**11**
Cle Elum	6414073	BLS	2.8	2 U	2 U	2 U	2 U	2 U	**6.3**	**1.5 J**	--	2 U	**8 J**
Cle Elum	6414074	BLS	2.51	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Cle Elum	6414076	NPM	1.98	2 U	2 U	2 U	2 U	2 U	**4.8 J**	2 U	2 U	2 U	**5 J**
Cle Elum	6414077	NPM	1.73	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	**4.6 J**	1.9 U	1.9 U	1.9 U	**5 J**
Cle Elum	6414078	NPM	1.27	2 U	2 U	2 U	2 U	2 U	**3.2 J**	**2.3**	2 U	2 U	**6 J**
Yakima Canyon	6414050	MWF	4.51	2 U	2 U	2 U	2 U	2 U	**17**	**7.1**	--	2 U	**24**
Yakima Canyon	6414051	MWF	5.43	2 U	2 U	2 U	2 U	2 U	**15**	**6**	--	2 U	**21**
Yakima Canyon	6414052	MWF	4.67	2 U	2 U	2 U	2 U	2 U	**20**	**8.7**	--	2 U	**29**
Yakima Canyon	6414057	NPM	2.87	2 U	2 U	2 U	2 U	2 U	**21**	**13**	--	2 U	**34**
Yakima Canyon	6414058	NPM	2.04	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	**16**	**7.1**	--	1.9 U	**23**
Yakima Canyon	6414059	NPM	1.76	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	**10**	**4.3**	--	**1.2 J**	**16 J**
Yakima Canyon	6414061	BLS	4.72	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	**15.0**	**7.0**	--	1.9 U	**22**
Yakima Canyon	6414062	BLS	2.16	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	**2.4**	1.9 U	--	1.9 U	**2**
Yakima Canyon	6414063	BLS	2.93	2 U	2 U	2 U	2 U	2 U	**3.8**	2 U	--	2 U	**4**
Wapato-Toppenish	6484230	LSS	3.33	1.9 U	1.9 U	1.9 U	1.9 U	**3.9 J**	**7**	**3.1**	4.8 UJ	1.9 U	**14 J**
Wapato-Toppenish	6484231	LSS	2.92	1.9 U	1.9 U	1.9 U	1.9 U	**3.9 J**	**7.9**	**4.1**	4.8 UJ	1.9 U	**16 J**
Wapato-Toppenish	6484232	LSS	3.25	2 U	2 U	2 U	2 U	**4.6 J**	**8**	**3.4**	5 UJ	2 U	**16 J**
Wapato-Toppenish	6484234	NPM	1.06	2 U	2 U	2 U	2 U	2 U	**6.9**	**5**	5 UJ	2 U	**12 J**
Wapato-Toppenish	6484235	NPM	1.1	2 U	2 U	2 U	2 U	4.9 UJ	**5.6**	**4.1 J**	4.9 UJ	2 U	**10 J**
Wapato-Toppenish	6484236	NPM	1.35	2 U	2 U	2 U	2 U	**3.6 J**	**12 J**	**12 J**	5 UJ	2 U	**28 J**
Wapato-Toppenish	6484238	MWF	3.15	2 U	2 U	2 U	2 U	**6.2 J**	**17 J**	**7.3**	9.9 UJ	2 U	**31 J**

Table D-2 continued.

Reach	Sample No.	Species	Lipids (%)	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Aroclor 1262	Aroclor 1268	Total PCB Aroclors
Wapato-Toppenish	6484239	MWF	2.9	1.9 U	1.9 U	1.9 U	1.9 U	**6.2 J**	**16 J**	**7.9 J**	9.6 UJ	1.9 U	**30 J**
Wapato-Toppenish	6484240	MWF	3.02	2 U	2 U	2 U	2 U	**5.3 J**	**11 J**	**5.2 J**	5 UJ	2 U	**22 J**
Prosser	6454105	CRP	4.31	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	**24**	**39**	--	1.9 U	**63**
Prosser	6454106	CRP	7.14	2 U	2 U	2 U	2 U	2 U	**48**	**61**	--	2 U	**109**
Prosser	6454107	CRP	3.71	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	**45**	**48 J**	--	1.9 U	**93 J**
Prosser	6444234	SMB	0.62	2 U	2 U	2 U	2 U	2 U	**3.6 J**	**2.6**	2 U	2 U	**6 J**
Prosser	6444235	SMB	0.66	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U
Prosser	6444236	SMB	0.3	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Prosser	6444238	LSS	1.77	2 U	2 U	2 U	2 U	2 U	**4.9 J**	**7.1**	2 U	2 U	**12 J**
Prosser	6444239	LSS	2.01	2 U	2 U	2 U	2 U	2 U	**11 J**	**7.2**	9.8 UJ	2 U	**18 J**
Prosser	6444240	LSS	2.41	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	**12 J**	**7.2**	9.7 UJ	1.9 U	**19 J**
Horn Rapids	6444230	CRP	7.94	2 U	2 U	2 U	2 U	8.5 UJ	**35 J**	**110**	99 UJ	20 UJ	**145 J**
Horn Rapids	6444231	CRP	9.17	1.9 U	1.9 U	1.9 U	1.9 U	7.2 UJ	**25 J**	**68 J**	58 UJ	1.9 UJ	**93**
Horn Rapids	6444232	CRP	5.83	4.9 UJ	2 U	2 U	2 U	2 U	**12 J**	**42**	59 UJ	2 U	**54 J**
Horn Rapids	6444242	NPM	1.08	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	**5.7 J**	**6.9**	9.6 UJ	1.9 U	**13 J**
Horn Rapids	6444243	NPM	1.41	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	**4.9 J**	**6**	9.7 UJ	1.9 U	**11 J**
Horn Rapids	6444244	NPM	1.3	2 U	2 U	2 U	2 U	2 U	**3.5 J**	**3.9**	2 U	2 U	**7 J**
Horn Rapids	6454108	SMB	1.37	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	**9.8**	**6.2 J**	--	1.9 U	**16 J**
Horn Rapids	6454109	SMB	1.01	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	**6.9**	**3.5 J**	--	1.9 U	**10 J**
Horn Rapids	6454110	SMB	0.95	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	**7.7**	1.9 U	--	1.9 U	**8**
Horn Rapids	6454111	LSS	2.79	2 U	2 U	2 U	2 U	2 U	**7.4**	**4 J**	--	2 U	**11 J**
Horn Rapids	6454112	LSS	4.65	2 U	2 U	2 U	2 U	2 U	**9.8**	**4.8 J**	--	2 U	**15 J**
Horn Rapids	6454113	LSS	3.56	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	**11**	**9.5 J**	--	1.9 U	**21 J**

(--) Not analyzed for
U = The analyte was not detected at or above the reported result.
J = The analyte was positively identified. The associated numerical result is an estimate.
UJ = The analyte was not detected at or above the reported estimated result.

BLS = bridgelip sucker
CRP = common carp
CTT = cutthroat trout
KOK = kokanee
LSS = largescale sucker
MWF = mountain whitefish
NPM = northern pikeminnow
SMB = smallmouth bass

Table D-3. Dioxin and Furan Concentrations in Yakima River Fish Fillet Samples, 2006 (ng/Kg, wet weight; parts per trillion).

Reach	Sample No.	Species	Lipids (%)	2,3,7,8-TCDD	1,2,3,7,8-PeCDD	1,2,3,4,7,8-HxCDD	1,2,3,6,7,8-HxCDD	1,2,3,7,8,9-HxCDD	1,2,3,4,6,7,8-HpCDD	OCDD	2,3,7,8-TCDF	1,2,3,7,8-PeCDF	2,3,4,7,8-PeCDF	1,2,3,4,7,8-HxCDF	1,2,3,6,7,8-HxCDF	2,3,4,6,7,8-HxCDF
Keechelus Lake	394091	LSS	1.9	0.030 UJ	0.050 UJ	0.100 UJ	0.080 UJ	0.060 UJ	**0.206 J**	**1.08**	**0.132**	**1.850**	0.040 UJ	0.075 UJ	0.075 UJ	0.060 UJ
Keechelus Lake	394094	NPM	1.7	0.030 UJ	0.050 UJ	0.100 UJ	0.080 UJ	0.060 UJ	**0.125 J**	0.230 UJ	**0.120**	**1.80**	0.040 UJ	0.075 UJ	0.075 UJ	0.060 UJ
Keechelus Lake	394098	KOK	3.6	0.030 UJ	0.050 UJ	0.100 UJ	**0.104 J**	0.060 UJ	0.085 UJ	0.230 UJ	**0.159**	**1.46**	0.040 UJ	**0.136 J**	**0.076 J**	0.060 UJ
Keechelus Lake	394102	CTT	2.2	0.030 UJ	0.080 UJ	0.100 UJ	**0.080 J**	0.060 UJ	0.085 UJ	0.230 UJ	**0.105**	**0.507**	0.040 UJ	**0.075 J**	**0.075 J**	0.060 UJ
Keechelus Lake	394105	MWF	3.4	0.030 UJ	0.050 UJ	0.100 UJ	0.080 UJ	0.060 UJ	0.085 UJ	**0.256 J**	**0.156**	**0.434 J**	0.040 UJ	0.075 UJ	0.075 UJ	0.060 UJ
Kachess Lake	394083	LSS	1.8	0.030 UJ	0.050 UJ	0.100 UJ	0.080 UJ	0.060 UJ	0.085 UJ	0.230 UJ	**0.039 J**	**0.234 J**	0.040 UJ	0.075 UJ	0.075 UJ	0.060 UJ
Kachess Lake	394087	NPM	1.4	0.030 UJ	0.050 UJ	0.100 UJ	0.080 UJ	0.060 UJ	**0.249 J**	0.230 UJ	**0.088 J**	**1.00**	0.040 UJ	**0.239 J**	0.075 UJ	0.060 UJ
Cle Elum	414071	MWF	5	0.030 UJ	0.050 UJ	0.100 UJ	**0.124 J**	0.060 UJ	**0.197 J**	0.230 UJ	**0.329**	**0.682**	0.040 UJ	0.075 UJ	0.075 UJ	0.060 UJ
Cle Elum	414075	BLS	3.4	0.030 UJ	0.050 UJ	0.100 UJ	0.080 UJ	0.060 UJ	0.085 UJ	0.230 UJ	**0.120**	**0.457 J**	0.040 UJ	0.075 UJ	0.075 UJ	0.060 UJ
Cle Elum	414079	NPM	2.9	0.030 UJ	0.050 UJ	0.100 UJ	0.080 UJ	0.060 UJ	**0.189 J**	**0.290 J**	**0.144**	**0.509**	0.040 UJ	0.075 UJ	0.075 UJ	0.060 UJ
Canyon	414056	MWF	6.4	**0.146**	0.050 UJ	0.100 UJ	0.080 UJ	0.060 UJ	**0.190 J**	0.230 UJ	**0.364**	**0.700**	0.040 UJ	0.075 UJ	0.075 UJ	0.060 UJ
Canyon	414060	NPM	2.8	0.030 UJ	0.050 UJ	0.100 UJ	0.080 UJ	0.060 UJ	0.085 UJ	0.230 UJ	**0.156**	**0.787**	0.040 UJ	0.075 UJ	0.075 UJ	0.060 UJ
Canyon	414067	BLS	4.2	0.03 UJ	0.05 UJ	0.100 UJ	0.08 UJ	0.060 UJ	0.085 UJ	0.23 UJ	**0.036 J**	**0.226 J**	0.040 UJ	0.075 UJ	0.075 UJ	0.060 UJ
Wapato-Toppenish	484233	LSS	4.7	0.03 UJ	0.05 UJ	0.10 UJ	0.08 UJ	0.06 UJ	0.085 UJ	0.23 UJ	**0.27**	0.05 UJ	0.042 UJ	**0.304**	0.075 UJ	**0.295**
Wapato-Toppenish	484241	MWF	4.5	0.03 UJ	0.05 UJ	0.10 UJ	0.08 UJ	0.06 UJ	0.085 UJ	0.23 UJ	**0.227**	0.054 UJ	0.04 UJ	**0.145 J**	0.075 UJ	**0.063 J**
Wapato-Toppenish	484237	NPM	1.7	**0.242 J**	**0.267 J**	0.10 UJ	0.08 UJ	0.06 UJ	0.085 UJ	**0.969**	**0.998**	0.066 UJ	0.075 UJ	**0.121 J**	**0.195 J**	0.06 UJ
Prosser	454114	CRP	5.1	0.03 UJ	0.05 UJ	0.1 UJ	0.08 UJ	0.06 UJ	0.784 UJ	1.44 UJ	**1.11**	0.075 UJ	0.136 UJ	**0.214 J**	0.075 UJ	**0.495**
Prosser	444241	LSS	3.1	**0.031 J**	0.05 UJ	0.1 UJ	0.08 UJ	0.06 UJ	**0.142 J**	**0.728**	**0.625**	0.05 UJ	0.04 UJ	0.075 UJ	0.075 UJ	**0.144 J**
Prosser	444237	SMB	1.5	0.03 UJ	0.05 UJ	0.10 UJ	0.08 UJ	0.06 UJ	0.085 UJ	**1.24**	**0.251**	0.05 UJ	0.171 UJ	**0.366**	0.075 UJ	**0.153 J**
Horn Rapids	444233	CRP	8.5	0.03 UJ	0.05 UJ	0.1 UJ	**0.567**	**0.087 J**	**1.29**	**2.23**	**1.68**	0.094 UJ	0.157 UJ	**0.102 J**	0.075 UJ	**0.574**
Horn Rapids	454116	LSS	6.1	0.03 UJ	0.05 UJ	0.10 UJ	0.08 UJ	0.06 UJ	0.085 UJ	0.906 UJ	**0.266**	0.05 UJ	0.096 UJ	**0.112 J**	0.075 UJ	**0.159 J**
Horn Rapids	444245	NPM	2.2	**0.101**	0.05 UJ	0.10 UJ	0.08 UJ	0.06 UJ	0.085 UJ	**0.942**	**0.06**	0.05 UJ	0.067 UJ	**0.461**	0.075 UJ	**0.211 J**
Horn Rapids	454115	SMB	2.2	0.03 UJ	0.05 UJ	0.1 UJ	0.08 UJ	0.06 UJ	0.085 UJ	0.23 UJ	**0.136**	0.085 UJ	0.044 UJ	**0.174 J**	0.075 UJ	**0.121 J**

U = The analyte was not detected at or above the reported result.
J = The analyte was positively identified. The associated numerical result is an estimate.
UJ = The analyte was not detected at or above the reported estimated result.
TEQ = 2,3,7,8-TCDD toxicity equivalent based on toxicity equivalency factors from Van den Berg et. al., 1998; Only detected chemicals were used in calculation.

BLS = bridgelip sucker
CRP = common carp
CTT = cutthroat trout
KOK = kokanee
LSS = largescale sucker
MWF = mountain whitefish
NPM = northern pikeminnow
SMB = smallmouth bass

Table D-3 continued.

Reach	Sample No.	Species	1,2,3,7,8,9-HxCDF	1,2,3,4,6,7,8-HpCDF	1,2,3,4,7,8,9-HpCDF	OCDF	TEQ
Keechelus Lake	394091	LSS	0.060 UJ	0.070 UJ	0.085 UJ	**0.309 J**	**0.358**
Keechelus Lake	394094	NPM	0.060 UJ	0.070 UJ	0.085 UJ	0.200 UJ	**0.205**
Keechelus Lake	394098	KOK	0.060 UJ	0.070 UJ	0.085 UJ	0.200 UJ	**0.194**
Keechelus Lake	394102	CTT	0.060 UJ	0.070 UJ	0.085 UJ	0.200 UJ	**0.069**
Keechelus Lake	394105	MWF	0.060 UJ	0.070 UJ	0.085 UJ	0.200 UJ	**0.083**
Kachess Lake	394083	LSS	0.060 UJ	**0.134 J**	0.085 UJ	0.200 UJ	**0.041**
Kachess Lake	394087	NPM	0.060 UJ	0.070 UJ	0.085 UJ	0.200 UJ	**0.158**
Cle Elum	414071	MWF	0.060 UJ	0.070 UJ	0.085 UJ	0.200 UJ	**0.133**
Cle Elum	414075	BLS	0.060 UJ	0.070 UJ	0.085 UJ	0.200 UJ	**0.058**
Cle Elum	414079	NPM	0.060 UJ	0.070 UJ	0.085 UJ	0.200 UJ	**0.113**
Canyon	414056	MWF	0.060 UJ	0.070 UJ	0.085 UJ	0.200 UJ	**0.140**
Canyon	414060	NPM	0.060 UJ	0.070 UJ	0.085 UJ	0.200 UJ	**0.095**
Canyon	414067	BLS	0.060 UJ	0.070 UJ	0.085 UJ	0.200 UJ	**0.026**
Wapato-Toppenish	484233	LSS	0.06 UJ	0.07 UJ	0.085 UJ	0.20 UJ	**0.091**
Wapato-Toppenish	484241	MWF	0.06 UJ	0.07 UJ	0.085 UJ	0.20 UJ	**0.049**
Wapato-Toppenish	484237	NPM	0.06 UJ	**0.158 J**	0.085 UJ	0.20 UJ	**0.309**
Prosser	454114	CRP	0.06 UJ	**0.19 J**	0.085 UJ	**0.971**	**0.319**
Prosser	444241	LSS	0.06 UJ	0.07 UJ	0.085 UJ	0.2 UJ	**0.167**
Prosser	444237	SMB	0.06 UJ	**0.279**	0.085 UJ	0.20 UJ	**0.246**
Horn Rapids	444233	CRP	0.06 UJ	**0.252 J**	0.085 UJ	**0.476 J**	**0.751**
Horn Rapids	454116	LSS	0.06 UJ	0.07 UJ	0.085 UJ	**0.581**	**0.121**
Horn Rapids	444245	NPM	0.06 UJ	**0.085 J**	0.085 UJ	0.20 UJ	**0.19**
Horn Rapids	454115	SMB	0.06 UJ	0.07 UJ	0.085 UJ	0.2 UJ	**0.056**

U = The analyte was not detected at or above the reported result.
J = The analyte was positively identified. The associated numerical result is an estimate.
UJ = The analyte was not detected at or above the reported estimated result.

TEQ = 2,3,7,8-TCDD toxicity equivalent based on toxicity equivalency factors from Van den Berg et al., 1998;
Only detected chemicals were used in calculation.

Table D-4. PBDE Concentrations in Yakima River Fish Fillets, 2006 (ug/Kg, wet weight, parts per billion).

Reach	Sample No.	Species	Lipids (%)	PBDE - 47	PBDE - 49	PBDE - 66	PBDE - 71	PBDE - 99	PBDE - 100	PBDE - 138	PBDE - 153	PBDE - 154	PBDE - 183	PBDE - 184	PBDE - 191	PBDE - 209
Keechelus Lake	6394088	LSS	2.08	**5**	0.2 U	0.2 U	0.2 U	0.2 U	**0.8**	0.4 U	**0.13 J**	**0.36 J**	0.4 U	0.4 U	0.4 U	0.99 U
Keechelus Lake	6394093	NPM	1.09	**1**	**0.13 J**	0.2 U	0.2 U	0.2 U	**0.57**	0.39 U	0.39 U	**0.28 J**	0.39 U	0.39 U	0.39 U	0.98 U
Keechelus Lake	6394099	CTT	1.86	**1**	0.2 U	0.2 U	0.2 U	**0.4**	**0.18 J**	0.4 U	**0.13 J**	**0.14 J**	0.4 U	0.4 U	0.4 U	0.99 U
Keechelus Lake	6394103	MWF	2.55	**1**	0.2 U	0.2 U	0.2 U	**0.9**	**0.31**	0.4 U	**0.16 J**	**0.16 J**	0.4 U	0.4 U	0.4 U	0.99 U
Kachess Lake	6394080	LSS	0.69	**5**	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.39 U	0.39 U	0.19 U	0.39 U	0.39 U	0.39 U	0.97 U
Kachess Lake	6394084	NPM	0.58	**1**	**0.16 J**	0.19 U	0.19 U	0.19 U	**0.33**	0.39 U	**0.12 J**	**0.2 J**	0.39 U	0.39 U	0.39 U	0.96 U
Yakima Canyon	6414050	MWF	4.51	**26**	**1.3**	**1**	0.2 U	**18**	**5.5**	0.39 U	**1.6**	**1.3**	0.39 U	0.39 U	0.39 U	0.98 U
Yakima Canyon	6414057	NPM	2.87	**17**	**0.71**	0.2 U	0.2 U	0.2 U	**3.6**	0.39 U	**0.22 J**	**1.2**	0.39 U	0.39 U	0.39 U	0.99 U
Yakima Canyon	6414061	BLS	4.72	**18**	**0.51**	0.2 U	0.2 U	0.2 U	**2.4**	0.39 U	**0.31 J**	**0.67**	0.39 U	0.39 U	0.39 U	0.98 U
Wapato-Toppenish	6484230	LSS	3.33	**33**	**0.58**	0.2 U	0.2 U	**0.2 J**	**4.2**	0.4 U	**0.85**	**1**	0.4 U	0.4 U	0.4 U	1 U
Wapato-Toppenish	6484234	NPM	1.06	**15**	**0.52**	0.2 U	0.2 U	0.2 U	**2.9**	0.39 U	**0.32 J**	**0.69**	0.39 U	0.39 U	0.39 U	0.98 U
Wapato-Toppenish	6484238	MWF	3.15	**94**	**2.7**	**2.6**	0.19 U	**61.6**	**19.1**	0.38 U	**5.5**	**3.3**	0.38 U	0.38 U	0.38 U	**3.3**
Wapato-Toppenish	6484239	MWF	2.9	**95**	**2.5**	**3**	0.2 U	**68.3**	**20.6**	0.4 U	**6.8**	**4.2**	0.4 U	0.4 U	0.4 U	1.3 U

U = The analyte was not detected at or above the reported result.
J = The analyte was positively identified. The associated numerical result is an estimate.

BLS = bridgelip sucker
CTT = cutthroat trout
LSS = largescale sucker
MWF = mountain whitefish
NPM = northern pikeminnow

Appendix E. Pesticides Analyzed in Surface Water and in Effluents from Fruit Packers and Vegetable Processors during the 2007-08 Yakima River Water Quality Study

4,4'-DDE
4,4'-DDD
4,4'-DDT
Dieldrin
cis-Chlordane
trans-Chlordane
cis-Nonachlor
trans-Nonachlor
Oxychlordane
alpha-BHC
beta-BHC
gamma-BHC (Lindane)
delta-BHC
Chlorpyrifos
Endosulfan I
Endosulfan II
Endosulfan Sulfate
Toxaphene
Heptachlor
Heptachlor epoxide
Aldrin
Endrin
Endrin Ketone
Endrin Aldehyde
Methoxychlor
Hexachlorobenzene

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Appendix F. Deployment Dates and PRC Recovery for SPMDs

Table F-1. Deployment Dates and PRC Concentrations for May-June 2007 SPMDs. [Each sample consisted of five standard SPMD membranes. Each membrane was 4.50 grams/0.00495 L.]

Sample Number (723-)	Site	Start		End		Deploy Time	Final PRC Concentrations (1,000 ng/sample starting)	
		Date	Time	Date	Time	(days)	PCB-4	PCB-29
4180	EASTON	5/8/07	8:00	6/5/07	8:00	28.0	228	496
4182	TOWNE DIV	5/8/07	9:30	6/5/07	9:00	28.0	272	839
4183	WILSON CR*	5/7/08	12:50	6/6/08	8:20	31.8	80	338
4184	ROZA DAM	5/8/07	11:45	6/5/07	10:45	27.9	280	820
4185	NACHES R	5/8/07	13:10	6/11/07	11:20	31.9	170	578
4186	MOXEE	5/8/07	14:20	6/5/07	11:55	27.9	108	517
4187	SUNNYSIDE	5/9/07	8:35	6/5/07	12:30	27.2	116	574
4188	GRANGER	5/9/07	9:35	6/5/07	13:15	27.2	114	534
4189	SULPHUR	5/9/07	10:45	6/5/07	13:50	27.1	149	608
4190	SULPHUR REP	5/9/07	10:45	6/5/07	13:50	27.1	114	736
4192	PROSSER	5/9/07	13:35	6/6/07	9:40	27.8	113	466
4193	PROSSER REP	5/9/07	13:35	6/6/07	9:40	27.8	177	619
4194	SPRING CR	5/9/07	12:10	6/5/07	15:25	27.1	161	584
4195	HORN RAPIDS	5/8/07	16:55	6/5/07	16:00	28.3	101	488
4181	FIELD BLNK (Easton)	- -	- -	- -	- -	- -		
4191	FIELD BLNK (Sulphur)	- -	- -	- -	- -	- -		

*Original sample from 2007 lost in laboratory accident; re-deployed in 2008.

Table F-2. Deployment Dates and PRC Concentrations for October-November 2007 SPMDs. [Each sample consisted of five standard SPMD membranes. Each membrane was 4.50 grams/0.00495 L.]

Sample Number (748-)	Site	Start		End		Deploy Time	Final PRC Concentrations (1,000 ng/sample starting)	
		Date	Time	Date	Time	(days)	PCB-4	PCB-29
4250	EASTON	10/30/07	7:55	11/26/07	8:15	27.0	355	603
4252	TOWNE DIV	10/30/07	9:20	11/26/07	9:30	27.0	356	644
4253	WILSON CR	10/30/07	10:30	11/26/07	10:30	27.0	277	560
4254	ROZA DAM	10/30/07	11:45	11/26/07	11:20	26.0	264	627
4255	NACHES R	10/30/07	13:15	11/26/07	12:25	26.0	328	665
4256	MOXEE	10/30/07	14:45	11/26/07	13:25	26.9	252	648
4257	SUNNYSIDE	10/30/07	14:00	11/26/07	14:10	27.0	198	518
4258	GRANGER	10/30/07	15:35	11/26/07	15:00	26.0	187	560
4259	SULPHUR	10/30/07	16:29	11/26/07	15:45	25.0	135	406
4261	PROSSER	10/31/07	8:30	11/27/07	8:35	27.0	225	431
4262	PROSSER REP	10/31/07	8:30	11/27/07	8:35	27.0	196	255
4263	SPRING CR	10/31/07	11:10	11/26/07	9:15	25.9	381	673
4264	HORN RAPIDS	10/31/07	10:00	11/27/07	10:25	27.0	193	443
4251	FIELD BLNK (Easton)	- -	- -	- -	- -	- -	- -	- -
4260	FIELD BLNK (Sulphur)	- -	- -	- -	- -	- -	- -	- -

Appendix G. Ancillary Water Quality Data for SPMD Deployments

Table G-1. Ancillary Water Quality Data for Spring 2007 SPMD Deployments

Sample No.	Field ID	Collection Date	Parameter	Result		Units
7194080	EASTON	5/8/2007	Conductivity	49.3		umhos/cm
7194080	EASTON	5/8/2007	Dissolved Organic Carbon	1	U	mg/L
7194080	EASTON	5/8/2007	Total Organic Carbon	1	U	mg/L
7194080	EASTON	5/8/2007	Total Suspended Solids	2		mg/L
7194080	EASTON	5/8/2007	Turbidity	1.6		NTU
7214095	EASTON	5/22/2007	Conductivity	46		umhos/cm
7214095	EASTON	5/22/2007	Dissolved Organic Carbon	1	U	mg/L
7214095	EASTON	5/22/2007	Total Suspended Solids	1		mg/L
7214095	EASTON	5/22/2007	Turbidity	1.3		NTU
7234210	EASTON	6/5/2007	Conductivity	45		umhos/cm
7234210	EASTON	6/5/2007	Dissolved Organic Carbon	1	U	mg/L
7234210	EASTON	6/5/2007	Total Non-Volatile Suspended Solids	1	U	mg/L
7234210	EASTON	6/5/2007	Total Organic Carbon	1	U	mg/L
7234210	EASTON	6/5/2007	Total Suspended Solids	1	U	mg/L
7234210	EASTON	6/5/2007	Turbidity	1.1		NTU
7194081	TOWNE DIV	5/8/2007	Conductivity	80.4		umhos/cm
7194081	TOWNE DIV	5/8/2007	Dissolved Organic Carbon	1.5		mg/L
7194081	TOWNE DIV	5/8/2007	Total Organic Carbon	1.1		mg/L
7194081	TOWNE DIV	5/8/2007	Total Suspended Solids	10		mg/L
7194081	TOWNE DIV	5/8/2007	Turbidity	4.1		NTU
7234211	TOWNE DIV	6/5/2007	Conductivity	58		umhos/cm
7234211	TOWNE DIV	6/5/2007	Dissolved Organic Carbon	1	U	mg/L
7234211	TOWNE DIV	6/5/2007	Total Non-Volatile Suspended Solids	23		mg/L
7234211	TOWNE DIV	6/5/2007	Total Organic Carbon	1.2		mg/L
7234211	TOWNE DIV	6/5/2007	Total Suspended Solids	27		mg/L
7234211	TOWNE DIV	6/5/2007	Turbidity	12		NTU
7194082	WILSON CR	5/8/2007	Conductivity	232		umhos/cm
7194082	WILSON CR	5/8/2007	Dissolved Organic Carbon	3.8		mg/L
7194082	WILSON CR	5/8/2007	Total Organic Carbon	4		mg/L
7194082	WILSON CR	5/8/2007	Total Suspended Solids	50		mg/L
7194082	WILSON CR	5/8/2007	Turbidity	20		NTU
7234212	WILSON CR	6/5/2007	Conductivity	253		umhos/cm
7234212	WILSON CR	6/5/2007	Dissolved Organic Carbon	3.8		mg/L
7234212	WILSON CR	6/5/2007	Total Non-Volatile Suspended Solids	46		mg/L
7234212	WILSON CR	6/5/2007	Total Organic Carbon	4.5		mg/L
7234212	WILSON CR	6/5/2007	Total Suspended Solids	54		mg/L
7234212	WILSON CR	6/5/2007	Turbidity	18		NTU
7194083	ROZA DAM	5/8/2007	Conductivity	118		umhos/cm
7194083	ROZA DAM	5/8/2007	Dissolved Organic Carbon	1.8		mg/L
7194083	ROZA DAM	5/8/2007	Total Organic Carbon	1.9		mg/L
7194083	ROZA DAM	5/8/2007	Total Suspended Solids	4		mg/L
7194083	ROZA DAM	5/8/2007	Turbidity	3.4		NTU
7214098	ROZA DAM	5/22/2007	Conductivity	97		umhos/cm
7214098	ROZA DAM	5/22/2007	Dissolved Organic Carbon	1.6		mg/L
7214098	ROZA DAM	5/22/2007	Total Organic Carbon	1.9		mg/L
7214098	ROZA DAM	5/22/2007	Total Suspended Solids	13		mg/L

Sample No.	Field ID	Collection Date	Parameter	Result	Units
7214098	ROZA DAM	5/22/2007	Turbidity	6.6	NTU
7234213	ROZA DAM	6/5/2007	Conductivity	78	umhos/cm
7234213	ROZA DAM	6/5/2007	Dissolved Organic Carbon	1.2	mg/L
7234213	ROZA DAM	6/5/2007	Total Non-Volatile Suspended Solids	20	mg/L
7234213	ROZA DAM	6/5/2007	Total Organic Carbon	1.5	mg/L
7234213	ROZA DAM	6/5/2007	Total Suspended Solids	23	mg/L
7234213	ROZA DAM	6/5/2007	Turbidity	14	NTU
7194084	NACHES R.	5/8/2007	Dissolved Organic Carbon	1.3	mg/L
7194084	NACHES R.	5/8/2007	Total Organic Carbon	1.7	mg/L
7234214	NACHES R.	6/5/2007	Dissolved Organic Carbon	1.2	mg/L
7234214	NACHES R.	6/5/2007	Total Organic Carbon	2	mg/L
7194085	MOXEE	5/8/2007	Dissolved Organic Carbon	2.4	mg/L
7194085	MOXEE	5/8/2007	Total Organic Carbon	2.5	mg/L
7234215	MOXEE	6/5/2007	Dissolved Organic Carbon	1.8	mg/L
7234215	MOXEE	6/5/2007	Total Organic Carbon	2.1	mg/L
7194086	SUNNYSIDE	5/9/2007	Dissolved Organic Carbon	1.6	mg/L
7194086	SUNNYSIDE	5/9/2007	Total Organic Carbon	2.1	mg/L
7214104	SUNNYSIDE	5/22/2007	Dissolved Organic Carbon	1.7	mg/L
7214104	SUNNYSIDE	5/22/2007	Total Organic Carbon	1.8	mg/L
7234216	SUNNYSIDE	6/5/2007	Dissolved Organic Carbon	1.2	mg/L
7234216	SUNNYSIDE	6/5/2007	Total Organic Carbon	1.8	mg/L
7194087	GRANGER	5/9/2007	Dissolved Organic Carbon	2.7	mg/L
7194087	GRANGER	5/9/2007	Total Organic Carbon	3.5	mg/L
7234217	GRANGER	6/5/2007	Dissolved Organic Carbon	4.2	mg/L
7234217	GRANGER	6/5/2007	Total Organic Carbon	4.9	mg/L
7194088	SULPHUR	5/9/2007	Dissolved Organic Carbon	2	mg/L
7194088	SULPHUR	5/9/2007	Total Organic Carbon	2.9	mg/L
7234218	SULPHUR	6/5/2007	Dissolved Organic Carbon	2.3	mg/L
7234218	SULPHUR	6/5/2007	Total Organic Carbon	2.9	mg/L
7194093	SULPHUR-REP	5/9/2007	Dissolved Organic Carbon	2.4	mg/L
7194093	SULPHUR-REP	5/9/2007	Total Organic Carbon	2.5	mg/L
7194089	PROSS DM	5/9/2007	Dissolved Organic Carbon	1.8	mg/L
7194089	PROSS DM	5/9/2007	Total Organic Carbon	2.6	mg/L
7194090	PROSSER-REP	5/9/2007	Total Organic Carbon	2.6	mg/L
7224102	PROSS DM	5/30/2007	Dissolved Organic Carbon	1.4	mg/L
7224102	PROSS DM	5/30/2007	Total Organic Carbon	1.6	mg/L
7234219	PROSS DM	6/5/2007	Dissolved Organic Carbon	1.5	mg/L
7234219	PROSS DM	6/5/2007	Total Organic Carbon	1.9	mg/L
7194091	SPRING CR	5/9/2007	Dissolved Organic Carbon	2.8	mg/L
7194091	SPRING CR	5/9/2007	Total Organic Carbon	3.3	mg/L
7234220	SPRING CR	6/5/2007	Dissolved Organic Carbon	2.3	mg/L
7234220	SPRING CR	6/5/2007	Total Organic Carbon	2.9	mg/L
7194092	HORNRAPID	5/8/2007	Dissolved Organic Carbon	1.9	mg/L
7194092	HORNRAPID	5/8/2007	Total Organic Carbon	2.4	mg/L
7234221	HORNRAPID	6/5/2007	Dissolved Organic Carbon	1.5	mg/L
7234221	HORNRAPID	6/5/2007	Total Organic Carbon	2.1	mg/L

U = not detected

Table G-2. Ancillary Water Quality Data for Fall 2007 SPMD Deployments.

Sample No.	Field ID	Collection Date	Total Organic Carbon (mg/L)	Dissolved Organic Carbon (mg/L)	Total Suspended Solids (mg/L)	Turbidity (NTU)	Conductivity (umhos/cm)
7444205	EASTON	10/30/2007	1.0 U	1.0 U	2.0	2.1	60.5
7484230	EASTON	11/26/2007	1.0 U	1.0 U	2	1.3	59.4
7444206	TOWNE DIV	10/30/2007	1.0 U	1.0 U	1	0.5	82
7474205	TOWNE DIV	11/16/2007	1.0 U	1.0 U	1 U	na	na
7484231	TOWNE DIV	11/26/2007	1.0 U	1.0 U	2	0.7	83.1
7444207	WILSON CR	10/30/2007	2.1	1.8	21	3.4	369
7474206	WILSON	11/16/2007	2.0 U	1.7	8	na	na
7484232	WILSON	11/26/2007	1.6	1.8	10	3.5	387
7444208	ROZA DAM	10/30/2007	1.4	2.0 U	30	11	152
7444209	ROZA-REP	10/30/2007	1.5	1.1	29	9.8	151
7484233	ROZA DAM	11/26/2007	1.0 U	1.0 U	5	1.4	142
7444210	NACHES R.	10/30/2007	1.5	1.0 U			
7474208	NACHES R.	11/16/2007	1.0 U	1.0 U			
7484235	NACHES R.	11/26/2007	1.0 U	1.0 U			
7444211	MOXEE	10/30/2007	2.8	2.4			
7474207	MOXEE	11/16/2007	2.6 J	2.4			
7484236	MOXEE	11/26/2007	2.8	2.5			
7444212	SUNNYSIDE	10/30/2007	1.5	1			
7474214	SUNNYSIDE	11/16/2007	1.1	1.1			
7484237	SUNNYSIDE	11/26/2007	1.1	1.0 U			
7444213	GRANGER	10/30/2007	3.1	2.5			
7474209	GRANGER	11/16/2007	2.1	1.9			
7484238	GRANGER	11/26/2007	2.8	2.5			
7444214	SULPHUR	10/31/2007	2.8	2.3			
7474211	SULPHUR	11/16/2007	2.4 J	2.2			
7484239	SULPHUR	11/26/2007	2.7	2.4			
7444215	PROSSER DM	10/31/2007	1.4	1.1			
7444216	PROSSER-REP	10/31/2007	1.4	1.1			
7474212	PROSSER DM	11/16/2007	1.3	1.1			
7484240	PROSSER DM	11/27/2007	1.3	1.2			
7484241	PROSSER-REP	11/27/2007	1.2	1.1			
7444217	SPRING CR.	10/31/2007	2.3	1.8			
7474210	SPRING CR.	11/16/2007	2.3	2.0			
7484242	SPRING CR.	11/27/2007	2.1	2.2			
7444218	HORN RAPIDS	10/31/2007	1.5	1.2			
7474213	HORN RAPIDS	11/16/2007	1.3	1.1			
7484243	HORN RAPIDS	11/26/2007	1.2	1.3			

U = not detected
J = estimated
na = not analyzed

Appendix H. SPMD Calculations

The loss rates of Performance Reference Compounds (PRCs) are used to calibrate SPMDs for the effects of water velocity, temperature, and biofouling (Huckins et al., 2006). Each of the SPMD membranes used in the present study was spiked with the PRCs PCB-4 and PCB-29 prior to their being deployed in the field. PCB-4 and -29 are not present in significant amounts in the environment. Water column concentrations of PCBs and toxaphene were calculated from the residues accumulated in the SPMD and PRC loss rates using the SPMD Water Concentration Calculator Excel spreadsheet version 5-1 developed by USGS (http://137.227.231.90/Research/spmd.htm). The PRC recovery data are in Appendix F.

SPMDs only take up the dissolved form of a chemical. Total PCB and toxaphene concentrations were estimated from the dissolved residues using the equation $C_{w\text{-}tot} = C_w (1 + TOC (K_{oc}/M_w))$ where C_w is the dissolved concentration, K_{oc} is the organic carbon-water equilibrium partition coefficient, and M_w is the mass of water (Meadows et al., 1998). K_{oc} was calculated from the K_{ow} values used to determine the dissolved concentrations in the SPMD Water Concentration Calculator spreadsheet and Karickhoff's (1981) approximation $K_{oc} = 0.411K_{ow}$.

Appendix I. Pesticides Analyzed in Wastewater Treatment Plant Effluents and Urban Stormwater Runoff during the 2007-08 Yakima River Water Quality Study

Pesticides

4,4'-DDE
4,4'-DDD
4,4'-DDT
Dieldrin
Chlordane (technical)
alpha-BHC
beta-BHC
gamma-BHC (Lindane)
delta-BHC
Chlorpyrifos
Endosulfan I
Endosulfan II
Endosulfan Sulfate
Toxaphene
Heptachlor
Heptachlor epoxide
Aldrin
Endrin
Endrin Ketone
Endrin Aldehyde
Methoxychlor
Hexachlorobenzene

Polychlorinated Biphenyls

209 individual PCB congeners
(see Method 1668A - http://synetics.net/resources)

Appendix J. Routine Monitoring Data for Surface Water, 2007-08

Sample No.	Field ID	Collection Date	Flow (cfs)	4,4'-DDT (ng/L)		4,4'-DDE (ng/L)		4,4'-DDD (ng/L)	
7144080	CHERRY	4/4/2007	198	0.063	U	0.081		0.063	U
7144081	WIPPLE	4/4/2007	23	0.065	U	0.08		0.065	U
7144082	HARRISON	4/4/2007	2,074	0.066	U	0.066	U	0.066	U
7144085	PARKER	4/4/2007	5,368	0.065	U	0.15		0.065	U
7144088	EUCLID	4/5/2007	6,452	0.067		0.34		0.08	
7144090	KIONA	4/5/2007	6,331	0.096		0.4		0.1	
7144083	NACHES	4/4/2007	3,188	0.089		0.23		0.064	U
7144084	MOXEE	4/4/2007	69	0.43		0.79		0.46	
7144086	GRANGER	4/5/2007	24	0.17		1.9		0.36	
7144091	GRANGER REP	4/5/2007	- -	0.17		1.9		0.36	
7144087	SULFUR	4/5/2007	182	0.15		1		0.23	
7144089	SPRING	4/5/2007	54	2.9		2		0.73	
7144092	TRNSFR BLNK	4/5/2007	- -	0.063	U	0.063	U	0.063	U
7164080	CHERRY	4/18/2007	156	0.1		0.13		0.062	U
7164081	WIPPLE	4/18/2007	45	0.077		0.32		0.066	
7164082	HARRISON	4/18/2007	880	0.063	U	0.063	U	0.063	U
7164085	PARKER	4/18/2007	3,217	0.063	U	0.17		0.063	U
7164088	EUCLID	4/19/2007	4,044	0.063	U	0.2		0.063	U
7164090	KIONA	4/19/2007	4,257	0.064	U	0.26		0.074	
7164083	NACHES	4/18/2007	2,868	0.12		0.28		0.063	U
7164084	MOXEE	4/18/2007	52	0.2		0.79		0.16	
7164086	GRANGER	4/19/2007	25	0.25		2.1		0.35	
7164087	SULFUR	4/19/2007	131	0.16		1.2		0.23	
7164089	SPRING	4/19/2007	28	0.16		0.48		0.15	
7184080	CHERRY	5/2/2007	459	0.59	J	0.62	J	0.066	J
7184081	WIPPLE	5/2/2007	104	0.2		0.64		0.063	U
7184082	HARRISON	5/2/2007	1,653	0.063	U	0.063	U	0.063	U
7184085	PARKER	5/2/2007	3,197	0.062	U	0.11		0.062	U
7184088	EUCLID	5/3/2007	3,999	0.062	U	0.25		0.074	
7184090	KIONA	5/3/2007	4,017	0.063	U	0.23		0.064	
7184083	NACHES	5/2/2007	2,571	0.063	U	0.16		0.063	U
7184084	MOXEE	5/2/2007	99	0.305		1.1		0.24	
7184091	MOXEE REP	5/2/2007	- -	0.24		1.1		0.23	
7184086	GRANGER	5/3/2007	28	0.21		1.8		0.32	
7184087	SULFUR	5/3/2007	222	0.14		1.1		0.23	
7184089	SPRING	5/3/2007	18	0.12		0.53		0.14	

U = not detected at or above reported value J = estimated na = not analyzed

Field ID	Collection Date	Dieldrin (ng/L)		Chlorpyrifos (ng/L)		Endosulfan I (ng/L)		Endosulfan II (ng/L)		Endosulfan Sulfate (ng/L)	
CHERRY	4/4/2007	0.19	UJ	0.51		0.37		0.15	J	0.35	
WIPPLE	4/4/2007	0.32	UJ	1.3		0.19	J	0.15	J	0.74	
HARRISON	4/4/2007	0.12	UJ	0.89		0.43		0.24		0.45	J
PARKER	4/4/2007	0.067	UJ	4.1		1.1		0.35		0.44	
EUCLID	4/5/2007	0.32	U	8.2		1.8		0.63		1.1	
KIONA	4/5/2007	0.13	UJ	16		1.6		0.68		1.6	J
NACHES	4/4/2007	0.064	U	3.6		0.96		0.25	J	0.42	J
MOXEE	4/4/2007	0.1	UJ	88		1.7		0.78		1.9	
GRANGER	4/5/2007	0.17	UJ	18		3.7		1.9		2.6	
GRANGER REP	4/5/2007	0.16	UJ	18		3.7		1.8		2.5	
SULFUR	4/5/2007	0.16	UJ	46		10		4.8		4.6	
SPRING	4/5/2007	0.27	UJ	82		3.3		1.4		5.1	
TRNSFR BLNK	4/5/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
CHERRY	4/18/2007	0.28	J	0.12	J	0.062	UJ	0.062	UJ	0.09	J
WIPPLE	4/18/2007	0.21		0.33		0.064		0.062	U	0.15	UJ
HARRISON	4/18/2007	0.071	UJ	0.17		0.084		0.063	U	0.094	UJ
PARKER	4/18/2007	0.072	UJ	2.4		0.21		0.092		0.3	UJ
EUCLID	4/19/2007	0.063	UJ	4.4		1	J	0.33	J	0.52	UJ
KIONA	4/19/2007	0.085	J	3.3		0.33	J	0.14	J	0.46	J
NACHES	4/18/2007	0.063	U	2.7		0.17	J	0.063	J	0.33	UJ
MOXEE	4/18/2007	0.061	U	5.9		0.53		0.28		0.68	
GRANGER	4/19/2007	0.1		3.7		0.82		0.45		1.2	
SULFUR	4/19/2007	0.23		5.5		0.5		0.28	J	1.3	
SPRING	4/19/2007	0.22		14		0.15	J	0.063	UJ	2.2	J
CHERRY	5/2/2007	1.6		4.4		0.24		0.11		0.27	J
WIPPLE	5/2/2007	0.62	UJ	0.31		0.17	UJ	0.11		0.27	J
HARRISON	5/2/2007	0.13	UJ	0.25		0.15	UJ	0.063	U	0.14	J
PARKER	5/2/2007	0.1	UJ	0.74		0.24		0.062	U	0.14	J
EUCLID	5/3/2007	0.078	UJ	1.3		0.38		0.089	J	0.48	J
KIONA	5/3/2007	0.067	UJ	1.5		0.27		0.15		0.54	J
NACHES	5/2/2007	0.063	U	0.61		0.22	UJ	0.13	J	0.21	J
MOXEE	5/2/2007	0.1265	U	2	J	2		1.05		1.5	
MOXEE REP	5/2/2007	0.063	U	2.1	J	2		1.1		1.6	
GRANGER	5/3/2007	0.13	UJ	1.5		0.31		0.19		0.69	J
SULFUR	5/3/2007	0.23	UJ	3.1		1.4		0.34		0.73	
SPRING	5/3/2007	0.14	J	4.3		0.71		0.18		1.4	

U = not detected at or above reported value   J = estimated   na = not analyzed

Field ID	Collection Date	Toxaphene (ng/L)		Cis-Chlordane (ng/L)		Cis-Nonachlor (ng/L)		Trans-Chlordane (ng/L)		Trans-Nonachlor (ng/L)		Oxy-chlordane (ng/L)	
CHERRY	4/4/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
WIPPLE	4/4/2007	3.2	U	0.065	U	0.065	U	0.065	U	0.065	U	0.065	UJ
HARRISON	4/4/2007	3.3	U	0.066	U	0.066	U	0.066	U	0.066	U	0.066	U
PARKER	4/4/2007	3.3	U	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
EUCLID	4/5/2007	3.2	U	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U
KIONA	4/5/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
NACHES	4/4/2007	3.2	U	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U
MOXEE	4/4/2007	3.2	U	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U
GRANGER	4/5/2007	3.2	U	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U
GRANGER REP	4/5/2007	3.2	U	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
SULFUR	4/5/2007	3.3	U	0.065	U	0.065	U	0.068	UJ	0.065	U	0.065	U
SPRING	4/5/2007	3.2	U	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
TRNSFR BLNK	4/5/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
CHERRY	4/18/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
WIPPLE	4/18/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
HARRISON	4/18/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
PARKER	4/18/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
EUCLID	4/19/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
KIONA	4/19/2007	3.2	U	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U
NACHES	4/18/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
MOXEE	4/18/2007	3	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
GRANGER	4/19/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SULFUR	4/19/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SPRING	4/19/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
CHERRY	5/2/2007	3.1	UJ	0.062	UJ	0.062	UJ	0.062	UJ	0.062	UJ	0.062	UJ
WIPPLE	5/2/2007	3.1	UJ	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
HARRISON	5/2/2007	3.1	UJ	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
PARKER	5/2/2007	3.1	UJ	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
EUCLID	5/3/2007	3.1	UJ	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
KIONA	5/3/2007	3.1	UJ	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
NACHES	5/2/2007	3.1	UJ	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
MOXEE	5/2/2007	11	J	0.0625	U	0.0765	U	0.0625	U	0.0625	U	0.0625	U
MOXEE REP	5/2/2007	3.1	UJ	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
GRANGER	5/3/2007	3.1	UJ	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SULFUR	5/3/2007	3.1	UJ	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
SPRING	5/3/2007	3.2	UJ	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U

U = not detected at or above reported value J = estimated na = not analyzed

Field ID	Collection Date	Alpha-BHC (ng/L)		Beta-BHC (ng/L)		Delta-BHC (ng/L)		Lindane (ng/L)		Aldrin (ng/L)		Endrin (ng/L)	
CHERRY	4/4/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.39	UJ	0.083	UJ
WIPPLE	4/4/2007	0.065	U	0.065	U	0.065	U	0.065	U	0.29	UJ	0.065	U
HARRISON	4/4/2007	0.066	U	0.066	U	0.066	U	0.066	U	0.12	UJ	0.066	U
PARKER	4/4/2007	0.065	U	0.065	U	0.065	U	0.065	U	0.074	UJ	0.065	U
EUCLID	4/5/2007	0.064	U	0.087	UJ	0.064	U	0.064	U	0.32	U	0.32	U
KIONA	4/5/2007	0.063	U	0.07	UJ	0.063	U	0.063	U	0.29	UJ	0.063	U
NACHES	4/4/2007	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U
MOXEE	4/4/2007	0.064	U	0.085	U	0.064	U	0.064	U	0.18	UJ	0.064	U
GRANGER	4/5/2007	0.064	U	0.101	UJ	0.064	U	0.064	U	0.20	UJ	0.064	U
GRANGER REP	4/5/2007	0.065	U	0.11	UJ	0.065	U	0.065	U	0.17	UJ	0.065	U
SULFUR	4/5/2007	0.065	U	0.065	U	0.065	U	0.065	U	0.21	UJ	0.065	U
SPRING	4/5/2007	0.065	U	0.065	U	0.065	U	0.065	U	0.44	UJ	0.065	U
TRNSFR BLNK	4/5/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
CHERRY	4/18/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	UJ	0.062	UJ
WIPPLE	4/18/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
HARRISON	4/18/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
PARKER	4/18/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
EUCLID	4/19/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	UJ	0.063	UJ
KIONA	4/19/2007	0.064	U	0.064	U	0.064	U	0.064	U	0.064	UJ	0.064	UJ
NACHES	4/18/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
MOXEE	4/18/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
GRANGER	4/19/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SULFUR	4/19/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.1	J	0.063	U
SPRING	4/19/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	UJ	0.063	UJ
CHERRY	5/2/2007	0.062	UJ	0.062	UJ	0.062	UJ	0.062	UJ	0.2	UJ	0.13	UJ
WIPPLE	5/2/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	UJ	0.063	U
HARRISON	5/2/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	UJ	0.063	U
PARKER	5/2/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	UJ	0.062	U
EUCLID	5/3/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	UJ	0.062	U
KIONA	5/3/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	UJ	0.063	U
NACHES	5/2/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
MOXEE	5/2/2007	0.0625	U	0.063	U	0.0625	U	0.063	U	0.063	UJ	0.063	U
MOXEE REP	5/2/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	UJ	0.063	U
GRANGER	5/3/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	UJ	0.063	U
SULFUR	5/3/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	UJ	0.061	U
SPRING	5/3/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	UJ	0.063	U

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Field ID	Collection Date	Endrin Aldehyde (ng/L)		Endrin Ketone (ng/L)		Heptachlor (ng/L)		Heptachlor Epoxide (ng/L)		Hexachloro-benzene (ng/L)	
CHERRY	4/4/2007	0.37	UJ	0.096	UJ	0.063	U	0.063	U	0.063	U
WIPPLE	4/4/2007	1.6	UJ	0.14	UJ	0.065	U	0.065	U	0.065	U
HARRISON	4/4/2007	0.16	UJ	0.079	UJ	0.066	U	0.087	UJ	0.066	U
PARKER	4/4/2007	0.11	UJ	0.065	UJ	0.065	U	0.074	UJ	0.065	U
EUCLID	4/5/2007	0.32	U	0.32	U	0.064	U	0.32	U	0.064	U
KIONA	4/5/2007	0.34	UJ	0.063	UJ	0.063	U	0.16	U	0.063	U
NACHES	4/4/2007	0.42	UJ	0.12	UJ	0.064	U	0.064	U	0.064	U
MOXEE	4/4/2007	0.42	UJ	0.064	UJ	0.064	U	0.12		0.064	U
GRANGER	4/5/2007	0.23	UJ	0.064	UJ	0.064	U	0.075	UJ	0.064	U
GRANGER REP	4/5/2007	0.17	UJ	0.065	UJ	0.065	U	0.071	UJ	0.065	U
SULFUR	4/5/2007	0.23	UJ	0.065	UJ	0.065	U	0.13	UJ	0.065	U
SPRING	4/5/2007	0.1	UJ	0.065	UJ	0.065	U	0.18	UJ	0.065	U
TRNSFR BLNK	4/5/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
CHERRY	4/18/2007	0.062	UJ	0.062	UJ	0.062	U	0.062	UJ	0.062	U
WIPPLE	4/18/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
HARRISON	4/18/2007	0.063	U	0.063	U	0.063	U	0.065		0.063	U
PARKER	4/18/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
EUCLID	4/19/2007	0.063	UJ	0.063	UJ	0.063	U	0.1	J	0.063	U
KIONA	4/19/2007	0.064	UJ	0.064	UJ	0.064	U	0.064	UJ	0.064	U
NACHES	4/18/2007	0.063	U	0.25	UJ	0.063	U	0.063	U	0.063	U
MOXEE	4/18/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
GRANGER	4/19/2007	0.063	U	0.063	U	0.063	U	0.18	UJ	0.063	U
SULFUR	4/19/2007	0.089	UJ	0.063	U	0.063	U	0.14		0.063	U
SPRING	4/19/2007	0.15	UJ	0.063	UJ	0.063	U	0.15	UJ	0.063	U
CHERRY	5/2/2007	0.42	UJ	0.065	UJ	0.062	UJ	0.1	UJ	0.062	UJ
WIPPLE	5/2/2007	0.084	UJ	0.065	UJ	0.063	U	0.063	U	0.063	U
HARRISON	5/2/2007	0.063	U	0.063	UJ	0.063	U	0.13	UJ	0.063	U
PARKER	5/2/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
EUCLID	5/3/2007	0.062	U	0.062	U	0.062	U	0.077	UJ	0.062	U
KIONA	5/3/2007	0.063	U	0.063	U	0.063	U	0.18	UJ	0.063	U
NACHES	5/2/2007	0.063	U	0.063	U	0.063	U	0.14	UJ	0.063	U
MOXEE	5/2/2007	0.265	UJ	0.0625	U	0.0625	U	0.125		0.0625	U
MOXEE REP	5/2/2007	0.17	UJ	0.063	U	0.063	U	0.13		0.063	U
GRANGER	5/3/2007	0.094	UJ	0.063	U	0.063	U	0.11	UJ	0.063	U
SULFUR	5/3/2007	0.081	UJ	0.061	U	0.061	U	0.11	UJ	0.061	U
SPRING	5/3/2007	0.082	UJ	0.063	U	0.063	U	0.084	UJ	0.063	U

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Field ID	Collection Date	Methoxychlor (ng/L)		TSS (mg/L)		TNVSS (mg/L)		Turbidity (NTU)		Conductivity (umhos/cm)	
CHERRY	4/4/2007	0.13	UJ	18		na		7.8		249	
WIPPLE	4/4/2007	1.2	UJ	5		na		2.1		490	
HARRISON	4/4/2007	0.43	UJ	16		13		7.8		114	
PARKER	4/4/2007	0.065	UJ	15		12		9.4		102	
EUCLID	4/5/2007	0.32	UJ	58		53		24		133	
KIONA	4/5/2007	0.4	UJ	36		33		20		142	
NACHES	4/4/2007	0.52	UJ	12		10		11		74.4	
MOXEE	4/4/2007	0.064	UJ	85		na		17		199	
GRANGER	4/5/2007	0.064	UJ	109		na		28		453	
GRANGER REP	4/5/2007	0.065	UJ	96				26		454	
SULFUR	4/5/2007	0.065	UJ	73		na		17		244	
SPRING	4/5/2007	0.065	UJ	40		na		22		206	
TRNSFR BLNK	4/5/2007	0.063	UJ	na		na		na		na	
CHERRY	4/18/2007	0.062	UJ	23		na		11		252	
WIPPLE	4/18/2007	0.062	UJ	31		na		15		252	
HARRISON	4/18/2007	0.24	UJ	5		3		3.6		120	
PARKER	4/18/2007	0.14	UJ	9		7		6.5		102	
EUCLID	4/19/2007	0.19	UJ	19		17		8.5		145	
KIONA	4/19/2007	0.064	UJ	16		14		8.8		153	
NACHES	4/18/2007	0.37	UJ	8		8		7.7		74.4	
MOXEE	4/18/2007	0.13	UJ	122		na		19		169	
GRANGER	4/19/2007	0.063	UJ	180		na		42		395	
SULFUR	4/19/2007	0.22	UJ	39		na		13		355	
SPRING	4/19/2007	0.063	UJ	13		na		5.4		254	
CHERRY	5/2/2007	0.062	U	121		107		36		301	
WIPPLE	5/2/2007	0.063	U	140		125		29		261	
HARRISON	5/2/2007	0.063	U	12	J	8		3.7		120	
PARKER	5/2/2007	0.062	U	13		10		3.7	J	107	
EUCLID	5/3/2007	0.062	U	18		15		7.6		148	
KIONA	5/3/2007	0.063	U	14		11		5.9		155	
NACHES	5/2/2007	0.063	U	7		6		4.4		71.2	
MOXEE	5/2/2007	0.106	UJ	108		99.5		18		193	
MOXEE REP	5/2/2007	0.15	UJ	105		95		21		193	
GRANGER	5/3/2007	0.063	U	170		160		37		397	
SULFUR	5/3/2007	0.061	U	38		34		13		290	
SPRING	5/3/2007	0.063	U	16		13		6.2		283	

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Sample No.	Field ID	Collection Date	Flow (cfs)	4,4'-DDT (ng/L)		4,4'-DDE (ng/L)		4,4'-DDD (ng/L)	
7214080	CHERRY	5/23/2007	541	0.1		0.24		0.063	U
7214081	WIPPLE	5/23/2007	156	0.13		0.67		0.063	U
7214082	HARRISON	5/23/2007	2,771	0.063	U	0.063	U	0.063	U
7214085	PARKER	5/23/2007	4,566	0.063	U	0.14		0.063	U
7214088	EUCLID	5/24/2007	4,865	0.066		0.33		0.064	U
7214090	KIONA	5/24/2007	5,267	0.062	U	0.38		0.075	
7214083	NACHES	5/23/2007	3,191	0.063	U	0.12		0.063	U
7214084	MOXEE	5/23/2007	69	0.39		1.8		0.32	
7214086	GRANGER	5/23/2007	29	0.89		4.1		0.42	
7214087	SULFUR	5/24/2007	297	0.25		1.9		0.22	
7214089	SPRING	5/24/2007	35	0.12	J	1.5	J	0.28	J
7234080	CHERRY	6/6/2007	459	0.063	U	0.23		0.063	U
7234081	WIPPLE	6/6/2007	144	0.25	J	0.98		0.063	U
7234082	HARRISON	6/6/2007	2,942	0.063	U	0.063	U	0.063	U
7234085	PARKER	6/6/2007	6,950	0.061	U	0.15		0.061	U
7234088	EUCLID	6/7/2007	6,516	0.2	J	0.51		0.062	U
7234090	KIONA	6/7/2007	6,961	0.44	J	0.55		0.063	U
7234083	NACHES	6/6/2007	4,728	0.063	U	0.14	J	0.063	U
7234084	MOXEE	6/6/2007	82	0.53	J	1.8		0.21	J
7234086	GRANGER	6/7/2007	34	1.7	J	3		0.22	J
7234087	SULFUR	6/7/2007	492	0.3	J	1.9	J	0.14	J
7234089	SPRING	6/7/2007	114	0.52	J	1.9	J	0.23	J
7234091	SPRING REP	6/7/2007	- -	0.7	J	1.6		0.26	J
7264080	CHERRY	6/27/2007	411	0.063	U	0.21		0.063	U
7264081	WIPPLE	6/27/2007	183	0.12		0.33		0.063	U
7264082	HARRISON	6/27/2007	1,364	0.062	U	0.062	U	0.062	U
7264085	PARKER	6/27/2007	266	0.061	U	0.097		0.061	U
7264088	EUCLID	6/28/2007	939	0.064		0.35		0.079	
7264090	KIONA	6/28/2007	929	0.063	U	0.16		0.063	U
7264083	NACHES	6/27/2007	744	0.065	U	0.13		0.065	U
7264084	MOXEE	6/27/2007	55	0.23		1.3		0.23	
7264086	GRANGER	6/28/2007	50	0.88		3.4		0.25	
7264087	SULFUR	6/28/2007	254	0.26		1.5		0.16	
7264089	SPRING	6/28/2007	51	0.15		0.66		0.19	

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Field ID	Collection Date	Dieldrin (ng/L)		Chlorpyrifos (ng/L)		Endosulfan I (ng/L)		Endosulfan II (ng/L)		Endosulfan Sulfate (ng/L)	
CHERRY	5/23/2007	0.54		0.42		0.063	U	0.063	U	0.23	
WIPPLE	5/23/2007	0.91		0.15		0.063	U	0.063	U	0.31	
HARRISON	5/23/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.097	UJ
PARKER	5/23/2007	0.063	U	0.17	J	0.22		0.095		0.32	J
EUCLID	5/24/2007	0.073	UJ	1.3		0.15		0.13		0.76	J
KIONA	5/24/2007	0.092	UJ	1.4		0.2		0.11		0.63	J
NACHES	5/23/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.22	J
MOXEE	5/23/2007	0.078	UJ	0.98		0.19		0.3		1	
GRANGER	5/23/2007	0.28		1.1	J	1		0.63		1.8	
SULFUR	5/24/2007	0.37		1.2		0.12		0.26		0.88	
SPRING	5/24/2007	0.23		2.4		0.16		0.29		2.7	
CHERRY	6/6/2007	0.87		0.19		0.063	U	0.063	U	0.18	J
WIPPLE	6/6/2007	0.66	J	0.063	U	0.063	U	0.063	U	0.22	J
HARRISON	6/6/2007	0.089	UJ	0.063	U	0.063	U	0.063	U	0.093	J
PARKER	6/6/2007	0.075	UJ	0.061	U	0.075	UJ	0.062		0.22	UJ
EUCLID	6/7/2007	0.082	UJ	0.062	U	0.085	UJ	0.062	U	0.19	J
KIONA	6/7/2007	0.1	UJ	0.42		0.15	UJ	0.082	J	0.45	J
NACHES	6/6/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.14	J
MOXEE	6/6/2007	0.092	UJ	0.5		0.16	UJ	0.28		0.82	J
GRANGER	6/7/2007	0.38		3.9		0.063	U	0.11		0.45	J
SULFUR	6/7/2007	0.28		0.44	J	0.066	UJ	0.19		0.58	J
SPRING	6/7/2007	0.31		1.1		0.35	J	0.27	J	1.6	J
SPRING REP	6/7/2007	0.34		1.3		0.41	J	0.34	J	1.7	J
CHERRY	6/27/2007	0.31	J	13		0.063	U	0.063	U	0.15	UJ
WIPPLE	6/27/2007	0.3	J	0.12	J	0.063	U	0.063	U	0.17	UJ
HARRISON	6/27/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.12	UJ
PARKER	6/27/2007	0.061	U	0.13	J	0.061	U	0.061	U	0.13	UJ
EUCLID	6/28/2007	0.19	UJ	0.63		0.062	U	0.062	U	0.39	
KIONA	6/28/2007	0.14	UJ	0.43	J	0.063	U	0.078		0.44	
NACHES	6/27/2007	0.065	U	0.065	U	0.065	U	0.065	U	0.084	UJ
MOXEE	6/27/2007	0.11	UJ	0.43		0.41		0.62		1.2	
GRANGER	6/28/2007	0.47	J	0.27	J	0.11	J	0.065	UJ	0.065	UJ
SULFUR	6/28/2007	0.41	J	0.28		0.082	J	0.13	J	0.46	
SPRING	6/28/2007	0.15	UJ	0.82		0.093	J	0.1		0.91	

U =

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Field ID	Collection Date	Toxaphene (ng/L)		Cis-Chlordane (ng/L)		Cis-Nonachlor (ng/L)		Trans-Chlordane (ng/L)		Trans-Nonachlor (ng/L)		Oxy-chlordane (ng/L)	
CHERRY	5/23/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
WIPPLE	5/23/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
HARRISON	5/23/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
PARKER	5/23/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
EUCLID	5/24/2007	3.2	U	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U
KIONA	5/24/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
NACHES	5/23/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
MOXEE	5/23/2007	3.5	E	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
GRANGER	5/23/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.066	UJ
SULFUR	5/24/2007	4.3	E	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
SPRING	5/24/2007	3.2	UJ	0.063	UJ	0.063	UJ	0.063	UJ	0.063	UJ	0.063	UJ
CHERRY	6/6/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
WIPPLE	6/6/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.084		0.063	U
HARRISON	6/6/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
PARKER	6/6/2007	3	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
EUCLID	6/7/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
KIONA	6/7/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
NACHES	6/6/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
MOXEE	6/6/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
GRANGER	6/7/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SULFUR	6/7/2007	3.2	U	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U
SPRING	6/7/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SPRING REP	6/7/2007	3.2	U	0.063	U	0.063	U	0.1		0.063	U	0.063	U
CHERRY	6/27/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
WIPPLE	6/27/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
HARRISON	6/27/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
PARKER	6/27/2007	3.1	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
EUCLID	6/28/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
KIONA	6/28/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
NACHES	6/27/2007	3.3	U	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
MOXEE	6/27/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
GRANGER	6/28/2007	3.3	U	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
SULFUR	6/28/2007	3.3	U	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
SPRING	6/28/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U

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Field ID	Collection Date	Alpha-BHC (ng/L)		Beta-BHC (ng/L)		Delta-BHC (ng/L)		Lindane (ng/L)		Aldrin (ng/L)		Endrin (ng/L)	
CHERRY	5/23/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.088	UJ	0.063	U
WIPPLE	5/23/2007	0.063	U	0.063	U	0.063	U	0.11	UJ	0.063	U	0.063	U
HARRISON	5/23/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
PARKER	5/23/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
EUCLID	5/24/2007	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U
KIONA	5/24/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
NACHES	5/23/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
MOXEE	5/23/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
GRANGER	5/23/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SULFUR	5/24/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
SPRING	5/24/2007	0.063	UJ	0.087	UJ	0.063	UJ	0.063	UJ	0.063	U	0.095	UJ
CHERRY	6/6/2007	0.063	U	0.063	U	0.063	U	0.063	UJ	0.063	U	0.063	U
WIPPLE	6/6/2007	0.063	U	0.063	U	0.063	U	0.063	UJ	0.063	U	0.063	U
HARRISON	6/6/2007	0.063	U	0.063	U	0.063	U	0.063	UJ	0.063	U	0.063	U
PARKER	6/6/2007	0.061	U	0.061	U	0.061	U	0.061	UJ	0.061	U	0.061	U
EUCLID	6/7/2007	0.062	U	0.062	U	0.062	U	0.062	UJ	0.062	U	0.062	U
KIONA	6/7/2007	0.063	U	0.063	U	0.063	U	0.063	UJ	0.063	U	0.063	U
NACHES	6/6/2007	0.063	U	0.063	U	0.063	U	0.063	UJ	0.063	U	0.063	U
MOXEE	6/6/2007	0.063	U	0.063	U	0.063	U	0.097	UJ	0.063	U	0.063	U
GRANGER	6/7/2007	0.063	U	0.063	U	0.063	U	0.063	UJ	0.063	U	0.063	U
SULFUR	6/7/2007	0.064	U	0.064	U	0.064	U	0.069	UJ	0.064	U	0.064	U
SPRING	6/7/2007	0.063	U	0.063	U	0.063	U	0.063	UJ	0.063	U	0.063	U
SPRING REP	6/7/2007	0.063	U	0.063	U	0.063	U	0.063	UJ	0.063	U	0.063	U
CHERRY	6/27/2007	0.063	U	0.11	UJ	0.063	U	0.063	U	0.063	U	0.063	U
WIPPLE	6/27/2007	0.063	U	0.14	UJ	0.063	U	0.063	U	0.063	U	0.063	U
HARRISON	6/27/2007	0.062	U	0.15	UJ	0.062	U	0.062	U	0.062	U	0.062	U
PARKER	6/27/2007	0.061	U	0.14	UJ	0.061	U	0.061	U	0.061	U	0.061	U
EUCLID	6/28/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
KIONA	6/28/2007	0.063	U	0.11	UJ	0.063	U	0.063	U	0.063	U	0.063	U
NACHES	6/27/2007	0.065	U	0.1	UJ	0.065	U	0.065	U	0.065	UJ	0.065	U
MOXEE	6/27/2007	0.063	U	0.12	UJ	0.063	U	0.071	UJ	0.063	U	0.063	U
GRANGER	6/28/2007	0.065	U	0.065	U	0.065	U	0.065	U	0.065	UJ	0.065	UJ
SULFUR	6/28/2007	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
SPRING	6/28/2007	0.063	U	0.14	UJ	0.063	U	0.063	U	0.063	U	0.063	U

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Field ID	Collection Date	Endrin Aldehyde (ng/L)		Endrin Ketone (ng/L)		Heptachlor (ng/L)		Heptachlor Epoxide (ng/L)		Hexachloro-benzene (ng/L)	
CHERRY	5/23/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
WIPPLE	5/23/2007	0.067	UJ	0.063	U	0.063	U	0.063	U	0.063	U
HARRISON	5/23/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
PARKER	5/23/2007	0.063	U	0.063	U	0.063	U	0.11		0.063	U
EUCLID	5/24/2007	0.16	UJ	0.19	UJ	0.064	U	0.072	UJ	0.064	U
KIONA	5/24/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
NACHES	5/23/2007	0.063	U	0.063	U	0.063	U	0.12		0.063	U
MOXEE	5/23/2007	0.092	UJ	0.063	U	0.063	U	0.063	U	0.063	U
GRANGER	5/23/2007	0.063	U	0.063	U	0.063	U	0.077	UJ	0.063	U
SULFUR	5/24/2007	0.073	UJ	0.062	U	0.062	U	0.077	UJ	0.062	U
SPRING	5/24/2007	0.11	UJ	0.063	U	0.063	UJ	0.063	U	0.12	J
CHERRY	6/6/2007	0.12	UJ	0.063	U	0.063	U	0.063	U	0.063	U
WIPPLE	6/6/2007	0.076	UJ	0.063	U	0.063	U	0.066		0.063	U
HARRISON	6/6/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
PARKER	6/6/2007	0.13	UJ	0.061	U	0.061	U	0.061	U	0.061	U
EUCLID	6/7/2007	0.062	UJ	0.062	U	0.062	U	0.062	U	0.062	U
KIONA	6/7/2007	0.063	U	0.063	U	0.063	U	0.11	UJ	0.063	U
NACHES	6/6/2007	0.13	UJ	0.063	U	0.063	U	0.063	U	0.063	U
MOXEE	6/6/2007	0.48	UJ	0.063	U	0.063	U	0.063	U	0.063	U
GRANGER	6/7/2007	0.1	UJ	0.063	U	0.063	U	0.17		0.063	U
SULFUR	6/7/2007	0.083	UJ	0.064	U	0.064	U	1.3		0.064	U
SPRING	6/7/2007	0.077	UJ	0.063	U	0.063	U	0.1	UJ	0.063	U
SPRING REP	6/7/2007	0.14	UJ	0.063	U	0.063	U	0.11	UJ	0.063	U
CHERRY	6/27/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.072	UJ
WIPPLE	6/27/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
HARRISON	6/27/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
PARKER	6/27/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
EUCLID	6/28/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
KIONA	6/28/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
NACHES	6/27/2007	0.065	U	0.065	U	0.065	U	0.065	U	0.065	UJ
MOXEE	6/27/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
GRANGER	6/28/2007	0.065	UJ	0.065	UJ	0.065	U	0.12	J	0.065	U
SULFUR	6/28/2007	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
SPRING	6/28/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U

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Field ID	Collection Date	Methoxychlor (ng/L)		TSS (mg/L)		TNVSS (mg/L)		Turbidity (NTU)		Conductivity (umhos/cm)	
CHERRY	5/23/2007	0.063	UJ	58		50		17		258	
WIPPLE	5/23/2007	0.077	UJ	52		45		19		228	
HARRISON	5/23/2007	0.16	UJ	16		13		5.5		98	
PARKER	5/23/2007	0.063	UJ	16		14		5.7		90	
EUCLID	5/24/2007	0.064	UJ	38		34		15		126	
KIONA	5/24/2007	0.062	UJ	43		38		16		135	
NACHES	5/23/2007	0.063	UJ	8		7		6.6		64	
MOXEE	5/23/2007	0.18	UJ	125		117		23		221	
GRANGER	5/23/2007	0.063	UJ	133		123		39		392	
SULFUR	5/24/2007	0.062	UJ	73		66		18		241	
SPRING	5/24/2007	0.063	UJ	218		195		50		299	
CHERRY	6/6/2007	0.063	U	67		58		22		271	
WIPPLE	6/6/2007	0.063	U	63		56		24		262	
HARRISON	6/6/2007	0.084	UJ	24		20		12		87	
PARKER	6/6/2007	0.061	U	27		23		17		77	
EUCLID	6/7/2007	0.062	U	67		61		27		105	
KIONA	6/7/2007	0.063	U	76		68		32		109	
NACHES	6/6/2007	0.063	U	29		26		17		56	
MOXEE	6/6/2007	0.19	UJ	139		129		33		177	
GRANGER	6/7/2007	0.063	U	132		122		60		331	
SULFUR	6/7/2007	0.064	U	80		74		25		181	
SPRING	6/7/2007	0.063	U	92		83		34		153	
SPRING REP	6/7/2007	0.063	U	100		90		32		153	
CHERRY	6/27/2007	0.1	UJ	44		38		13		244	
WIPPLE	6/27/2007	0.063	U	35		31		14		164	
HARRISON	6/27/2007	0.062	U	9		7		4.2		90.2	
PARKER	6/27/2007	0.061	U	7		6		2.9		94.9	
EUCLID	6/28/2007	0.062	U	16		13		5.3		236	
KIONA	6/28/2007	0.22	UJ	14		11		4.2		264	
NACHES	6/27/2007	0.065	U	4		3		3.8		72.2	
MOXEE	6/27/2007	0.063	U	61		57		16		212	
GRANGER	6/28/2007	0.17	UJ	33		30		17		374	
SULFUR	6/28/2007	0.065	U	26		24		9.4		287	
SPRING	6/28/2007	0.063	U	22		20		6		230	

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Sample No.	Field ID	Collection Date	Flow (cfs)	4,4'-DDT (ng/L)		4,4'-DDE (ng/L)		4,4'-DDD (ng/L)	
7284080	CHERRY	7/11/2007	142	0.3		0.33		0.063	U
7284081	WIPPLE	7/11/2007	61	0.27		0.5		0.061	U
7284082	HARRISON	7/11/2007	2,211	0.063	U	0.063	U	0.063	U
7284085	PARKER	7/11/2007	384	0.066	U	0.096		0.066	U
7284088	EUCLID	7/12/2007	875	0.19	UJ	0.4		0.11	UJ
7284091	EUCLID REP	7/12/2007	- -	0.14	UJ	0.46		0.11	UJ
7284090	KIONA	7/12/2007	846	0.063	U	0.16		0.067	UJ
7284083	NACHES	7/11/2007	364	0.061	UJ	0.14		0.063	UJ
7284084	MOXEE	7/11/2007	38	0.21	UJ	0.76		0.19	
7284086	GRANGER	7/12/2007	42	0.98	J	2.7	J	0.22	J
7284087	SULFUR	7/12/2007	181	0.27		1.1		0.17	
7284089	SPRING	7/12/2007	22	0.065	U	0.37		0.13	UJ
7284092	TRNSFR BLNK	7/11/2007	- -	0.061	U	0.061	U	0.061	U
7304082	HARRISON	7/24/2007	2,138	0.063	U	0.063	U	0.063	U
7304085	PARKER	7/24/2007	384	0.062	U	0.074	J	0.062	U
7304088	EUCLID	7/24/2007	978	0.095		0.35		0.093	
7304090	KIONA	7/26/2007	1,101	0.063	U	0.14		0.063	U
7304083	NACHES	7/24/2007	299	0.063	U	0.17		0.063	U
7304084	MOXEE	7/24/2007	43	0.31		0.98		0.24	
7304086	GRANGER	7/24/2007	40	0.69		2.2		0.23	
7304087	SULFUR	7/24/2007	235	0.24		0.96		0.18	
7304089	SPRING	7/24/2007	24	0.063	U	0.38		0.15	
7324080	CHERRY	8/8/2007	249	0.44		0.26		0.061	U
7324081	WIPPLE	8/8/2007	98	0.099		0.54		0.062	U
7324082	HARRISON	8/8/2007	2,242	0.063	U	0.063	U	0.063	U
7324085	PARKER	8/9/2007	500	0.066	U	0.083		0.066	U
7324088	EUCLID	8/9/2007	1,007	0.11		0.44		0.11	
7324090	KIONA	8/9/2007	1,681	0.062	U	0.14		0.062	U
7324083	NACHES	8/8/2007	334	0.07		0.18		0.068	
7324084	MOXEE	8/8/2007	45	0.24		1		0.2	
7324086	GRANGER	8/9/2007	49	0.66		2.4		0.27	
7324091	SULFUR REP	8/9/2007	288	0.35		1.2		0.15	
7324089	SPRING	8/9/2007	43	0.074		0.4		0.15	

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Field ID	Collection Date	Dieldrin (ng/L)		Chlorpyrifos (ng/L)		Endosulfan I (ng/L)		Endosulfan II (ng/L)		Endosulfan Sulfate (ng/L)	
CHERRY	7/11/2007	2.1		0.011	J	0.063	U	0.063	U	0.21	
WIPPLE	7/11/2007	1.5		0.061	U	0.061	U	0.061	U	0.16	
HARRISON	7/11/2007	0.067	UJ	0.063	U	0.063	U	0.063	U	0.11	
PARKER	7/11/2007	0.087	UJ	0.089	J	0.066	U	0.066	U	0.19	
EUCLID	7/12/2007	0.25	J	1.1		0.17	J	0.095	J	0.72	
EUCLID REP	7/12/2007	0.25	J	1.4		0.21	J	0.14		0.68	
KIONA	7/12/2007	0.15	J	0.49		0.074	J	0.063	U	0.61	
NACHES	7/11/2007	0.061	U	0.074	J	0.061	U	0.061	U	0.11	
MOXEE	7/11/2007	0.063	U	0.31		0.063	U	0.18		0.44	
GRANGER	7/12/2007	0.65	J	0.22	J	0.3	J	0.19	J	0.49	J
SULFUR	7/12/2007	0.92	J	0.61	J	0.3	J	0.28		0.78	
SPRING	7/12/2007	0.17	J	0.64		0.27	J	0.17	J	0.89	
TRNSFR BLNK	7/11/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
HARRISON	7/24/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.28	
PARKER	7/24/2007	0.062	U	0.11	J	0.062	U	0.062	U	0.2	J
EUCLID	7/24/2007	0.22	J	20		0.12	UJ	0.096		0.76	
KIONA	7/26/2007	0.22	J	13		0.16	UJ	0.12		1.2	
NACHES	7/24/2007	0.063	U	0.063	U	0.07	UJ	0.063	U	0.15	J
MOXEE	7/24/2007	0.067	UJ	0.24		0.093	UJ	0.1	J	0.58	
GRANGER	7/24/2007	0.38		0.56	J	0.15	UJ	0.083	J	0.6	
SULFUR	7/24/2007	0.59		0.6	J	0.31	UJ	0.14		0.78	
SPRING	7/24/2007	0.19	J	0.79	J	0.33	UJ	0.26	J	2.8	
CHERRY	8/8/2007	1		0.23		0.061	U	0.061	U	0.18	
WIPPLE	8/8/2007	0.68		0.062	U	0.062	U	0.062	U	0.15	J
HARRISON	8/8/2007	0.063	U	0.063	U	0.08		0.063	U	0.13	J
PARKER	8/9/2007	0.066	U	0.066	U	0.2		0.073		0.29	
EUCLID	8/9/2007	0.29		6.2		0.35		0.18		0.76	
KIONA	8/9/2007	0.15	J	2.5		0.094	J	0.08	J	0.82	
NACHES	8/8/2007	0.063	U	0.063	U	0.37		0.063	U	0.18	J
MOXEE	8/8/2007	0.068	J	0.063	U	0.21	J	0.15	J	0.66	
GRANGER	8/9/2007	0.52		0.88		0.44	J	0.14	J	0.93	
SULFUR REP	8/9/2007	0.6		1.2		0.65		0.29		0.95	
SPRING	8/9/2007	0.17	J	3.5		0.33		0.25	J	2.7	

U = not detected at or above reported value   J = estimated   na = not analyzed

Field ID	Collection Date	Toxaphene (ng/L)		Cis-Chlordane (ng/L)		Cis-Nonachlor (ng/L)		Trans-Chlordane (ng/L)		Trans-Nonachlor (ng/L)		Oxy-chlordane (ng/L)	
CHERRY	7/11/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
WIPPLE	7/11/2007	3.1	U	0.061	U	0.061	U	0.061	U	0.061	U	0.11	UJ
HARRISON	7/11/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
PARKER	7/11/2007	3.3	U	0.066	U	0.066	U	0.066	U	0.066	U	0.12	UJ
EUCLID	7/12/2007	3.1	U	0.063	U	0.063	U	0.085	UJ	0.063	U	0.16	UJ
EUCLID REP	7/12/2007	3.3	U	0.066	U	0.066	U	0.066	U	0.066	U	0.066	U
KIONA	7/12/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
NACHES	7/11/2007	3.1	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
MOXEE	7/11/2007	3.2	U	0.063	U	0.063	U	0.063	UJ	0.063	U	0.063	U
GRANGER	7/12/2007	3	UJ	0.061	UJ	0.061	UJ	0.061	U	0.061	UJ	0.13	UJ
SULFUR	7/12/2007	3.2	U	0.064	U	0.064	U	0.064	U	0.064	U	0.094	UJ
SPRING	7/12/2007	3.2	U	0.065	U	0.065	U	0.065	U	0.065	U	0.11	UJ
TRNSFR BLNK	7/11/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.065	U	0.061	U
HARRISON	7/24/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
PARKER	7/24/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
EUCLID	7/24/2007	3.3	U	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
KIONA	7/26/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
NACHES	7/24/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
MOXEE	7/24/2007	3.1	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
GRANGER	7/24/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SULFUR	7/24/2007	4.1	J	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SPRING	7/24/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
CHERRY	8/8/2007	3	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
WIPPLE	8/8/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
HARRISON	8/8/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
PARKER	8/9/2007	3.3	U	0.066	U	0.066	U	0.066	U	0.066	U	0.066	U
EUCLID	8/9/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
KIONA	8/9/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
NACHES	8/8/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
MOXEE	8/8/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
GRANGER	8/9/2007	3.3	U	0.066	U	0.066	U	0.066	U	0.066	U	0.066	U
SULFUR REP	8/9/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
SPRING	8/9/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U

U = not detected at or above reported value J = estimated na = not analyzed

Field ID	Collection Date	Alpha-BHC (ng/L)		Beta-BHC (ng/L)		Delta-BHC (ng/L)		Lindane (ng/L)		Aldrin (ng/L)		Endrin (ng/L)	
CHERRY	7/11/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
WIPPLE	7/11/2007	0.061	U	0.061	U	0.061	U	0.092	UJ	0.061	U	0.061	U
HARRISON	7/11/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
PARKER	7/11/2007	0.066	U	0.066	U	0.066	U	0.066	U	0.066	U	0.066	U
EUCLID	7/12/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.19	UJ
EUCLID REP	7/12/2007	0.066	U	0.066	U	0.066	U	0.066	U	0.066	U	0.15	UJ
KIONA	7/12/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.075	UJ
NACHES	7/11/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
MOXEE	7/11/2007	0.063	U	0.063	U	0.063	U	0.075	UJ	0.063	U	0.063	U
GRANGER	7/12/2007	0.061	UJ	0.061	U	0.061	UJ	0.061	UJ	0.061	UJ	0.16	UJ
SULFUR	7/12/2007	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U	0.22	UJ
SPRING	7/12/2007	0.065	U	0.12	UJ	0.065	U	0.065	U	0.065	U	0.065	U
TRNSFR BLNK	7/11/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
HARRISON	7/24/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
PARKER	7/24/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
EUCLID	7/24/2007	0.065	U	0.065	U	0.065	U	0.065	U	0.085	UJ	0.065	U
KIONA	7/26/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.065	UJ	0.11	UJ
NACHES	7/24/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
MOXEE	7/24/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U	0.076	UJ
GRANGER	7/24/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SULFUR	7/24/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SPRING	7/24/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
CHERRY	8/8/2007	0.069		0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
WIPPLE	8/8/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
HARRISON	8/8/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
PARKER	8/9/2007	0.066	U	0.066	U	0.066	U	0.066	U	0.066	U	0.066	U
EUCLID	8/9/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
KIONA	8/9/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U	0.12	
NACHES	8/8/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
MOXEE	8/8/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
GRANGER	8/9/2007	0.066	U	0.066	U	0.066	U	0.066	U	0.066	U	0.066	U
SULFUR REP	8/9/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
SPRING	8/9/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U

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Field ID	Collection Date	Endrin Aldehyde (ng/L)		Endrin Ketone (ng/L)		Heptachlor (ng/L)		Heptachlor Epoxide (ng/L)		Hexachloro-benzene (ng/L)	
CHERRY	7/11/2007	0.063	U	0.063	U	0.063	U	0.064	UJ	0.063	U
WIPPLE	7/11/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
HARRISON	7/11/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
PARKER	7/11/2007	0.066	U	0.066	U	0.066	U	0.066	U	0.066	U
EUCLID	7/12/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
EUCLID REP	7/12/2007	0.066	U	0.066	U	0.066	U	0.066	U	0.066	U
KIONA	7/12/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
NACHES	7/11/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
MOXEE	7/11/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
GRANGER	7/12/2007	0.061	UJ	0.061	UJ	0.061	UJ	0.15	J	0.061	UJ
SULFUR	7/12/2007	0.064	U	0.064	U	0.064	U	0.16	J	0.064	U
SPRING	7/12/2007	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
TRNSFR BLNK	7/11/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
HARRISON	7/24/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
PARKER	7/24/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
EUCLID	7/24/2007	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
KIONA	7/26/2007	0.063	U	0.23	UJ	0.063	U	0.063	U	0.063	U
NACHES	7/24/2007	0.063	U	0.063	U	0.063	U	0.07	UJ	0.063	U
MOXEE	7/24/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
GRANGER	7/24/2007	0.063	U	0.063	U	0.063	U	0.14	UJ	0.063	U
SULFUR	7/24/2007	0.073	UJ	0.063	U	0.063	U	0.063	U	0.063	U
SPRING	7/24/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
CHERRY	8/8/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
WIPPLE	8/8/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
HARRISON	8/8/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
PARKER	8/9/2007	0.066	U	0.066	U	0.066	U	0.066	U	0.066	U
EUCLID	8/9/2007	0.069	UJ	0.062	U	0.062	U	0.062	U	0.062	U
KIONA	8/9/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
NACHES	8/8/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
MOXEE	8/8/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
GRANGER	8/9/2007	0.066	U	0.066	U	0.066	U	0.12		0.066	U
SULFUR REP	8/9/2007	0.062	U	0.062	U	0.062	U	0.07	J	0.062	U
SPRING	8/9/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U

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Field ID	Collection Date	Methoxychlor (ng/L)		TSS (mg/L)		TNVSS (mg/L)		Turbidity (NTU)		Conductivity (umhos/cm)	
CHERRY	7/11/2007	0.063	U	37		32		16		389	
WIPPLE	7/11/2007	0.28	UJ	34		31		11		392	
HARRISON	7/11/2007	0.063	U	17		14		6.7		77.4	
PARKER	7/11/2007	0.066	U	12		10		5.2		88.7	
EUCLID	7/12/2007	0.063	U	11		8		5.8		252	
EUCLID REP	7/12/2007	0.066	U	14		12		6.9		252	
KIONA	7/12/2007	0.61	UJ	7		6		4.1		273	
NACHES	7/11/2007	0.061	U	4		3		3.8		82.5	
MOXEE	7/11/2007	0.13	UJ	61		56		15		230	
GRANGER	7/12/2007	0.061	U	20		18		12		372	
SULFUR	7/12/2007	0.064	U	9		8		3.9		361	
SPRING	7/12/2007	0.065	U	9		7		3.6		368	
TRNSFR BLNK	7/11/2007	0.061	U	3.1		na		na		na	
HARRISON	7/24/2007	0.063	U	13		11		6.5		87.3	
PARKER	7/24/2007	0.062	U	10		8		4.7		98.3	
EUCLID	7/24/2007	0.065	U	14		12		7.6		236	
KIONA	7/26/2007	0.26	UJ	8		6		4.2		266	
NACHES	7/24/2007	0.063	U	5		3		3.2		92	
MOXEE	7/24/2007	0.079	UJ	44		40		13		230	
GRANGER	7/24/2007	0.063	U	13		12		8.7		391	
SULFUR	7/24/2007	0.063	U	9	J	7		4.3		321	
SPRING	7/24/2007	0.063	U	8		6		3.3		331	
CHERRY	8/8/2007	0.061	U	47		41		18		343	
WIPPLE	8/8/2007	0.062	U	49		42		21		350	
HARRISON	8/8/2007	0.063	U	10		8		4.1		83.7	
PARKER	8/9/2007	0.066	U	10		8		5.6		97.3	
EUCLID	8/9/2007	0.062	U	11		9		6.2		240	
KIONA	8/9/2007	0.25	UJ	7		6		3.5		258	
NACHES	8/8/2007	0.063	U	5		5		4.8		89.7	
MOXEE	8/8/2007	0.063	U	34		30		11		232	
GRANGER	8/9/2007	0.066	U	14		11		8.3		353	
SULFUR REP	8/9/2007	0.062	U	14		12		7.1		299	
SPRING	8/9/2007	0.063	U	14		11		6		265	

U = not detected at or above reported value J = estimated na = not analyzed

Sample No.	Field ID	Collection Date	Flow (cfs)	4,4'-DDT (ng/L)		4,4'-DDE (ng/L)		4,4'-DDD (ng/L)	
7344082	HARRISON	8/23/2007	1,653	0.064	U	0.064	U	0.064	U
7344085	PARKER	8/23/2007	578	0.063	U	0.11		0.063	U
7344088	EUCILID	8/23/2007	1,414	0.083		0.54		0.11	
7344090	KIONA	8/23/2007	2,682	0.061	U	0.23		0.075	
7344083	NACHES	8/22/2007	394	0.063	U	0.21		0.075	
7344084	MOXEE	8/22/2007	78	0.23		1.3		0.25	
7344086	GRANGER	8/22/2007	42	0.6		2.8		0.31	
7344087	SULFUR	8/22/2007	401	0.58		2.4		0.19	
7344089	SPRING	8/23/2007	36	0.065	U	0.46		0.14	
7364080	CHERRY	9/5/2007	422	0.065		0.13		0.061	U
7364081	WIPPLE	9/5/2007	203	0.063		0.27		0.062	U
7364082	HARRISON	9/5/2007	462	0.061	U	0.061	U	0.061	U
7364085	PARKER	9/6/2007	452	0.067	U	0.12		0.067	U
7364088	EUCLID	9/6/2007	1,041	0.063	U	0.42		0.11	
7364090	KIONA	9/6/2007	2,421	0.063	U	0.18		0.063	U
7364091	KIONA REP	9/6/2007	- -	0.065	U	0.17		0.065	U
7364083	NACHES	9/5/2007	1,720	0.061	U	0.16		0.061	U
7364084	MOXEE	9/5/2007	54	0.19		1.1		0.2	
7364086	GRANGER	9/6/2007	40	0.28		2		0.29	
7364087	SULFUR	9/6/2007	364	0.16		1.2		0.14	
7364089	SPRING	9/6/2007	71	0.063	U	0.42		0.12	
7384082	HARRISON	9/19/2007	520	0.063	U	0.063	U	0.063	U
7384085	PARKER	9/19/2007	473	0.063	U	0.15		0.063	U
7384088	EUCLID	9/20/2007	1,049	0.061	U	0.45		0.085	
7384090	KIONA	9/20/2007	2,519	0.063	U	0.18		0.063	U
7384083	NACHES	9/19/2007	2,386	0.063	U	0.13		0.063	U
7384084	MOXEE	9/19/2007	61	0.23		1.2		0.22	
7384086	GRANGER	9/20/2007	39	0.33		2		0.3	
7384087	SULFUR	9/20/2007	346	0.093		0.87		0.14	
7384089	SPRING	9/20/2007	28	0.063	U	0.4		0.13	
7384092	TRNSFR BLNK	9/19/2007	- -	0.063	U	0.063	U	0.063	U

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Field ID	Collection Date	Dieldrin (ng/L)		Chlorpyrifos (ng/L)		Endosulfan I (ng/L)		Endosulfan II (ng/L)		Endosulfan Sulfate (ng/L)	
HARRISON	8/23/2007	0.064	U	0.064	U	0.064	U	0.064	U	0.083	J
PARKER	8/23/2007	0.076	J	0.063	U	0.063	U	0.063	U	0.25	
EUCILID	8/23/2007	0.18	J	2		1		0.3	J	0.99	
KIONA	8/23/2007	0.15	J	1.5		0.46		0.25		1.3	
NACHES	8/22/2007	0.063	U	0.071	UJ	0.077		0.063	U	0.22	
MOXEE	8/22/2007	0.062	U	0.22	J	0.19		0.35		0.9	
GRANGER	8/22/2007	0.37		0.49		2.9		0.49		1.6	
SULFUR	8/22/2007	0.65		0.85		4		1.6		2	
SPRING	8/23/2007	0.15	J	0.38	J	1.1		0.93		9.3	
CHERRY	9/5/2007	0.21		0.061	U	0.061	U	0.061	U	0.078	
WIPPLE	9/5/2007	0.26		0.062	U	0.062	U	0.062	U	0.12	
HARRISON	9/5/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.066	J
PARKER	9/6/2007	0.067	U	0.067	U	0.1	J	0.12		0.14	J
EUCLID	9/6/2007	0.14	J	2.5		0.15		0.068	J	0.67	
KIONA	9/6/2007	0.12	J	1		0.063	U	0.063	U	0.67	
KIONA REP	9/6/2007	0.19		1.1		0.065	U	0.065	U	0.64	
NACHES	9/5/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.2	J
MOXEE	9/5/2007	0.062	U	0.062	U	0.55		0.35		0.92	
GRANGER	9/6/2007	0.21	J	0.47	J	0.18		0.16	J	0.96	
SULFUR	9/6/2007	0.31	J	0.52	J	0.24		0.31	J	0.78	
SPRING	9/6/2007	0.17	J	0.21	J	0.13		0.23	J	2.4	
HARRISON	9/19/2007	0.12		0.063	U	0.063	U	0.063	UJ	0.1	J
PARKER	9/19/2007	0.063	U	0.063	U	0.063	U	0.063	UJ	0.28	J
EUCLID	9/20/2007	0.11	J	5.1		0.087	U	0.061	UJ	0.46	J
KIONA	9/20/2007	0.1	J	2.2		0.068	UJ	0.063	UJ	0.48	J
NACHES	9/19/2007	0.063	U	0.063	U	0.063	U	0.063	UJ	0.22	J
MOXEE	9/19/2007	0.15		0.2	UJ	0.17		0.31	J	0.58	J
GRANGER	9/20/2007	0.12	J	0.08	J	0.086	UJ	0.084	J	0.47	J
SULFUR	9/20/2007	0.25		0.31		0.085	UJ	0.1	J	0.43	J
SPRING	9/20/2007	0.17	J	0.16	J	0.12	UJ	0.1	J	1.7	J
TRNSFR BLNK	9/19/2007	0.063	U	0.063	U	0.063	U	0.063	UJ	0.063	UJ

U = not detected at or above reported value J = estimated na = not analyzed

Field ID	Collection Date	Toxaphene (ng/L)		Cis-Chlordane (ng/L)		Cis-Nonachlor (ng/L)		Trans-Chlordane (ng/L)		Trans-Nonachlor (ng/L)		Oxy-chlordane (ng/L)	
HARRISON	8/23/2007	3.2	U	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U
PARKER	8/23/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
EUCILID	8/23/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
KIONA	8/23/2007	3.0	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
NACHES	8/22/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
MOXEE	8/22/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
GRANGER	8/22/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SULFUR	8/22/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SPRING	8/23/2007	3.2	U	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
CHERRY	9/5/2007	3.1	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
WIPPLE	9/5/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
HARRISON	9/5/2007	3	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
PARKER	9/6/2007	3.3	U	0.067	U	0.067	U	0.067	U	0.067	U	0.067	U
EUCLID	9/6/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
KIONA	9/6/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
KIONA REP	9/6/2007	3.3	U	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
NACHES	9/5/2007	3	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
MOXEE	9/5/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
GRANGER	9/6/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SULFUR	9/6/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SPRING	9/6/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
HARRISON	9/19/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.063	UJ	0.063	U
PARKER	9/19/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	UJ	0.063	U
EUCLID	9/20/2007	3.1	U	0.061	U	0.061	U	0.061	U	0.061	UJ	0.061	U
KIONA	9/20/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.063	UJ	0.063	U
NACHES	9/19/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	UJ	0.063	U
MOXEE	9/19/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.062	UJ	0.062	U
GRANGER	9/20/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.062	UJ	0.062	U
SULFUR	9/20/2007	3.1	U	0.061	U	0.061	U	0.061	U	0.061	UJ	0.061	U
SPRING	9/20/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	UJ	0.081	
TRNSFR BLNK	9/19/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.063	UJ	0.063	U

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Field ID	Collection Date	Alpha-BHC (ng/L)		Beta-BHC (ng/L)		Delta-BHC (ng/L)		Lindane (ng/L)		Aldrin (ng/L)		Endrin (ng/L)	
HARRISON	8/23/2007	0.064	U	0.064	U	0.064	U	0.064	U	0.064	UJ	0.064	UJ
PARKER	8/23/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
EUCILID	8/23/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.22	J
KIONA	8/23/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U	0.26	
NACHES	8/22/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	UJ	0.063	UJ
MOXEE	8/22/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	UJ	0.062	UJ
GRANGER	8/22/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.21	
SULFUR	8/22/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.19	J
SPRING	8/23/2007	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
CHERRY	9/5/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
WIPPLE	9/5/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
HARRISON	9/5/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
PARKER	9/6/2007	0.067	U	0.067	U	0.067	U	0.067	U	0.067	U	0.067	U
EUCLID	9/6/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.14	UJ
KIONA	9/6/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.095	UJ
KIONA REP	9/6/2007	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U	0.076	UJ
NACHES	9/5/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
MOXEE	9/5/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
GRANGER	9/6/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SULFUR	9/6/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SPRING	9/6/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
HARRISON	9/19/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	UJ
PARKER	9/19/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	UJ
EUCLID	9/20/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	UJ
KIONA	9/20/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	UJ
NACHES	9/19/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	UJ
MOXEE	9/19/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	UJ
GRANGER	9/20/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	UJ
SULFUR	9/20/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	UJ
SPRING	9/20/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	UJ
TRNSFR BLNK	9/19/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	UJ

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Field ID	Collection Date	Endrin Aldehyde (ng/L)		Endrin Ketone (ng/L)		Heptachlor (ng/L)		Heptachlor Epoxide (ng/L)		Hexachloro-benzene (ng/L)	
HARRISON	8/23/2007	0.064	U	0.064	U	0.064	U	0.064	UJ	0.064	U
PARKER	8/23/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
EUCILID	8/23/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
KIONA	8/23/2007	0.061	U	0.091	UJ	0.061	U	0.061	U	0.061	U
NACHES	8/22/2007	0.063	U	0.063	U	0.063	U	0.12	UJ	0.063	U
MOXEE	8/22/2007	0.062	U	0.062	U	0.062	U	0.062	UJ	0.062	U
GRANGER	8/22/2007	0.063	U	0.063	U	0.063	U	0.095		0.063	U
SULFUR	8/22/2007	0.14	UJ	0.063	U	0.063	U	0.063	U	0.063	U
SPRING	8/23/2007	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
CHERRY	9/5/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
WIPPLE	9/5/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
HARRISON	9/5/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
PARKER	9/6/2007	0.085	UJ	0.067	U	0.067	U	0.067	U	0.067	U
EUCLID	9/6/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
KIONA	9/6/2007	0.063	U	0.091	UJ	0.063	U	0.063	U	0.063	U
KIONA REP	9/6/2007	0.22	UJ	0.31	UJ	0.065	U	0.065	U	0.065	U
NACHES	9/5/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
MOXEE	9/5/2007	0.073	UJ	0.062	U	0.062	U	0.062	U	0.062	U
GRANGER	9/6/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SULFUR	9/6/2007	0.077	UJ	0.063	U	0.063	U	0.074	UJ	0.063	U
SPRING	9/6/2007	0.08	UJ	0.063	U	0.063	U	0.063	U	0.063	U
HARRISON	9/19/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
PARKER	9/19/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
EUCLID	9/20/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
KIONA	9/20/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
NACHES	9/19/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
MOXEE	9/19/2007	0.31	UJ	0.062	U	0.062	U	0.062	U	0.062	U
GRANGER	9/20/2007	0.062	U	0.062	U	0.062	U	0.08		0.062	U
SULFUR	9/20/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
SPRING	9/20/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
TRNSFR BLNK	9/19/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U

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Field ID	Collection Date	Methoxychlor (ng/L)		TSS (mg/L)		TNVSS (mg/L)		Turbidity (NTU)		Conductivity (umhos/cm)	
HARRISON	8/23/2007	0.18	UJ	8		6		4.4		95.3	
PARKER	8/23/2007	0.063	U	8		6		4		107	
EUCILID	8/23/2007	0.063	U	14		11		7.4		214	
KIONA	8/23/2007	0.061	U	11		9		5		239	
NACHES	8/22/2007	0.37	UJ	6		4		4.3		88.4	
MOXEE	8/22/2007	0.062	UJ	56		51		16		217	
GRANGER	8/22/2007	0.063	U	17		15		7.6		425	
SULFUR	8/22/2007	0.063	U	38		35		16		270	
SPRING	8/23/2007	0.28	UJ	10		8		5.2		309	
CHERRY	9/5/2007	0.061	U	24		21		10		284	
WIPPLE	9/5/2007	0.062	U	28		24		13		196	
HARRISON	9/5/2007	0.061	U	2		1		1.7		115	
PARKER	9/6/2007	0.46	UJ	10		8		5.1		111	
EUCLID	9/6/2007	0.063	U	11		9		5		255	
KIONA	9/6/2007	0.063	U	6		5		2.8		274	
KIONA REP	9/6/2007	0.065	U	7		6		2.9		274	
NACHES	9/5/2007	0.061	U	14		12		11		79.3	
MOXEE	9/5/2007	0.2	UJ	36		33		11		265	
GRANGER	9/6/2007	0.063	U	11		10		5.2		396	
SULFUR	9/6/2007	0.12	UJ	17		15		7.7		316	
SPRING	9/6/2007	0.063	U	14		12		3.8		288	
HARRISON	9/19/2007	0.063	UJ	4		3		2.4		145	
PARKER	9/19/2007	0.063	UJ	13		11		11		112	
EUCLID	9/20/2007	0.061	UJ	10		8		6		252	
KIONA	9/20/2007	0.19	UJ	5		4		2.8		278	
NACHES	9/19/2007	0.063	UJ	14		12		12		79.6	
MOXEE	9/19/2007	0.062	UJ	41		37		16		280	
GRANGER	9/20/2007	0.062	UJ	20		18		11		374	
SULFUR	9/20/2007	0.061	UJ	21		19		9.2		300	
SPRING	9/20/2007	0.063	UJ	6		5		2.9		376	
TRNSFR BLNK	9/19/2007	0.063	UJ	na		na		na		na	

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Sample No.	Field ID	Collection Date	Flow (cfs)	4,4'-DDT (ng/L)		4,4'-DDE (ng/L)		4,4'-DDD (ng/L)	
7404080	CHERRY	10/3/2007	516	0.064	U	0.36	J	0.064	U
7404081	WIPPLE	10/3/2007	204	0.093	J	0.55	J	0.063	U
7404082	HARRISON	10/3/2007	486	0.063	U	0.063	UJ	0.063	U
7404085	PARKER	10/3/2007	716	0.061	U	0.18	J	0.061	U
7404088	EUCLID	10/4/2007	1,359	0.065	U	0.77	J	0.12	
7404090	KIONA	10/4/2007	2,943	0.061	U	0.39	J	0.092	
7404083	NACHES	10/3/2007	1,172	0.069	UJ	0.31	J	0.078	UJ
7404084	MOXEE	10/3/2007	67	0.28		1.5	J	0.25	
7404086	GRANGER	10/4/2007	42	0.23		3.2	J	0.38	
7404091	GRANGER REP	10/4/2007	- -	0.29		3.6	J	0.46	
7404087	SULFUR	10/4/2007	413	0.092	J	1.3	J	0.18	
7404089	SPRING	10/4/2007	77	0.37		0.95	J	0.26	
7454082	HARRISON	11/8/2007	848	0.063	U	0.063	U	0.063	U
7454085	PARKER	11/8/2007	1,373	0.063	U	0.068		0.063	U
7454091	PARKER REP	11/8/2007	- -	0.063	U	0.066		0.063	U
7454088	EUCLID	11/8/2007	1,430	0.063	U	0.19		0.063	U
7454090	KIONA	11/8/2007	2,702	0.067	U	0.18		0.067	U
7454083	NACHES	11/8/2007	456	0.064	U	0.081		0.064	U
7454084	MOXEE	11/8/2007	15	0.064	U	0.081		0.064	U
7454086	GRANGER	11/8/2007	22	0.12	J	1.9		0.31	
7454087	SULFUR	11/8/2007	101	0.062	U	1.2		0.23	
7454089	SPRING	11/8/2007	12	0.062	U	0.39		0.12	
7494082	HARRISON	12/4/2007	794	0.065	U	0.065	U	0.065	U
7494091	HARRISON REP	12/4/2007	- -	0.065	U	0.065	U	0.065	U
7494085	PARKER	12/4/2007	5,500	0.1		0.32		0.083	
7494088	EUCLID	12/5/2007	3,724	0.12	J	0.75	J	0.15	J
7494090	KIONA	12/5/2007	3,865	0.22		1.3		0.22	
7494083	NACHES	12/4/2007	5,447	0.13	J	0.27	J	0.07	J
7494084	MOXEE	12/4/2007	16	0.078		0.43		0.12	
7494086	GRANGER	12/5/2007	22	0.13		2.8		0.43	
7494087	SULFUR	12/5/2007	70	0.074		1.8		0.36	
7494089	SPRING	12/5/2007	8	0.065	U	0.3		0.11	

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Field ID	Collection Date	Dieldrin (ng/L)		Chlorpyrifos (ng/L)		Endosulfan I (ng/L)		Endosulfan II (ng/L)		Endosulfan Sulfate (ng/L)	
CHERRY	10/3/2007	0.29		28		0.064	U	0.064	U	0.064	U
WIPPLE	10/3/2007	0.37		1.5		0.063	U	0.13	UJ	0.12	
HARRISON	10/3/2007	0.11		4		0.063	U	0.063	U	0.12	J
PARKER	10/3/2007	0.061	U	1.3	J	0.061	U	0.061	U	0.21	
EUCLID	10/4/2007	0.066	UJ	15		0.065	U	0.065	U	0.35	
KIONA	10/4/2007	0.07	J	9.5		0.061	U	0.061	U	0.39	
NACHES	10/3/2007	0.062	U	0.062	U	0.087	J	0.062	U	0.15	
MOXEE	10/3/2007	0.061	J	1.5		0.14		0.83		0.52	
GRANGER	10/4/2007	0.14	J	0.47	J	0.061	U	0.061	U	0.41	
GRANGER REP	10/4/2007	0.14	J	0.45	J	0.063	U	0.063	U	0.41	
SULFUR	10/4/2007	0.2	J	1.3		0.063	U	0.085	J	0.4	
SPRING	10/4/2007	0.14	J	1.1		0.11	J	0.16	J	1	
HARRISON	11/8/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.089	J
PARKER	11/8/2007	0.063	U	0.11	UJ	0.063	U	0.1		0.16	J
PARKER REP	11/8/2007	0.063	U	0.12	UJ	0.063	U	0.11	J	0.15	
EUCLID	11/8/2007	0.063	U	0.41	J	0.063	U	0.089	J	0.16	
KIONA	11/8/2007	0.067	U	0.37	J	0.067	U	0.073	J	0.19	
NACHES	11/8/2007	0.064	U	0.064	U	0.064	U	0.064	U	0.079	
MOXEE	11/8/2007	0.064	U	0.064	U	0.064	U	0.064	U	0.079	
GRANGER	11/8/2007	0.082	J	0.27		0.062	U	0.062	U	0.24	
SULFUR	11/8/2007	0.32	J	0.062	U	0.11		0.094	J	0.6	
SPRING	11/8/2007	0.19		0.062	U	0.062	U	0.062	U	0.64	
HARRISON	12/4/2007	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
HARRISON REP	12/4/2007	0.065	U	0.065	U	0.065	U	0.065	U	0.089	
PARKER	12/4/2007	0.063	U	0.063	U	0.063	U	0.08		0.36	J
EUCLID	12/5/2007	0.063	U	0.36	J	0.063	U	0.11		0.41	
KIONA	12/5/2007	0.084		0.71	J	0.078		0.13		0.48	
NACHES	12/4/2007	0.063	U	0.063	U	0.063	U	0.085		0.26	J
MOXEE	12/4/2007	0.064		0.32		0.15		0.43		0.94	
GRANGER	12/5/2007	0.13		0.065	U	0.065	U	0.065	U	0.29	
SULFUR	12/5/2007	0.37		0.07		0.063	U	0.14		0.44	
SPRING	12/5/2007	0.16		0.065	U	0.065	U	0.065	U	0.9	

U = not detected at or above reported value. J = estimated. na = not analyzed.

Field ID	Collection Date	Toxaphene (ng/L)		Cis-Chlordane (ng/L)		Cis-Nonachlor (ng/L)		Trans-Chlordane (ng/L)		Trans-Nonachlor (ng/L)		Oxy-chlordane (ng/L)	
CHERRY	10/3/2007	3.2	U	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U
WIPPLE	10/3/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
HARRISON	10/3/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
PARKER	10/3/2007	3	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
EUCLID	10/4/2007	3.2	U	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
KIONA	10/4/2007	3	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
NACHES	10/3/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
MOXEE	10/3/2007	3	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
GRANGER	10/4/2007	3	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
GRANGER REP	10/4/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SULFUR	10/4/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SPRING	10/4/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
HARRISON	11/8/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
PARKER	11/8/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
PARKER REP	11/8/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
EUCLID	11/8/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
KIONA	11/8/2007	3.3	U	0.067	U	0.067	U	0.067	U	0.067	U	0.067	U
NACHES	11/8/2007	3.2	U	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U
MOXEE	11/8/2007	3.2	U	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U
GRANGER	11/8/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
SULFUR	11/8/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
SPRING	11/8/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
HARRISON	12/4/2007	3.3	U	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
HARRISON REP	12/4/2007	3.3	U	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
PARKER	12/4/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
EUCLID	12/5/2007	3.1	UJ	0.063	UJ	0.063	UJ	0.063	UJ	0.063	UJ	0.063	UJ
KIONA	12/5/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
NACHES	12/4/2007	3.1	UJ	0.063	UJ	0.063	UJ	0.063	UJ	0.063	UJ	0.063	UJ
MOXEE	12/4/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
GRANGER	12/5/2007	3.3	U	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
SULFUR	12/5/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SPRING	12/5/2007	3.2	U	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U

U = not detected at or above reported value. J = estimated. na = not analyzed.

Field ID	Collection Date	Alpha-BHC (ng/L)		Beta-BHC (ng/L)		Delta-BHC (ng/L)		Lindane (ng/L)		Aldrin (ng/L)		Endrin (ng/L)	
CHERRY	10/3/2007	0.064	U	0.064	U	0.064	UJ	0.064	U	0.08	UJ	0.064	U
WIPPLE	10/3/2007	0.063	U	0.063	U	0.063	UJ	0.063	U	0.063	U	0.063	U
HARRISON	10/3/2007	0.063	U	0.063	U	0.063	UJ	0.063	U	0.063	U	0.063	U
PARKER	10/3/2007	0.061	U	0.061	U	0.061	UJ	0.061	U	0.061	U	0.061	U
EUCLID	10/4/2007	0.065	U	0.065	U	0.065	UJ	0.065	U	0.065	U	0.065	U
KIONA	10/4/2007	0.061	U	0.061	U	0.061	UJ	0.061	U	0.061	U	0.18	UJ
NACHES	10/3/2007	0.062	U	0.062	U	0.062	UJ	0.069	UJ	0.062	U	0.062	U
MOXEE	10/3/2007	0.061	U	0.061	U	0.061	UJ	0.061	U	0.061	U	0.061	U
GRANGER	10/4/2007	0.061	U	0.061	U	0.061	UJ	0.061	U	0.061	U	0.061	U
GRANGER REP	10/4/2007	0.063	U	0.063	U	0.063	UJ	0.063	U	0.063	U	0.063	U
SULFUR	10/4/2007	0.063	U	0.063	U	0.063	UJ	0.063	U	0.063	U	0.095	UJ
SPRING	10/4/2007	0.063	U	0.063	U	0.063	UJ	0.063	U	0.063	U	0.071	UJ
HARRISON	11/8/2007	0.063	U	0.063	U	0.063	UJ	0.063	U	0.063	U	0.063	U
PARKER	11/8/2007	0.063	U	0.063	U	0.063	UJ	0.063	U	0.063	U	0.063	U
PARKER REP	11/8/2007	0.063	U	0.53	UJ	0.063	UJ	0.063	U	0.063	U	0.063	U
EUCLID	11/8/2007	0.063	U	0.09	UJ	0.063	UJ	0.063	U	0.063	U	0.063	U
KIONA	11/8/2007	0.067	U	0.067	U	0.067	UJ	0.067	U	0.067	U	0.067	U
NACHES	11/8/2007	0.064	U	0.064	U	0.064	UJ	0.064	U	0.064	U	0.064	U
MOXEE	11/8/2007	0.064	U	0.064	U	0.064	UJ	0.064	U	0.064	U	0.064	U
GRANGER	11/8/2007	0.062	U	0.064	UJ	0.062	UJ	0.062	U	0.062	U	0.062	U
SULFUR	11/8/2007	0.062	U	0.062	U	0.062	UJ	0.062	U	0.062	U	0.062	U
SPRING	11/8/2007	0.062	U	0.062	U	0.062	UJ	0.062	U	0.062	U	0.062	U
HARRISON	12/4/2007	0.065	U	0.21	UJ	0.065	U	0.065	U	0.065	UJ	0.065	U
HARRISON REP	12/4/2007	0.065	U	0.15	UJ	0.065	U	0.065	U	0.065	UJ	0.065	U
PARKER	12/4/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	UJ	0.063	U
EUCLID	12/5/2007	0.063	UJ	0.075	UJ	0.063	UJ	0.063	UJ	0.063	UJ	0.063	U
KIONA	12/5/2007	0.062	U	0.094	UJ	0.062	U	0.062	U	0.062	UJ	0.062	U
NACHES	12/4/2007	0.063	UJ	0.091	UJ	0.063	UJ	0.063	UJ	0.063	UJ	0.063	U
MOXEE	12/4/2007	0.062	U	0.11	UJ	0.062	U	0.062	U	0.062	UJ	0.067	UJ
GRANGER	12/5/2007	0.065	U	0.12	UJ	0.065	U	0.065	U	0.065	UJ	0.091	UJ
SULFUR	12/5/2007	0.063	U	0.09	UJ	0.063	U	0.063	U	0.063	UJ	0.083	UJ
SPRING	12/5/2007	0.065	U	0.065	U	0.065	U	0.065	U	0.065	UJ	0.065	U

U = not detected at or above reported value. J = estimated. na = not analyzed.

Field ID	Collection Date	Endrin Aldehyde (ng/L)		Endrin Ketone (ng/L)		Heptachlor (ng/L)		Heptachlor Epoxide (ng/L)		Hexachloro-benzene (ng/L)	
CHERRY	10/3/2007	0.11	UJ	0.064	U	0.064	U	0.064	U	0.064	U
WIPPLE	10/3/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
HARRISON	10/3/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
PARKER	10/3/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
EUCLID	10/4/2007	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
KIONA	10/4/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
NACHES	10/3/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
MOXEE	10/3/2007	1.1	UJ	0.061	U	0.061	U	0.061	U	0.061	U
GRANGER	10/4/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
GRANGER REP	10/4/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SULFUR	10/4/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SPRING	10/4/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
HARRISON	11/8/2007	0.11	UJ	0.063	U	0.063	U	0.063	U	0.063	U
PARKER	11/8/2007	0.13	UJ	0.063	U	0.063	U	0.063	U	0.063	U
PARKER REP	11/8/2007	0.13	UJ	0.063	U	0.063	U	0.063	U	0.063	U
EUCLID	11/8/2007	0.07	UJ	0.063	U	0.063	U	0.063	U	0.063	U
KIONA	11/8/2007	0.15	UJ	0.067	U	0.067	U	0.067	U	0.067	U
NACHES	11/8/2007	0.074	UJ	0.064	U	0.064	U	0.064	U	0.064	U
MOXEE	11/8/2007	0.074	UJ	0.064	U	0.064	U	0.064	U	0.064	U
GRANGER	11/8/2007	0.064	UJ	0.062	U	0.062	U	0.062	U	0.062	U
SULFUR	11/8/2007	0.19	UJ	0.062	U	0.062	U	0.062	U	0.062	U
SPRING	11/8/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
HARRISON	12/4/2007	0.065	UJ	0.065	U	0.065	U	0.065	U	0.16	U
HARRISON REP	12/4/2007	0.065	UJ	0.065	U	0.065	U	0.065	U	0.16	U
PARKER	12/4/2007	0.084	UJ	0.063	U	0.063	U	0.063	U	0.21	J
EUCLID	12/5/2007	0.063	UJ	0.063	U	0.063	UJ	0.063	U	0.16	UJ
KIONA	12/5/2007	0.062	UJ	0.062	U	0.062	U	0.062	U	0.16	U
NACHES	12/4/2007	0.15	UJ	0.077	UJ	0.063	UJ	0.063	U	0.16	UJ
MOXEE	12/4/2007	0.062	UJ	0.062	U	0.062	U	0.062	U	0.16	U
GRANGER	12/5/2007	0.065	UJ	0.065	U	0.065	U	0.065	U	0.16	U
SULFUR	12/5/2007	0.063	UJ	0.063	U	0.063	U	0.063	U	0.16	U
SPRING	12/5/2007	0.065	UJ	0.065	U	0.065	U	0.065	U	0.16	U

U = not detected at or above reported value. J = estimated. na = not analyzed.

Field ID	Collection Date	Methoxychlor (ng/L)		TSS (mg/L)		TNVSS (mg/L)		Turbidity (NTU)		Conductivity (umhos/cm)
CHERRY	10/3/2007	0.064	U	36		32		12		287
WIPPLE	10/3/2007	0.063	U	33		30		12		222
HARRISON	10/3/2007	0.063	U	5		4		3.8		156
PARKER	10/3/2007	0.061	U	8		7		5.3		140
EUCLID	10/4/2007	0.065	U	10		9		6.5		294
KIONA	10/4/2007	0.095	UJ	5		4		3.7		247
NACHES	10/3/2007	0.11	UJ	6		5		9.8		88.1
MOXEE	10/3/2007	0.36	UJ	34		31		12		304
GRANGER	10/4/2007	0.061	U	28		24		12		399
GRANGER REP	10/4/2007	0.063	U	26		23		12		403
SULFUR	10/4/2007	0.063	U	21		19		7.4	J	287
SPRING	10/4/2007	0.063	U	11		9		5		295
HARRISON	11/8/2007	0.063	U	8		6		3.3		152
PARKER	11/8/2007	0.063	U	4		3		1.6		157
PARKER REP	11/8/2007	0.063	U	3		2		1.7		157
EUCLID	11/8/2007	0.063	U	8		7		4.1		247
KIONA	11/8/2007	0.067	U	4		3		2.5		267
NACHES	11/8/2007	0.39	UJ	2		1		0.9		103
MOXEE	11/8/2007	0.39	UJ	2		1		0.9		103
GRANGER	11/8/2007	0.062	U	36		28		16		656
SULFUR	11/8/2007	0.062	U	12		9		7.2		750
SPRING	11/8/2007	0.062	U	5		4		2.4		598
HARRISON	12/4/2007	0.065	U	6		4		3.5		177
HARRISON REP	12/4/2007	0.42	UJ	6		5		3.6		178
PARKER	12/4/2007	0.063	U	164		143		120		101
EUCLID	12/5/2007	0.063	U	342		313		150		124
KIONA	12/5/2007	0.062	U	199		176		130		145
NACHES	12/4/2007	0.063	U	229		201		160		61.4
MOXEE	12/4/2007	0.062	U	4		2		6.6		758
GRANGER	12/5/2007	0.065	U	84		78		24		740
SULFUR	12/5/2007	0.063	U	40		33		19		750
SPRING	12/5/2007	0.065	U	3		2		1.3		665

U = not detected at or above reported value. J = estimated. na = not analyzed.

Sample No.	Field ID	Collection Date	Flow (cfs)	4,4'-DDT (ng/L)		4,4'-DDE (ng/L)		4,4'-DDD (ng/L)	
8024682	HARRISON	1/9/2008	433	0.063	U	0.063	U	0.063	U
8024683	NACHES	1/9/2008	883	0.062	U	0.062	U	0.062	U
8024691	NACHES REP	1/9/2008	- -	0.062	U	0.062	U	0.062	U
8024684	MOXEE	1/9/2008	13	0.072		0.39		0.12	
8024685	PARKER	1/9/2008	1,536	0.064	U	0.064	U	0.064	U
8024686	GRANGER	1/10/2008	18	44		5.5		0.89	
8024687	SULFUR	1/10/2008	64	0.11		2.5		0.45	
8024688	EUCLID	1/10/2008	1,788	0.061	U	0.18	J	0.061	U
8024689	SPRING	1/10/2008	8	0.061	U	0.33		0.089	
8024690	KIONA	1/10/2008	2,497	0.061	U	0.14		0.061	U
8024692	TRNSFR BLNK	1/9/2008	- -	0.062	U	0.062	U	0.062	U
8064082	HARRISON	2/5/2008	793	0.061	U	0.061	U	0.061	U
8064083	NACHES	2/5/2008	872	0.063	U	0.063	U	0.063	U
8064084	MOXEE	2/5/2008	13	0.061	UJ	0.27	J	0.2	J
8064091	MOXEE REP	2/5/2008	- -	0.061	U	0.28		0.15	
8064085	PARKER	2/5/2008	1,472	0.063	UJ	0.073	J	0.063	UJ
8064086	GRANGER	2/6/2008	28	0.17	J	1	J	0.18	J
8064087	SULFUR	2/6/2008	73	0.33	J	1.8	J	0.42	J
8064088	EUCLID	2/6/2008	1,652	0.19		0.69		0.11	
8064089	SPRING	2/6/2008	9	0.063	U	0.49		0.14	
8064090	KIONA	2/6/2008	2,255	0.063	U	0.14		0.063	U
8104082	HARRISON	3/4/2008	679	0.061	U	0.061	U	0.061	U
8104083	NACHES	3/4/2008	1,113	0.061	U	0.064		0.061	U
8104084	MOXEE	3/4/2008	12	0.077		0.28		0.098	
8104085	PARKER	3/4/2008	2,957	0.062	U	0.062	U	0.062	U
8104086	GRANGER	3/3/2008	18	0.15		2.1		0.42	
8104087	SULFUR	3/3/2008	63	0.093		1.6		0.39	
8104088	EUCLID	3/3/2008	3,259	0.063	U	0.2		0.063	U
8104090	SPRING	3/3/2008	6	0.061	U	0.31		0.081	
8104091	KIONA	3/3/2008	4,151	0.062	U	0.26		0.096	
8104089	KIONA REP	3/3/2008	- -	0.061	U	0.24		0.08	
8134084	MOXEE	3/24/2008	38	0.26		1.1		0.2	
8134086	GRANGER	3/28/2008	21	0.23		1.9		0.27	
8134087	SULFUR	3/24/2008	303	0.16		1.4		0.19	
8134091	SULFUR REP	3/24/2008	- -	0.16		1.5		0.2	
8134089	SPRING	3/24/2008	41	0.15		0.78		0.15	

U = not detected at or above reported value.   J = estimated.   na = not analyzed.

Field ID	Collection Date	Dieldrin (ng/L)		Chlorpyrifos (ng/L)		Endosulfan I (ng/L)		Endosulfan II (ng/L)		Endosulfan Sulfate (ng/L)	
HARRISON	1/9/2008	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
NACHES	1/9/2008	0.062	U	0.062	U	0.062	U	0.062	U	0.075	J
NACHES REP	1/9/2008	0.062	U	0.062	U	0.062	U	0.062	U	0.1	J
MOXEE	1/9/2008	0.063	U	0.31	J	0.063	U	0.15		0.79	J
PARKER	1/9/2008	0.064	U	0.18	J	0.064	U	0.064	U	0.17	J
GRANGER	1/10/2008	0.061	U	0.077	UJ	0.061	U	0.061	U	0.27	J
SULFUR	1/10/2008	0.22		0.33	J	0.061	U	0.11		0.51	J
EUCLID	1/10/2008	0.061	U	0.26	J	0.061	U	0.061	U	0.28	J
SPRING	1/10/2008	0.077	J	0.13	J	0.061	U	0.33		0.85	J
KIONA	1/10/2008	0.061	U	0.19	J	0.061	U	0.061	U	0.21	J
TRNSFR BLNK	1/9/2008	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
HARRISON	2/5/2008	0.061	U	0.15	UJ	0.061	U	0.061	U	0.22	J
NACHES	2/5/2008	0.063	U	0.092	J	0.063	U	0.063	U	0.11	J
MOXEE	2/5/2008	0.13	J	0.69	J	0.16		0.22		0.33	J
MOXEE REP	2/5/2008	0.12	J	0.79	J	0.1	J	0.24		0.3	J
PARKER	2/5/2008	0.063	U	0.33	J	0.072	J	0.12		0.25	J
GRANGER	2/6/2008	0.47	J	0.9	J	0.11	J	0.23	J	0.48	J
SULFUR	2/6/2008	0.66		0.58	UJ	0.41	UJ	0.13	J	0.37	J
EUCLID	2/6/2008	0.08		0.54	J	0.063	U	0.11		0.19	J
SPRING	2/6/2008	0.096		0.18	J	0.063	U	0.063	U	0.31	J
KIONA	2/6/2008	0.063	U	0.37	J	0.16		0.14		0.4	J
HARRISON	3/4/2008	0.061	U	0.13	UJ	0.061	U	0.061	UJ	0.061	UJ
NACHES	3/4/2008	0.061	U	0.065		0.061	U	0.061	UJ	0.11	UJ
MOXEE	3/4/2008	0.13	J	0.47	J	0.062	U	0.25	J	1.5	J
PARKER	3/4/2008	0.062	U	0.11	UJ	0.062	U	0.062	UJ	0.13	UJ
GRANGER	3/3/2008	0.17		0.15		0.062	U	0.062	UJ	0.39	UJ
SULFUR	3/3/2008	0.47		0.36	J	0.063	U	0.23	J	1	J
EUCLID	3/3/2008	0.063	U	0.16	J	0.063	U	0.063	UJ	0.24	UJ
SPRING	3/3/2008	0.061	U	0.2	J	0.061	U	0.077	J	0.29	UJ
KIONA	3/3/2008	0.14		0.12		0.062	U	0.062	UJ	0.89	J
KIONA REP	3/3/2008	0.14		0.092		0.061	U	0.061	UJ	0.81	J
MOXEE	3/24/2008	0.063	U	16		3.6		1.8		2.9	
GRANGER	3/28/2008	0.079		23		1		0.65	J	1.8	J
SULFUR	3/24/2008	0.16		58		6.6		2.8		4.5	
SULFUR REP	3/24/2008	0.14		56		7.3		3		4.1	
SPRING	3/24/2008	0.12	J	211		7.3		2.8		7.1	

U = not detected at or above reported value J = estimated na = not analyzed

Field ID	Collection Date	Toxaphene (ng/L)		Cis-Chlordane (ng/L)		Cis-Nonachlor (ng/L)		Trans-Chlordane (ng/L)		Trans-Nonachlor (ng/L)		Oxy-chlordane (ng/L)	
HARRISON	1/9/2008	3.1	U	0.063	U	0.063	U	0.14	UJ	0.063	U	0.19	UJ
NACHES	1/9/2008	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.15	UJ
NACHES REP	1/9/2008	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.15	UJ
MOXEE	1/9/2008	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.19	UJ
PARKER	1/9/2008	3.2	U	0.064	U	0.064	U	0.22	UJ	0.064	U	0.21	UJ
GRANGER	1/10/2008	3.1	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
SULFUR	1/10/2008	3.1	U	0.061	U	0.061	U	0.061	U	0.061	U	0.15	UJ
EUCLID	1/10/2008	3.1	U	0.061	U	0.061	U	0.10	UJ	0.061	U	0.13	UJ
SPRING	1/10/2008	3.1	U	0.061	U	0.061	U	0.061	U	0.061	U	0.14	UJ
KIONA	1/10/2008	3.0	U	0.061	U	0.061	U	0.061	U	0.061	U	0.13	UJ
TRNSFR BLNK	1/9/2008	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.16	UJ
HARRISON	2/5/2008	3.1	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
NACHES	2/5/2008	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
MOXEE	2/5/2008	3	UJ	0.061	UJ	0.061	UJ	0.061	UJ	0.061	UJ	0.061	UJ
MOXEE REP	2/5/2008	3.1	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
PARKER	2/5/2008	3.1	UJ	0.063	UJ	0.063	UJ	0.063	UJ	0.063	UJ	0.063	UJ
GRANGER	2/6/2008	3	UJ	0.061	UJ	0.061	UJ	0.061	UJ	0.061	UJ	0.061	UJ
SULFUR	2/6/2008	3.1	UJ	0.063	UJ	0.063	UJ	0.063	UJ	0.063	UJ	0.063	UJ
EUCLID	2/6/2008	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SPRING	2/6/2008	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
KIONA	2/6/2008	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
HARRISON	3/4/2008	3.1	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
NACHES	3/4/2008	3.1	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
MOXEE	3/4/2008	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
PARKER	3/4/2008	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
GRANGER	3/3/2008	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.12	UJ
SULFUR	3/3/2008	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
EUCLID	3/3/2008	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SPRING	3/3/2008	3.1	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
KIONA	3/3/2008	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
KIONA REP	3/3/2008	3.1	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
MOXEE	3/24/2008	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
GRANGER	3/28/2008	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
SULFUR	3/24/2008	3.2	U	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U
SULFUR REP	3/24/2008	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SPRING	3/24/2008	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U

U = not detected at or above reported value J = estimated na = not analyzed

Field ID	Collection Date	Alpha-BHC (ng/L)		Beta-BHC (ng/L)		Delta-BHC (ng/L)		Lindane (ng/L)		Aldrin (ng/L)		Endrin (ng/L)	
HARRISON	1/9/2008	0.063	U	0.063	U	0.063	UJ	0.063	U	0.063	U	0.063	U
NACHES	1/9/2008	0.062	U	0.062	U	0.062	UJ	0.062	U	0.062	U	0.062	U
NACHES REP	1/9/2008	0.062	U	0.062	U	0.062	UJ	0.062	U	0.062	U	0.062	U
MOXEE	1/9/2008	0.063	U	0.063	U	0.063	UJ	0.063	U	0.063	U	0.063	U
PARKER	1/9/2008	0.064	U	0.064	U	0.064	UJ	0.064	U	0.064	U	0.064	U
GRANGER	1/10/2008	0.095	UJ	0.061	U	0.061	UJ	0.061	U	0.061	U	0.061	U
SULFUR	1/10/2008	0.061	U	0.061	U	0.061	UJ	0.061	U	0.061	U	0.061	U
EUCLID	1/10/2008	0.061	U	0.061	U	0.061	UJ	0.061	U	0.061	U	0.061	U
SPRING	1/10/2008	0.061	U	0.061	U	0.061	UJ	0.061	U	0.061	U	0.061	U
KIONA	1/10/2008	0.061	U	0.061	U	0.061	UJ	0.061	U	0.061	U	0.061	U
TRNSFR BLNK	1/9/2008	0.062	U	0.062	U	0.062	UJ	0.062	U	0.062	U	0.062	U
HARRISON	2/5/2008	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
NACHES	2/5/2008	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
MOXEE	2/5/2008	0.061	UJ	0.061	UJ	0.061	UJ	0.061	UJ	0.088	UJ	0.061	UJ
MOXEE REP	2/5/2008	0.061	U	0.061	U	0.061	U	0.061	U	0.075	UJ	0.061	U
PARKER	2/5/2008	0.063	UJ	0.063	UJ	0.063	UJ	0.063	UJ	0.063	U	0.063	U
GRANGER	2/6/2008	0.061	UJ	0.061	UJ	0.061	UJ	0.061	UJ	0.061	UJ	0.41	J
SULFUR	2/6/2008	0.063	UJ	0.063	UJ	0.063	UJ	0.063	UJ	0.27	UJ	0.063	U
EUCLID	2/6/2008	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SPRING	2/6/2008	0.063	U	0.063	U	0.063	U	0.063	U	0.1	UJ	0.075	
KIONA	2/6/2008	0.063	U	0.063	U	0.063	U	0.063	U	0.067	UJ	0.22	
HARRISON	3/4/2008	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	UJ
NACHES	3/4/2008	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	UJ
MOXEE	3/4/2008	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	UJ
PARKER	3/4/2008	0.062	U	0.072	UJ	0.062	U	0.062	U	0.062	U	0.062	UJ
GRANGER	3/3/2008	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	UJ
SULFUR	3/3/2008	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	UJ
EUCLID	3/3/2008	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	UJ
SPRING	3/3/2008	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	UJ
KIONA	3/3/2008	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	UJ
KIONA REP	3/3/2008	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	UJ
MOXEE	3/24/2008	0.063	U	0.063	U	0.063	UJ	0.063	U	0.063	U	0.063	U
GRANGER	3/28/2008	0.062	U	0.062	U	0.062	U	0.062	U	0.098		0.062	U
SULFUR	3/24/2008	0.064	U	0.064	U	0.064	UJ	0.064	U	0.12		0.064	U
SULFUR REP	3/24/2008	0.063	U	0.063	U	0.063	UJ	0.063	U	0.1		0.063	U
SPRING	3/24/2008	0.063	U	0.063	U	0.063	UJ	0.063	U	0.26		0.063	U

U = not detected at or above reported value J = estimated na = not analyzed

Field ID	Collection Date	Endrin Aldehyde (ng/L)		Endrin Ketone (ng/L)		Heptachlor (ng/L)		Heptachlor Epoxide (ng/L)		Hexachloro-benzene (ng/L)	
HARRISON	1/9/2008	0.063	UJ	0.063	U	0.063	U	0.063	U	0.063	U
NACHES	1/9/2008	0.062	UJ	0.062	U	0.062	U	0.062	U	0.062	U
NACHES REP	1/9/2008	0.062	UJ	0.062	U	0.062	U	0.062	U	0.062	U
MOXEE	1/9/2008	0.063	UJ	0.063	U	0.063	U	0.063	U	0.063	U
PARKER	1/9/2008	0.064	UJ	0.064	U	0.064	U	0.064	U	0.064	U
GRANGER	1/10/2008	0.061	UJ	0.061	U	0.061	U	0.069	UJ	0.061	U
SULFUR	1/10/2008	0.061	UJ	0.061	U	0.061	U	0.061	U	0.061	U
EUCLID	1/10/2008	0.061	UJ	0.061	U	0.061	U	0.061	U	0.061	U
SPRING	1/10/2008	0.061	UJ	0.061	U	0.061	U	0.061	U	0.061	U
KIONA	1/10/2008	0.061	UJ	0.061	U	0.061	U	0.061	U	0.061	U
TRNSFR BLNK	1/9/2008	0.062	UJ	0.062	U	0.062	U	0.062	U	0.062	U
HARRISON	2/5/2008	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
NACHES	2/5/2008	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
MOXEE	2/5/2008	0.46	UJ	0.061	U	0.061	UJ	0.061	U	0.061	UJ
MOXEE REP	2/5/2008	0.46	UJ	0.061	U	0.061	U	0.061	U	0.061	U
PARKER	2/5/2008	0.063	U	0.063	U	0.063	UJ	0.063	U	0.063	UJ
GRANGER	2/6/2008	0.11	UJ	0.62	J	0.061	UJ	0.14	UJ	0.061	UJ
SULFUR	2/6/2008	0.21	UJ	0.063	U	0.063	UJ	0.063	U	0.063	UJ
EUCLID	2/6/2008	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SPRING	2/6/2008	0.16		0.21	J	0.063	U	0.063	U	0.063	U
KIONA	2/6/2008	0.063	U	0.16	J	0.063	U	0.063	U	0.063	U
HARRISON	3/4/2008	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
NACHES	3/4/2008	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
MOXEE	3/4/2008	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
PARKER	3/4/2008	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
GRANGER	3/3/2008	0.11	UJ	0.069	UJ	0.062	U	0.062	U	0.062	U
SULFUR	3/3/2008	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
EUCLID	3/3/2008	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SPRING	3/3/2008	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
KIONA	3/3/2008	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
KIONA REP	3/3/2008	0.061	U	0.069	UJ	0.061	U	0.061	U	0.061	U
MOXEE	3/24/2008	0.063	UJ	0.063	U	0.063	U	0.063	U	0.063	U
GRANGER	3/28/2008	0.062	UJ	0.097	UJ	0.062	U	0.062	U	0.062	U
SULFUR	3/24/2008	0.064	UJ	0.064	U	0.064	U	0.064	U	0.064	U
SULFUR REP	3/24/2008	0.063	UJ	0.063	U	0.063	U	0.063	U	0.063	U
SPRING	3/24/2008	0.063	UJ	0.063	U	0.063	U	0.063	U	0.063	U

U = not detected at or above reported value   J = estimated   na = not analyzed

Field ID	Collection Date	Methoxychlor (ng/L)		TSS (mg/L)		TNVSS (mg/L)		Turbidity (NTU)		Conductivity (umhos/cm)
HARRISON	1/9/2008	0.063	U	2		na		1		144
NACHES	1/9/2008	0.062	U	2		na		1.5		87
NACHES REP	1/9/2008	0.062	U	2	U	na		2		87.1
MOXEE	1/9/2008	0.23	UJ	13		na		4.4		792
PARKER	1/9/2008	0.064	U	3		na		1.7		144
GRANGER	1/10/2008	0.061	U	141		133		27		733
SULFUR	1/10/2008	0.22		80		71		28	J	771
EUCLID	1/10/2008	0.061	U	5		4		3.2		224
SPRING	1/10/2008	0.061	U	2		1		1.4		671
KIONA	1/10/2008	0.061	U	3		2		2.6		248
TRNSFR BLNK	1/9/2008	0.062	U	na		na		na		na
HARRISON	2/5/2008	0.061	UJ	4		3		1.1	J	142
NACHES	2/5/2008	0.063	UJ	2		1		1.8	J	93.1
MOXEE	2/5/2008	0.22	UJ	7		6		3.4		801
MOXEE REP	2/5/2008	0.31	UJ	6		4		3.4		796
PARKER	2/5/2008	0.084	UJ	5		4		2.5		144
GRANGER	2/6/2008	0.45	UJ	56		42		37	J	775
SULFUR	2/6/2008	0.063	UJ	42		37		24	J	766
EUCLID	2/6/2008	0.063	UJ	10		7		7.7	J	242
SPRING	2/6/2008	0.063	UJ	2		2		1.6	J	680
KIONA	2/6/2008	0.063	UJ	3		3		2.6	J	243
HARRISON	3/4/2008	0.061	UJ	6		5		3.7		149
NACHES	3/4/2008	0.061	UJ	4		3		4.4		104
MOXEE	3/4/2008	0.35	UJ	9		6		3.3		814
PARKER	3/4/2008	0.062	UJ	7		6		4.6		146
GRANGER	3/3/2008	0.078	UJ	47		44		5.7		735
SULFUR	3/3/2008	0.29	UJ	42		38		11		801
EUCLID	3/3/2008	0.063	UJ	22		19		11		180
SPRING	3/3/2008	0.067	UJ	23		20		14		189
KIONA	3/3/2008	0.062	UJ	1		1	U	0.7		660
KIONA REP	3/3/2008	0.061	UJ	1		1	U	0.6		661
MOXEE	3/24/2008	0.063	U	85		66		28		254
GRANGER	3/28/2008	0.17	UJ	156		134		90	J	626
SULFUR	3/24/2008	0.083	UJ	39		35		16		306
SULFUR REP	3/24/2008	0.063	U	48		44		14		299
SPRING	3/24/2008	0.063	U	28		24		13		231

U = not detected at or above reported value J = estimated na = not analyzed

Appendix K. Screening Survey Data for Surface Water, 2007-08

Sample No.	Field ID	Collection Date	Flow (cfs)	4,4'-DDT (ng/L)		4,4'-DDE (ng/L)		4,4'-DDD (ng/L)	
7204084	AHTANUM	5/16/2007	120	0.062	U	0.19		0.062	U
7204101	AMON	5/16/2007	48	0.063	U	0.14		0.063	U
7204099	CORRAL	5/16/2007	11	0.064	U	0.27		0.064	U
7204090	COULEE DR	5/17/2007	16	0.69		0.57		0.13	
7234103	COWICHEE	6/4/2007	37	0.35	J	0.87		0.07	J
7204093	DID 7	5/16/2007	9.5	0.072	UJ	1.4		0.17	
7204097	DRAIN 31	5/16/2007	3.4	0.25		1.3		0.13	
7204086	EAST TOP	5/17/2007	31	0.33		0.65		0.13	
7204096	GRANDVIEW	5/16/2007	11	0.48		2.0		0.19	
7204088	MARION	5/16/2007	109	0.13		0.31		0.064	
7204102	MARION REP	5/16/2007	- -	0.14	UJ	0.36		0.064	U
7204095	SATUS 302	5/17/2007	14	1.3		5.9		0.18	
7204094	SATUS 303	5/17/2007	30	0.17	UJ	1.3		0.11	
7204091	SATUS CK	5/17/2007	162	0.063	U	0.13		0.063	U
7204082	SELAH DCH	5/16/2007	6.0	0.32		1.7		0.55	
7204092	SOUTH DR	5/17/2007	65	1.2		3.8		0.48	
7204103	SOUTH DR REP	5/17/2007	- -	1.3		3.8		0.57	
7204087	SUB 35	5/17/2007	47	1.2		1.3		0.40	
7214100	TAYLOR D	5/22/2007	6.0	0.063	U	0.32		0.082	
7204089	TOP CK	5/17/2007	69	0.078		0.25		0.061	
7204098	WAUNA	5/16/2007	6.5	0.072	UJ	0.71		0.088	
7214102	WENAS	5/22/2007	14	0.063	U	0.096		0.063	U
7204083	WIDE HOL	5/16/2007	13	0.1		0.97		0.39	
7204085	ZILLAH	5/16/2007	2.6	0.5		2.9		0.46	
- -	SELAH CR.	dry							
- -	COLD CR.	dry							

U = not detected at or above reported value
J = estimated
REJ = rejected
na = not analyzed

Field ID	Collection Date	Dieldrin (ng/L)		Chlorpyrifos (ng/L)		Endosulfan I (ng/L)		Endosulfan II (ng/L)		Endosulfan Sulfate (ng/L)	
AHTANUM	5/16/2007	0.062	U	0.6		0.47		0.3		0.75	J
AMON	5/16/2007	0.063	U	0.47		0.20	J	0.23		0.76	
CORRAL	5/16/2007	0.077	UJ	1.3	J	0.15		0.12	J	1.2	
COULEE DR	5/17/2007	0.062	U	4.5		0.28	UJ	0.31		0.76	J
COWICHEE	6/4/2007	0.081	UJ	1.0		0.25		0.27		0.48	J
DID 7	5/16/2007	0.077	UJ	3.4		0.24		0.13	J	0.83	J
DRAIN 31	5/16/2007	0.36		1.3		0.53		0.38	J	1.3	J
EAST TOP	5/17/2007	0.25		0.68		1.4		1.0		1.4	J
GRANDVIEW	5/16/2007	0.32		18		0.58		0.39		1.3	J
MARION	5/16/2007	0.13		15		0.55	UJ	0.65		1.1	J
MARION REP	5/16/2007	0.12	J	16		0.44		0.62		1.3	
SATUS 302	5/17/2007	1.5		7.6		0.16	J	0.34	J	1.4	J
SATUS 303	5/17/2007	0.17	J	4.2		0.27		0.23	J	1.2	J
SATUS CK	5/17/2007	0.063	U	4.3		0.24		0.16		0.4	UJ
SELAH DCH	5/16/2007	0.13	J	1.4		0.46	UJ	0.33		1.1	J
SOUTH DR	5/17/2007	0.17		3.2		0.33		0.23	J	1.1	
SOUTH DR REP	5/17/2007	0.2		8.1		0.36		0.49	J	1.3	
SUB 35	5/17/2007	0.15		3.9		0.33	UJ	0.42		0.94	J
TAYLOR D	5/22/2007	0.063	U	0.3	J	0.097	UJ	0.063	U	0.65	
TOP CK	5/17/2007	0.13	J	7.9		0.48	UJ	0.62		1.1	J
WAUNA	5/16/2007	0.063	U	1.9		0.76		0.49		2.5	J
WENAS	5/22/2007	0.063	U	0.093		0.063	U	0.063	U	0.36	
WIDE HOL	5/16/2007	0.47		2.1	J	1.1		0.85		7.0	J
ZILLAH	5/16/2007	0.4	UJ	1.8		0.89		1.2		2.4	J
SELAH CR.	dry										
COLD CR.	dry										

U = not detected at or above reported value
J = estimated
REJ = rejected
na = not analyzed

Field ID	Collection Date	Toxaphene (ng/L)		Cis-Chlordane (ng/L)		Cis-Nonachlor (ng/L)		Trans-Chlordane (ng/L)		Trans-Nonachlor (ng/L)		Oxy-chlordane (ng/L)	
AHTANUM	5/16/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
AMON	5/16/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
CORRAL	5/16/2007	3.2	U	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U
COULEE DR	5/17/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
COWICHEE	6/4/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
DID 7	5/16/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
DRAIN 31	5/16/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
EAST TOP	5/17/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.07	U	0.062	U
GRANDVIEW	5/16/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
MARION	5/16/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
MARION REP	5/16/2007	3.2	U	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U
SATUS 302	5/17/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SATUS 303	5/17/2007	3.0	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
SATUS CK	5/17/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SELAH DCH	5/16/2007	3.3	U	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
SOUTH DR	5/17/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SOUTH DR REP	5/17/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SUB 35	5/17/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
TAYLOR D	5/22/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
TOP CK	5/17/2007	3.0	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
WAUNA	5/16/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
WENAS	5/22/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
WIDE HOL	5/16/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
ZILLAH	5/16/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
SELAH CR.	dry												
COLD CR.	dry												

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na = not analyzed

Field ID	Collection Date	Alpha-BHC (ng/L)		Beta-BHC (ng/L)		Delta-BHC (ng/L)		Lindane (ng/L)		Aldrin (ng/L)		Endrin (ng/L)	
AHTANUM	5/16/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	UJ	0.062	UJ
AMON	5/16/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	UJ	0.063	U
CORRAL	5/16/2007	0.064	U	0.064	U	0.064	U	0.064	U	0.064	UJ	0.064	U
COULEE DR	5/17/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.21	UJ	0.062	U
COWICHEE	6/4/2007	0.063	U	0.063	UJ	0.063	U	0.063	UJ	0.063	U	0.063	U
DID 7	5/16/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	UJ	0.062	U
DRAIN 31	5/16/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	UJ	0.063	U
EAST TOP	5/17/2007	0.062	U	0.062	U	0.062	U	0.12	UJ	0.062	UJ	0.071	UJ
GRANDVIEW	5/16/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	UJ	0.063	U
MARION	5/16/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.075	UJ	0.092	UJ
MARION REP	5/16/2007	0.064	U	0.064	U	0.064	U	0.064	U	0.11	UJ	0.79	UJ
SATUS 302	5/17/2007	0.063	U	0.063	U	0.063	U	0.17	UJ	0.094	UJ	0.09	UJ
SATUS 303	5/17/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.1	UJ	0.061	U
SATUS CK	5/17/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	UJ	0.063	U
SELAH DCH	5/16/2007	0.065	U	0.098	UJ	0.065	U	0.069	UJ	0.065	UJ	0.094	UJ
SOUTH DR	5/17/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	UJ	0.063	U
SOUTH DR REP	5/17/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.19	UJ	0.063	U
SUB 35	5/17/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.10	UJ	0.11	UJ
TAYLOR D	5/22/2007	0.063	U	0.12	UJ	0.063	U	0.063	U	0.063	U	0.063	U
TOP CK	5/17/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.098	UJ	0.11	UJ
WAUNA	5/16/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	UJ	0.75	UJ
WENAS	5/22/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
WIDE HOL	5/16/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	UJ	0.14	UJ
ZILLAH	5/16/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	UJ	0.062	U
SELAH CR.	dry												
COLD CR.	dry												

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Field ID	Collection Date	Endrin Aldehyde (ng/L)		Endrin Ketone (ng/L)		Heptachlor (ng/L)		Heptachlor Epoxide (ng/L)		Hexachloro-benzene (ng/L)	
AHTANUM	5/16/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
AMON	5/16/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
CORRAL	5/16/2007	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U
COULEE DR	5/17/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
COWICHEE	6/4/2007	0.10	UJ	0.063	U	0.063	U	0.063	U	0.063	U
DID 7	5/16/2007	0.15	UJ	0.062	U	0.062	U	0.062	U	0.062	U
DRAIN 31	5/16/2007	0.083	UJ	0.063	U	0.063	U	0.071		0.063	U
EAST TOP	5/17/2007	0.062	UJ	0.062	U	0.062	U	0.062		0.062	U
GRANDVIEW	5/16/2007	0.082	UJ	0.063	U	0.063	U	0.063	U	0.063	U
MARION	5/16/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
MARION REP	5/16/2007	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U
SATUS 302	5/17/2007	0.065	UJ	0.063	U	0.063	U	0.10		0.063	U
SATUS 303	5/17/2007	0.10	UJ	0.061	U	0.061	U	0.061	U	0.061	U
SATUS CK	5/17/2007	0.14	UJ	0.063	U	0.063	U	0.063	U	0.063	U
SELAH DCH	5/16/2007	0.11	UJ	0.065	U	0.065	U	0.065	U	0.065	U
SOUTH DR	5/17/2007	0.078	UJ	0.063	U	0.063	U	0.063	U	0.063	U
SOUTH DR REP	5/17/2007	0.073	UJ	0.063	U	0.063	U	0.063	U	0.063	U
SUB 35	5/17/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
TAYLOR D	5/22/2007	0.063	U	0.063	UJ	0.063	U	0.063	U	0.063	U
TOP CK	5/17/2007	0.078	UJ	0.061	U	0.061	U	0.061	U	0.061	U
WAUNA	5/16/2007	0.087	UJ	0.063	U	0.063	U	0.063	U	0.063	U
WENAS	5/22/2007	0.09	UJ	0.063	U	0.063	U	0.063	U	0.063	U
WIDE HOL	5/16/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.14	J
ZILLAH	5/16/2007	0.087	UJ	0.1	UJ	0.062	U	0.087	J	0.062	U
SELAH CR.	dry										
COLD CR.	dry										

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na = not analyzed

Field ID	Collection Date	Methoxychlor (ng/L)		Total Suspended Solids (mg/L)		Turbidity (NTU)		Conductivity (umhos/cm)	
AHTANUM	5/16/2007	0.062	UJ	27		12		130	
AMON	5/16/2007	0.063	UJ	23		6.3		312	
CORRAL	5/16/2007	0.064	UJ	18		5.7		454	
COULEE DR	5/17/2007	0.062	UJ	9		12		274	
COWICHEE	6/4/2007	0.33	UJ	44		16		164	
DID 7	5/16/2007	0.062	UJ	60		35		350	
DRAIN 31	5/16/2007	0.063	UJ	16		11		260	
EAST TOP	5/17/2007	0.062	UJ	29		15		186	
GRANDVIEW	5/16/2007	0.063	UJ	31		12		174	
MARION	5/16/2007	0.062	UJ	13		9.2		233	
MARION REP	5/16/2007	0.064	UJ	66		9.2		233	
SATUS 302	5/17/2007	0.063	UJ	173		80		279	
SATUS 303	5/17/2007	0.061	UJ	47		21		182	
SATUS CK	5/17/2007	0.063	UJ	12		6.3		203	
SELAH DCH	5/16/2007	0.37	UJ	8		3.8		683	
SOUTH DR	5/17/2007	0.46	UJ	92		38		318	
SOUTH DR REP	5/17/2007	0.063	UJ	100		40		319	
SUB 35	5/17/2007	0.29	UJ	37		20		270	
TAYLOR D	5/22/2007	0.063	UJ	16		9.0		421	
TOP CK	5/17/2007	0.061	UJ	7		6.8		248	
WAUNA	5/16/2007	0.063	UJ	43		19		222	
WENAS	5/22/2007	0.21	UJ	10		4		198	
WIDE HOL	5/16/2007	0.063	UJ	5		4.2		307	
ZILLAH	5/16/2007	0.062	UJ	45		19		160	
SELAH CR.	dry								
COLD CR.	dry								

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Sample No.	Field ID	Collection Date	Flow (cfs)	4,4'-DDT (ng/L)		4,4'-DDE (ng/L)		4,4'-DDD (ng/L)	
7334084	AHTANUM	8/14/2007	26	0.062	UJ	0.062	UJ	0.062	UJ
7334101	AMON	8/16/2007	49	0.062	UJ	0.091	J	0.062	UJ
7334099	CORRAL	8/16/2007	13	0.064	UJ	0.25	J	0.064	UJ
7334090	COULEE DR	8/15/2007	37	0.12		0.36		0.099	
7334104	COWICHEE	8/14/2007	2	0.35		0.93		0.21	
7334093	DID7	8/16/2007	20	0.061	UJ	0.65	J	0.11	J
7334097	DRAIN 31	8/16/2007	3	0.41	J	1.4	J	0.14	J
7334086	EAST TOP	8/15/2007	15	0.22		0.58		0.21	
7334096	GRANDVIEW	8/16/2007	16	0.64	J	2.3	J	0.23	J
7334088	MARION	8/15/2007	54	0.062	U	0.25		0.066	
7334103	SAT302REP	8/15/2007	- -	1.3		5.1		0.14	
7334095	SATUS 302	8/15/2007	26	1.3		5.2		0.15	
7334094	SATUS 303	8/15/2007	6.6	0.49		2.5		0.22	
7334091	SATUS CK	8/15/2007	61	0.065	U	0.13		0.065	U
7334082	SELAH DCH	8/14/2007	6.6	0.46		2.0		0.70	
7334092	SOUTH DR	8/15/2007	61	0.79		3.5		0.46	
7334087	SUB 35	8/15/2007	60	0.57		0.75		0.25	
7334100	TAYLOR D	8/14/2007	1.4	0.062	U	0.30		0.10	
7334089	TOP CK	8/15/2007	40	0.063	U	0.16		0.063	U
7334098	WAUNA	8/16/2007	1.6	0.063	UJ	0.25	J	0.063	UJ
7334081	WENAS	8/14/2007	1.9	0.063	U	0.096		0.063	U
7334083	WIDE HOL	8/14/2007	9.6	0.087		1.1		0.38	
7334102	WIDE REP	8/14/2007	- -	0.091		1.1		0.39	
7334085	ZILLAH	8/15/2007	2.6	0.2		2.5		0.55	
- -	SELAH CR.	dry							
- -	COLD CR.	dry							

U = not detected at or above reported value
J = estimated
REJ = rejected
na = not analyzed

Field ID	Collection Date	Dieldrin (ng/L)		Chlorpyriphos (ng/L)		Endosulfan I (ng/l)		Endosulfan II (ng/L)		Endosulfan Sulfate (ng/L)	
AHTANUM	8/14/2007	REJ		REJ		0.062	UJ	REJ		0.062	UJ
AMON	8/16/2007	0.12	J	1.1	J	0.19	J	0.17	J	0.78	J
CORRAL	8/16/2007	0.064	UJ	0.32	J	0.25	J	0.064	UJ	0.68	J
COULEE DR	8/15/2007	0.061	U	21		0.12		0.14	J	0.61	
COWICHEE	8/14/2007	0.063		0.063	U	0.25		0.25		0.94	
DID7	8/16/2007	0.061	UJ	0.061	UJ	0.37	J	0.16	J	0.91	J
DRAIN 31	8/16/2007	1.7		0.58	J	0.75	J	0.5	J	1.4	J
EAST TOP	8/15/2007	0.14	UJ	0.67		0.34	J	0.41		0.99	
GRANDVIEW	8/16/2007	0.55	J	0.62	J	1.5	J	0.56	J	1.5	J
MARION	8/15/2007	0.15	J	4.8		0.23		0.17		0.87	
SAT302REP	8/15/2007	1.8		4.3		0.2		0.22		1.1	
SATUS 302	8/15/2007	1.9		7.6		0.19		0.28		1.1	
SATUS 303	8/15/2007	0.31		2.1		0.17		0.061	U	0.99	
SATUS CK	8/15/2007	0.079	J	10		0.19		0.12		0.57	
SELAH DCH	8/14/2007	0.062	U	0.15	UJ	7.1		5.0		5.8	
SOUTH DR	8/15/2007	0.57		2.1		0.2		0.18		1.0	
SUB 35	8/15/2007	0.27		12		0.2		0.21		0.94	
TAYLOR D	8/14/2007	0.062	U	0.81		0.36		0.1	J	0.57	
TOP CK	8/15/2007	0.11	J	3.7		0.2		0.21		0.93	
WAUNA	8/16/2007	0.088	J	0.71	J	0.54	J	0.29	J	1.4	J
WENAS	8/14/2007	0.063	U	0.13	J	0.081		0.088	UJ	0.49	
WIDE HOL	8/14/2007	0.47		0.32	J	0.35		0.53		2.6	
WIDE REP	8/14/2007	0.51		0.31		0.38		0.56		3.1	
ZILLAH	8/15/2007	0.11	J	0.51		2.2		0.38		1.6	
SELAH CR.	dry										
COLD CR.	dry										

U = not detected at or above reported value
J = estimated
REJ = rejected
na = not analyzed

Field ID	Collection Date	Toxaphene (ng/L)		Cis-Chlordane (ng/L)		Cis-Nonachlor (ng/L)		Trans-Chlordane (ng/L))		Trans-Nonachlor (ng/L)		Oxy-chlordane (ng/L)	
AHTANUM	8/14/2007	3.1	U	0.062	UJ	0.062	UJ	0.062	UJ	0.062	UJ	0.062	UJ
AMON	8/16/2007	3.1	U	0.062	UJ	0.062	UJ	0.062	UJ	0.062	UJ	0.062	UJ
CORRAL	8/16/2007	3.2	UJ	0.064	UJ	0.064	UJ	0.064	UJ	0.064	UJ	0.064	UJ
COULEE DR	8/15/2007	3.0	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
COWICHEE	8/14/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
DID7	8/16/2007	3.1	UJ	0.061	UJ	0.061	UJ	0.061	UJ	0.061	UJ	0.061	UJ
DRAIN 31	8/16/2007	3.2	UJ	0.064	UJ	0.064	UJ	0.064	UJ	0.064	J	0.064	UJ
EAST TOP	8/15/2007	3.1	U	0.09	J	0.063	U	0.10	UJ	0.098	UJ	0.14	UJ
GRANDVIEW	8/16/2007	3.1	UJ	0.063	UJ	0.063	UJ	0.063	UJ	0.063	UJ	0.063	UJ
MARION	8/15/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
SAT302REP	8/15/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
SATUS 302	8/15/2007	3.0	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
SATUS 303	8/15/2007	3.0	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
SATUS CK	8/15/2007	3.2	U	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
SELAH DCH	8/14/2007	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.073	UJ
SOUTH DR	8/15/2007	3.1	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
SUB 35	8/15/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
TAYLOR D	8/14/2007	3.1	U	0.13	J	0.062	U	0.062	U	0.062	U	0.062	U
TOP CK	8/15/2007	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
WAUNA	8/16/2007	3.1	UJ	0.063	UJ	0.063	UJ	0.063	UJ	0.063	UJ	0.34	J
WENAS	8/14/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
WIDE HOL	8/14/2007	3.2	U	0.081	J	0.063	U	0.063	U	0.074		0.063	U
WIDE REP	8/14/2007	3.2	U	0.08	J	0.063	U	0.063	U	0.063	U	0.063	U
ZILLAH	8/15/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SELAH CR.	dry												
COLD CR.	dry												

U = not detected at or above reported value
J = estimated
REJ = rejected
na = not analyzed

Field ID	Collection Date	Alpha-BHC (ng/L)		Beta-BHC (ng/L)		Delta-BHC (ng/L)		Lindane (ng/L)		Aldrin (ng/L)		Endrin (ng/L)	
AHTANUM	8/14/2007	0.062	UJ	0.062	UJ	0.062	UJ	0.062	UJ	0.062	UJ	REJ	
AMON	8/16/2007	0.062	UJ	0.062	UJ	0.062	UJ	0.062	UJ	0.062	UJ	0.062	UJ
CORRAL	8/16/2007	0.064	UJ	0.064	UJ	0.064	UJ	0.064	UJ	0.064	UJ	0.064	UJ
COULEE DR	8/15/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.078	UJ	0.73	
COWICHEE	8/14/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	UJ	0.063	UJ
DID7	8/16/2007	0.061	UJ	0.061	UJ	0.061	UJ	0.061	UJ	0.27	UJ	0.11	UJ
DRAIN 31	8/16/2007	0.064	UJ	0.064	UJ	0.064	UJ	0.064	UJ	0.064	UJ	0.36	UJ
EAST TOP	8/15/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.068	UJ	0.063	U
GRANDVIEW	8/16/2007	0.063	UJ	0.063	UJ	0.063	UJ	0.063	UJ	0.063	UJ	0.095	UJ
MARION	8/15/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.096	UJ	0.14	UJ
SAT302REP	8/15/2007	0.062	U	0.062	U	0.062	U	0.062	U	0.13	UJ	0.69	J
SATUS 302	8/15/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.11	UJ	0.64	
SATUS 303	8/15/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
SATUS CK	8/15/2007	0.065	U	0.065	U	0.065	U	0.065	U	0.092	UJ	0.47	J
SELAH DCH	8/14/2007	0.062	U	0.062	U	0.065	UJ	0.062	U	0.062	U	0.062	U
SOUTH DR	8/15/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.09	UJ	0.67	
SUB 35	8/15/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.17	UJ	0.17	UJ
TAYLOR D	8/14/2007	0.062	U	0.13	UJ	0.062	U	0.062	U	0.062	UJ	0.062	UJ
TOP CK	8/15/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.11	UJ	0.8	J
WAUNA	8/16/2007	0.063	UJ	0.063	UJ	0.063	UJ	0.063	UJ	0.063	UJ	0.19	UJ
WENAS	8/14/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
WIDE HOL	8/14/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.14	J
WIDE REP	8/14/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	UJ	0.15	J
ZILLAH	8/15/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SELAH CR.	dry												
COLD CR.	dry												

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Field ID	Collection Date	Endrin Aldehyde (ng/L)		Endrin Ketone (ng/L)		Heptachlor (ng/L)		Heptachlor Epoxide (ng/L)		Hexachloro-benzene (ng/L)	
AHTANUM	8/14/2007	REJ		REJ		0.062	UJ	REJ		0.062	UJ
AMON	8/16/2007	0.062	UJ	0.062	UJ	0.062	UJ	0.062	UJ	0.062	UJ
CORRAL	8/16/2007	0.064	UJ	0.064	UJ	0.064	UJ	0.064	UJ	0.064	UJ
COULEE DR	8/15/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
COWICHEE	8/14/2007	0.12	UJ	0.063	U	0.063	U	0.095	UJ	0.063	U
DID7	8/16/2007	0.061	UJ	0.061	UJ	0.061	UJ	0.061	UJ	0.061	UJ
DRAIN 31	8/16/2007	0.076	UJ	0.064	UJ	0.064	UJ	0.064	UJ	0.064	UJ
EAST TOP	8/15/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
GRANDVIEW	8/16/2007	0.087	UJ	0.063	UJ	0.063	UJ	0.063	UJ	0.063	UJ
MARION	8/15/2007	0.062	U	0.062	U	0.062	U	0.062		0.062	U
SAT302REP	8/15/2007	0.12	UJ	0.062	U	0.062	U	0.062	UJ	0.062	U
SATUS 302	8/15/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
SATUS 303	8/15/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
SATUS CK	8/15/2007	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
SELAH DCH	8/14/2007	0.062	U	0.062	U	0.062	U	0.064	J	0.062	U
SOUTH DR	8/15/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
SUB 35	8/15/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
TAYLOR D	8/14/2007	0.062	U	0.28		0.062	U	0.062	UJ	0.062	U
TOP CK	8/15/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
WAUNA	8/16/2007	0.063	UJ	0.063	UJ	0.063	UJ	0.077	J	0.063	UJ
WENAS	8/14/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
WIDE HOL	8/14/2007	0.063	U	0.063	U	0.063	U	0.07	J	0.28	
WIDE REP	8/14/2007	0.067	UJ	0.063	U	0.063	U	0.096	J	0.29	
ZILLAH	8/15/2007	0.063	UJ	0.063	U	0.063	U	0.07	UJ	0.063	U
SELAH CR.	dry										
COLD CR.	dry										

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Field ID	Collection Date	Methoxychlor (ng/L)		Total Suspended Solids (mg/L)		Turbidity (NTU)		Conductivity (umhos/cm)	
AHTANUM	8/14/2007	REJ		6		3.4		237	
AMON	8/16/2007	0.062	UJ	18		5.1		380	
CORRAL	8/16/2007	0.064	UJ	30		9.4		436	
COULEE DR	8/15/2007	0.061	U	4		2.8		290	
COWICHEE	8/14/2007	0.063	UJ	3		2.7		294	
DID7	8/16/2007	0.061	UJ	20		14		351	
DRAIN 31	8/16/2007	1.2	UJ	7		4.3		268	
EAST TOP	8/15/2007	0.063	U	13		9.8		255	
GRANDVIEW	8/16/2007	0.063	UJ	27		11		176	
MARION	8/15/2007	0.062	U	11		6		247	
SAT302REP	8/15/2007	1	UJ	85		40		282	
SATUS 302	8/15/2007	0.061	UJ	73		45		282	
SATUS 303	8/15/2007	0.061	U	6		4.4		368	
SATUS CK	8/15/2007	0.065	U	5		4.9		332	
SELAH DCH	8/14/2007	0.062	U	6		2.7		544	
SOUTH DR	8/15/2007	0.061	U	25		16		366	
SUB 35	8/15/2007	0.063	U	10		8.7		284	
TAYLOR D	8/14/2007	0.062	UJ	6		4.3		386	
TOP CK	8/15/2007	0.063	U	4		4.2		235	
WAUNA	8/16/2007	0.063	UJ	4		3.9		193	
WENAS	8/14/2007	0.063	U	5		3.3		510	
WIDE HOL	8/14/2007	0.15	UJ	4		2.4		263	
WIDE REP	8/14/2007	0.063	UJ	4		2.3		263	
ZILLAH	8/15/2007	0.063	U	47		13		164	
SELAH CR.	dry								
COLD CR.	dry								

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Sample No.	Field ID	Collection Date	Flow (cfs)	4,4'-DDT (ng/L)		4,4'-DDE (ng/L)		4,4'-DDD (ng/L)	
7464084	AHTANUM	11/15/2007	27	0.061	UJ	0.14		0.061	U
7464101	AMON CK	11/13/2007	19	0.066	U	0.066	U	0.066	U
7464099	CORRAL	11/13/2007	7.8	0.063	U	0.063	U	0.063	U
7464090	COULEE DR	11/14/2007	<1 est.	0.063	U	0.15		0.063	U
7464104	COWICHEE	11/15/2007	10	0.068	J	0.27		0.08	
7464093	DID 7	11/13/2007	6.0	0.064	U	0.41		0.078	
7464097	DRAIN 31	11/13/2007	0.5	0.064	U	0.41		0.064	U
7464086	EAST TOP	11/14/2007	21	0.064	U	0.58		0.24	
7464096	GRANDVIEW	11/13/2007	8.8	0.29		3.1		0.49	
7464088	MARION	11/14/2007	222	0.067	U	0.27		0.067	U
7464094	SATUS 303	11/13/2007	0.99	0.066	U	0.28		0.066	U
7464091	SATUS CK	11/13/2007	29	0.066	U	0.066	U	0.066	U
7484082	SELAH DC H	11/26/2007	9.6	0.51	J	6.1		1.3	
7464092	SOUTH DR	11/13/2007	9.2	0.063	U	0.83		0.16	
7464102	SOUTH REP	11/13/2007	- -	0.063	U	0.82		0.16	
7464087	SUB 35	11/14/2007	23	0.16		0.56		0.28	
7464100	TAYLOR D	11/15/2007	7.5	0.063	UJ	0.16		0.063	U
7464089	TOP CK	11/14/2007	48	0.064	U	0.13		0.064	U
7464081	WENAS	11/15/2007	5.4	0.063	UJ	0.064		0.063	U
7464083	WIDE HOL	11/15/2007	22	0.062	UJ	1.2		0.33	
7464103	WIDE REP	11/15/2007	- -	0.063	UJ	0.98		0.26	
7464085	ZILLAH	11/14/2007	0.3	0.067	U	0.82		0.22	
- -	SATUS 302	standing water							
- -	SELAH CR.	dry							
- -	COLD CR.	dry							

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Field ID	Collection Date	Dieldrin (ng/L)		Chlorpyrifos (ng/L)		Endosulfan I (ng/L)		Endosulfan II (ng/L)		Endosulfan Sulfate (ng/L)	
AHTANUM	11/15/2007	0.061	U	0.061	UJ	0.061	U	0.086	J	0.2	J
AMON CK	11/13/2007	0.066	U	0.074	J	0.066	U	0.066	UJ	0.12	UJ
CORRAL	11/13/2007	0.063	U	0.063	UJ	0.063	U	0.063	UJ	0.18	J
COULEE DR	11/14/2007	0.063	U	0.46	J	0.063	U	0.063	UJ	0.067	UJ
COWICHEE	11/15/2007	0.061	U	0.061	UJ	0.061	U	0.12	J	0.30	J
DID 7	11/13/2007	0.064	U	0.072	J	0.064	U	0.064	UJ	0.13	UJ
DRAIN 31	11/13/2007	0.22		0.068	J	0.064	U	0.064	U	0.064	UJ
EAST TOP	11/14/2007	0.39		0.064	UJ	0.064	U	0.42	J	0.54	J
GRANDVIEW	11/13/2007	0.29		0.065	UJ	0.065	U	0.065	UJ	0.09	UJ
MARION	11/14/2007	0.067	U	0.89	J	0.067	U	0.078	J	0.11	UJ
SATUS 303	11/13/2007	0.23		0.96	J	0.10	J	0.069	J	0.11	UJ
SATUS CK	11/13/2007	0.066	U	2.2	J	0.066	U	0.15	J	0.14	UJ
SELAH DC H	11/26/2007	0.20	UJ	0.49	UJ	0.10	UJ	0.75	J	1.3	
SOUTH DR	11/13/2007	0.16	J	0.32	J	0.063	U	0.063	UJ	0.17	J
SOUTH REP	11/13/2007	0.15	J	0.23	J	0.063	U	0.063	UJ	0.16	J
SUB 35	11/14/2007	0.072	J	2.4	J	0.064	U	0.064	J	0.071	UJ
TAYLOR D	11/15/2007	0.063	U	0.063	UJ	0.063	U	0.084	J	0.3	J
TOP CK	11/14/2007	0.064	U	0.48	J	0.064	U	0.076	J	0.25	J
WENAS	11/15/2007	0.063	U	0.074	J	0.063	U	0.063	UJ	0.14	J
WIDE HOL	11/15/2007	0.70	UJ	0.062	UJ	0.83		0.98	J	4.4	
WIDE REP	11/15/2007	0.60	UJ	0.063	UJ	0.68		0.65	J	2.2	J
ZILLAH	11/14/2007	0.063	U	0.063	UJ	0.067	U	0.16	J	0.59	J
SATUS 302	standing water										
SELAH CR.	dry										
COLD CR.	dry										

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REJ = rejected
na = not analyzed

Field ID	Collection Date	Toxaphene (ng/L)		Cis-Chlordane (ng/L)		Cis-Nonachlor (ng/L)		Trans-Chlordane (ng/L)		Trans-Nonachlo (ng/L)		Oxy-chlordane (ng/L)	
AHTANUM	11/15/2007	3.1	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
AMON CK	11/13/2007	3.3	UJ	0.066	U	0.066	U	0.066	U	0.066	U	0.066	U
CORRAL	11/13/2007	3.2	UJ	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
COULEE DR	11/14/2007	3.2	UJ	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
COWICHEE	11/15/2007	3.1	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
DID 7	11/13/2007	3.2	UJ	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U
DRAIN 31	11/13/2007	3.2	UJ	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U
EAST TOP	11/14/2007	3.2	UJ	0.064	U	0.10	UJ	0.064	U	0.064	U	0.064	U
GRANDVIEW	11/13/2007	3.2	UJ	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
MARION	11/14/2007	3.3	UJ	0.067	U	0.067	U	0.067	U	0.067	U	0.067	U
SATUS 303	11/13/2007	3.3	UJ	0.066	U	0.066	U	0.066	U	0.066	U	0.066	U
SATUS CK	11/13/2007	3.3	UJ	0.066	U	0.066	U	0.066	U	0.066	U	0.066	U
SELAH DC H	11/26/2007	3.1	U	0.063	U	0.063	U	0.11	UJ	0.063	U	0.063	U
SOUTH DR	11/13/2007	3.2	UJ	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SOUTH REP	11/13/2007	3.1	UJ	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SUB 35	11/14/2007	3.2	UJ	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U
TAYLOR D	11/15/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
TOP CK	11/14/2007	3.2	UJ	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U
WENAS	11/15/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
WIDE HOL	11/15/2007	3.1	U	0.062	J	0.062	U	0.072	J	0.062	U	0.062	U
WIDE REP	11/15/2007	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
ZILLAH	11/14/2007	3.2		0.063	U	0.063	U	0.067	U	0.067	U	0.067	U
SATUS 302	standing water												
SELAH CR.	dry												
COLD CR.	dry												

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na = not analyzed

Field ID	Collection Date	Alpha-BHC (ng/L)		Beta-BHC (ng/L)		Delta-BHC (ng/L)		Lindane (ng/L)		Aldrin (ng/L)		Endrin (ng/L)	
AHTANUM	11/15/2007	0.061	U	0.061	U	0.061	UJ	0.061	U	0.061	U	0.061	UJ
AMON CK	11/13/2007	0.066	U	0.098	UJ	0.066	UJ	0.066	U	0.066	U	0.066	UJ
CORRAL	11/13/2007	0.063	U	0.063	U	0.063	UJ	0.063	U	0.063	U	0.063	UJ
COULEE DR	11/14/2007	0.063	U	0.063	U	0.063	UJ	0.063	U	0.063	U	0.063	UJ
COWICHEE	11/15/2007	0.061	U	0.061	U	0.061	UJ	0.061	U	0.061	U	0.061	UJ
DID 7	11/13/2007	0.064	U	0.064	U	0.064	UJ	0.064	U	0.064	U	0.064	UJ
DRAIN 31	11/13/2007	0.064	U	0.064	U	0.064	UJ	0.064	U	0.064	U	0.064	UJ
EAST TOP	11/14/2007	0.064	U	0.064	U	0.064	UJ	0.49		0.064	U	0.07	UJ
GRANDVIEW	11/13/2007	0.065	U	0.065	U	0.065	UJ	0.065	U	0.065	U	0.065	UJ
MARION	11/14/2007	0.067	U	0.067	U	0.067	UJ	0.067	U	0.067	U	0.067	UJ
SATUS 303	11/13/2007	0.14		0.16	J	0.066	UJ	0.085		0.066	U	0.066	UJ
SATUS CK	11/13/2007	0.066	U	0.066	U	0.066	UJ	0.066	U	0.066	U	0.066	UJ
SELAH DC H	11/26/2007	0.063	U	0.099	UJ	0.097	UJ	0.30	UJ	0.063	U	0.091	J
SOUTH DR	11/13/2007	0.063	U	0.063	U	0.063	UJ	0.063	U	0.063	U	0.063	UJ
SOUTH REP	11/13/2007	0.063	U	0.063	U	0.063	UJ	0.063	U	0.063	U	0.063	UJ
SUB 35	11/14/2007	0.064	U	0.064	U	0.064	UJ	0.064	U	0.064	U	0.064	UJ
TAYLOR D	11/15/2007	0.063	U	0.12	UJ	0.063	UJ	0.063	U	0.063	U	0.063	UJ
TOP CK	11/14/2007	0.064	U	0.064	U	0.064	UJ	0.064	U	0.064	U	0.064	UJ
WENAS	11/15/2007	0.063	U	0.063	U	0.063	UJ	0.063	U	0.063	U	0.063	UJ
WIDE HOL	11/15/2007	0.062	U	0.062	U	0.062	UJ	0.062	U	0.062	U	0.36	J
WIDE REP	11/15/2007	0.063	U	0.063	U	0.063	UJ	0.063	U	0.063	U	0.27	J
ZILLAH	11/14/2007	0.067	U	0.067	U	0.067	UJ	0.067	U	0.067	U	0.063	UJ
SATUS 302	standing water												
SELAH CR.	dry												
COLD CR.	dry												

U = not detected at or above reported value
J = estimated
REJ = rejected
na = not analyzed

Field ID	Collection Date	Endrin Aldehyde (ng/L)		Endrin Ketone (ng/L)		Heptachlor (ng/L)		Heptachlor Epoxide (ng/L)		Hexachloro-benzene (ng/L)	
AHTANUM	11/15/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
AMON CK	11/13/2007	0.066	U	0.066	U	0.066	U	0.066	U	0.066	U
CORRAL	11/13/2007	0.13	UJ	0.063	U	0.063	U	0.063	U	0.063	U
COULEE DR	11/14/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
COWICHEE	11/15/2007	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
DID 7	11/13/2007	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U
DRAIN 31	11/13/2007	0.18	UJ	0.064	U	0.064	U	0.064	U	0.064	U
EAST TOP	11/14/2007	0.16	UJ	0.064	U	0.064	U	0.064	U	0.064	U
GRANDVIEW	11/13/2007	0.092	UJ	0.065	U	0.065	U	0.065	U	0.065	U
MARION	11/14/2007	0.067	U	0.067	U	0.067	U	0.067	U	0.067	U
SATUS 303	11/13/2007	0.096	UJ	0.066	U	0.066	U	0.066	U	0.066	U
SATUS CK	11/13/2007	0.1	UJ	0.066	U	0.066	U	0.066	U	0.066	U
SELAH DC H	11/26/2007	0.84	UJ	0.063	U	0.063	U	0.2	UJ	0.063	U
SOUTH DR	11/13/2007	0.064	UJ	0.063	U	0.063	U	0.063	U	0.063	U
SOUTH REP	11/13/2007	0.067	UJ	0.063	U	0.063	U	0.063	U	0.063	U
SUB 35	11/14/2007	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U
TAYLOR D	11/15/2007	0.21	UJ	0.11	UJ	0.063	U	0.063	U	0.063	U
TOP CK	11/14/2007	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U
WENAS	11/15/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
WIDE HOL	11/15/2007	0.15	UJ	0.13	J	0.062	U	0.062	U	0.43	UJ
WIDE REP	11/15/2007	0.13	UJ	0.075	UJ	0.063	U	0.063	U	0.35	UJ
ZILLAH	11/14/2007	0.097	UJ	0.067	U	0.067	U	0.067	U	0.067	U
SATUS 302	standing water										
SELAH CR.	dry										
COLD CR.	dry										

U = not detected at or above reported value
J = estimated
REJ = rejected
na = not analyzed

Field ID	Collection Date	Methoxychlor (ng/L)		Total Suspended Solids (mg/L)		Turbidity (NTU)		Conductivity (umhos/cm)	
AHTANUM	11/15/2007	0.25	UJ	3		2.6		219	
AMON CK	11/13/2007	0.066	UJ	2		0.6		718	
CORRAL	11/13/2007	0.086	UJ	3		1.8		545	
COULEE DR	11/14/2007	0.063	UJ	3		3.5		306	
COWICHEE	11/15/2007	0.45	UJ	2		1.2		345	
DID 7	11/13/2007	0.22	UJ	8		10		627	
DRAIN 31	11/13/2007	0.52	UJ	7		4.1		867	
EAST TOP	11/14/2007	0.064	UJ	11		11		310	
GRANDVIEW	11/13/2007	0.065	UJ	33		12		559	
MARION	11/14/2007	0.067	UJ	10		7.3		360	
SATUS 303	11/13/2007	0.24	UJ	1	U	1.0		1080	
SATUS CK	11/13/2007	0.19	UJ	2		2.2		237	
SELAH DC H	11/26/2007	0.063	UJ	73		28		696	
SOUTH DR	11/13/2007	0.063	UJ	10		3.4		780	
SOUTH REP	11/13/2007	0.10	UJ	10		4.4		780	
SUB 35	11/14/2007	0.064	UJ	11		8.9		331	
TAYLOR D	11/15/2007	0.33	UJ	3		2.6		432	
TOP CK	11/14/2007	0.19	UJ	5		6.0		424	
WENAS	11/15/2007	0.3	UJ	1		2.0		350	
WIDE HOL	11/15/2007	0.35	UJ	5		2.2		517	
WIDE REP	11/15/2007	0.39	UJ	4		2.7		517	
ZILLAH	11/14/2007	0.067	UJ	7		5.0		498	
SATUS 302	standing water								
SELAH CR.	dry								
COLD CR.	dry								

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na = not analyzed

Sample No.	Field ID	Collection Date	Flow (cfs)	4,4'-DDT (ng/L)		4,4'-DDE (ng/L)		4,4'-DDD (ng/L)	
8074084	AHTANUM	2/11/2008	44	0.062	U	0.2		0.079	
8074101	AMON CK	2/13/2008	9.6	0.065	U	0.085		0.065	U
8074099	CORRAL	2/13/2008	4.6	0.064	U	0.14		0.064	U
8074090	COULEE DR	2/12/2008	<1	0.062	U	0.35	J	0.14	J
8074104	COWICHEE	2/11/2008	10.0	0.13		0.38		0.085	
8074093	DID7	2/13/2008	3.6	0.065	U	0.52		0.1	J
8074097	DRAIN 31	2/13/2008	0.1	0.064	U	0.38		0.075	J
8074086	EAST TOP	2/12/2008	6.6	0.063	U	0.74	J	0.39	J
8074096	GRANDVIEW	2/13/2008	5.1	1.1	J	2.9	J	0.8	J
8074088	MARION	2/12/2008	179	0.061	U	0.5	J	0.14	J
8074094	SATUS 303	2/13/2008	1.3	0.063	U	0.33		0.063	U
8074091	SATUS CK	2/12/2008	352	0.063	U	0.063	U	0.063	U
8074080	SELAH CK	2/11/2008	1.7	0.061	UJ	0.061	UJ	0.061	UJ
8074082	SELAH DCH	2/11/2008	1.3	0.25		1.4		0.74	
8074092	SOUTH DR	2/13/2008	10	0.066	J	0.68		0.18	J
8074102	SOUTH REP	2/13/2008	- -	0.066	J	0.67		0.17	J
8074087	SUB 35	2/12/2008	20.9	0.28	J	1.4	J	1.1	J
8074100	TAYLOR D	2/11/2008	3.8	0.063	U	0.31		0.10	J
8074089	TOP CK	2/12/2008	112	0.063	U	0.11		0.063	U
8074081	WENAS	2/11/2008	2.5	0.065	U	0.15		0.065	U
8074083	WIDE HOL	2/12/2008	3.3	0.1	J	1.2	J	0.47	J
8074085	ZILLAH	2/12/2008	0.1	0.15		1.3		0.36	
8074103	ZILLAH REP	2/12/2008	- -	0.09		0.79		0.21	
- -	COLD CR.	dry							
- -	WAUNA	dry							

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Field ID	Collection Date	Dieldrin (ng/L)		Chlorpyrifos (ng/L)		Endosulfan I (ng/L)		Endosulfan II (ng/L)		Endosulfan Sulfate (ng/L)	
AHTANUM	2/11/2008	0.062	U	0.18	UJ	0.062	U	0.062	U	0.4	J
AMON CK	2/13/2008	0.065	U	0.15	J	0.074	J	0.12	J	1.1	J
CORRAL	2/13/2008	0.064	U	0.068	J	0.064	U	0.064	U	0.35	J
COULEE DR	2/12/2008	0.062	U	1.1		0.11		0.062	U	0.17	J
COWICHEE	2/11/2008	0.065	U	0.86		0.12	J	0.18	J	1.7	UJ
DID7	2/13/2008	0.065	U	0.11	J	0.065	U	0.065	U	0.29	J
DRAIN 31	2/13/2008	0.38		0.82		0.27	J	0.3		0.43	UJ
EAST TOP	2/12/2008	0.29		1.7		0.063	U	0.33	J	0.48	J
GRANDVIEW	2/13/2008	0.3		0.087	J	0.062	U	0.062	U	0.21	UJ
MARION	2/12/2008	0.061	U	0.86		0.072		0.061	U	0.13	J
SATUS 303	2/13/2008	0.27		0.79	J	0.17		0.11	J	1.5	UJ
SATUS CK	2/12/2008	0.063	U	0.14	J	0.063	U	0.063	U	0.26	J
SELAH CK	2/11/2008	0.061	U	0.061	U	0.48	UJ	0.39	UJ	8.7	J
SELAH DCH	2/11/2008	0.88	J	0.063	U	1.2	J	1.4	J	2.7	J
SOUTH DR	2/13/2008	0.12		0.21	J	0.078	J	0.063	U	0.41	J
SOUTH REP	2/13/2008	0.13		0.15	J	0.075	J	0.064	U	0.39	J
SUB 35	2/12/2008	0.061	U	1.2		0.061	U	0.061	U	0.1	J
TAYLOR D	2/11/2008	0.33	J	1.2		0.063	U	0.063	U	0.88	J
TOP CK	2/12/2008	0.063	U	0.53	J	0.084	J	0.063	U	0.54	J
WENAS	2/11/2008	0.35	J	0.72	J	0.4	UJ	0.22	J	1.1	J
WIDE HOL	2/12/2008	1.0	J	0.55	J	2.2	J	2	J	13	J
ZILLAH	2/12/2008	0.063	U	0.56		0.063	J	0.15		1.1	
ZILLAH REP	2/12/2008	0.063	U	0.34		0.063	U	0.078	J	0.36	J
COLD CR.	dry										
WAUNA	dry										

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Field ID	Collection Date	Toxaphene (ng/L)		Cis-Chlordane (ng/L)		Cis-Nonachlor (ng/L)		Trans-Chlordane (ng/L)		Trans-Nonachlor (ng/L)		Oxy-chlordane (ng/L)	
AHTANUM	2/11/2008	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
AMON CK	2/13/2008	3.2	U	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
CORRAL	2/13/2008	3.2	U	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U
COULEE DR	2/12/2008	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
COWICHEE	2/11/2008	3.2	U	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
DID7	2/13/2008	3.2	U	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
DRAIN 31	2/13/2008	3.2	U	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U
EAST TOP	2/12/2008	3.1	U	0.094	UJ	0.063	U	0.71	UJ	0.063	U	0.063	U
GRANDVIEW	2/13/2008	3.1	U	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
MARION	2/12/2008	3.1	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
SATUS 303	2/13/2008	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SATUS CK	2/12/2008	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SELAH CK	2/11/2008	3.1	UJ	0.061	UJ	0.061	UJ	0.061	UJ	0.061	UJ	0.061	UJ
SELAH DCH	2/11/2008	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SOUTH DR	2/13/2008	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
SOUTH REP	2/13/2008	3.2	U	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U
SUB 35	2/12/2008	3.1	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
TAYLOR D	2/11/2008	3.2	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
TOP CK	2/12/2008	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
WENAS	2/11/2008	3.2	U	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
WIDE HOL	2/12/2008	3.2	U	0.065	U	0.065	U	0.065	U	0.065	U	0.065	U
ZILLAH	2/12/2008	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
ZILLAH REP	2/12/2008	3.1	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
COLD CR.	dry												
WAUNA	dry												

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Field ID	Collection Date	Alpha-BHC (ng/L)		Beta-BHC (ng/L)		Delta-BHC (ng/L)		Lindane (ng/L)		Aldrin (ng/L)		Endrin (ng/L)	
AHTANUM	2/11/2008	0.062	U	0.063	UJ	0.062	U	0.062	U	0.064	UJ	0.062	U
AMON CK	2/13/2008	0.065	U	0.065	U	0.065	U	0.065	U	0.13	UJ	0.099	UJ
CORRAL	2/13/2008	0.064	U	0.064	U	0.064	U	0.064	U	0.087		0.064	U
COULEE DR	2/12/2008	0.062	U	0.062	U	0.062	U	0.062	U	0.21	UJ	0.062	U
COWICHEE	2/11/2008	0.065	U	0.065	U	0.065	U	0.065	U	0.58	UJ	0.14	UJ
DID7	2/13/2008	0.065	U	0.065	U	0.065	U	0.065	U	0.12	UJ	0.065	U
DRAIN 31	2/13/2008	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U
EAST TOP	2/12/2008	0.063	U	0.063	U	0.063	U	0.064	UJ	0.27	UJ	0.07	UJ
GRANDVIEW	2/13/2008	0.062	U	0.062	U	0.062	U	0.062	U	0.28		0.062	U
MARION	2/12/2008	0.061	U	0.061	U	0.061	U	0.061	U	0.067	UJ	0.061	U
SATUS 303	2/13/2008	0.063	U	0.063	U	0.063	U	0.063	U	0.10	UJ	0.19	UJ
SATUS CK	2/12/2008	0.063	U	0.063	U	0.063	U	0.063	U	0.12	UJ	0.063	U
SELAH CK	2/11/2008	0.085	J	0.061	J	0.061	UJ	0.075	J	1.6	UJ	2.7	UJ
SELAH DCH	2/11/2008	0.063	U	0.079	UJ	0.063	U	0.063	U	0.14	UJ	0.12	UJ
SOUTH DR	2/13/2008	0.063	U	0.063	U	0.063	U	0.063	U	0.17	UJ	0.068	
SOUTH REP	2/13/2008	0.064	U	0.064	U	0.064	U	0.064	U	0.17	UJ	0.064	U
SUB 35	2/12/2008	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
TAYLOR D	2/11/2008	0.063	U	0.063	U	0.063	U	0.063	U	0.83	UJ	0.15	UJ
TOP CK	2/12/2008	0.063	U	0.063	U	0.063	U	0.063	U	0.27	UJ	0.063	U
WENAS	2/11/2008	0.065	U	0.065	U	0.065	U	0.065	U	0.99	UJ	0.37	
WIDE HOL	2/12/2008	0.065	U	0.065	U	0.065	U	0.065	U	0.11	UJ	0.41	J
ZILLAH	2/12/2008	0.063	U	0.063	U	0.063	U	0.063	U	0.064	UJ	0.063	U
ZILLAH REP	2/12/2008	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
COLD CR.	dry												
WAUNA	dry												

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J = estimated
REJ = rejected
na = not analyzed

Field ID	Collection Date	Endrin Aldehyde (ng/L)		Endrin Ketone (ng/L)		Heptachlor (ng/L)		Heptachlor Epoxide (ng/L)		Hexachloro-benzene (ng/L)	
AHTANUM	2/11/2008	0.062	U	0.062	U	0.062	U	0.062	U	0.062	U
AMON CK	2/13/2008	0.13	UJ	0.065	U	0.065	U	0.065	U	0.065	U
CORRAL	2/13/2008	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U
COULEE DR	2/12/2008	0.062	U	0.15	UJ	0.062	U	0.062	U	0.062	U
COWICHEE	2/11/2008	0.065	UJ	0.065	U	0.065	U	0.065	U	0.065	U
DID7	2/13/2008	0.065	U	0.069	UJ	0.065	U	0.065	U	0.065	U
DRAIN 31	2/13/2008	0.11	UJ	0.23	UJ	0.064	U	0.11	UJ	0.064	U
EAST TOP	2/12/2008	0.18	UJ	0.063	U	0.063	U	0.063	U	0.063	U
GRANDVIEW	2/13/2008	0.069	UJ	0.071	UJ	0.062	U	0.062	U	0.062	U
MARION	2/12/2008	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
SATUS 303	2/13/2008	0.21	UJ	0.063	U	0.063	U	0.063	U	0.063	U
SATUS CK	2/12/2008	0.081	UJ	0.063	U	0.063	U	0.063	U	0.063	U
SELAH CK	2/11/2008	1.9	UJ	1.9	UJ	0.061	UJ	2.0	UJ	0.093	UJ
SELAH DCH	2/11/2008	0.063	U	0.063	U	0.063	U	0.57	UJ	0.063	U
SOUTH DR	2/13/2008	0.063	U	0.074	UJ	0.063	U	0.063	U	0.063	U
SOUTH REP	2/13/2008	0.064	U	0.064	U	0.064	U	0.064	U	0.064	U
SUB 35	2/12/2008	0.061	U	0.061	U	0.061	U	0.061	U	0.061	U
TAYLOR D	2/11/2008	1.4	UJ	0.063	U	0.063	U	0.063	U	0.063	U
TOP CK	2/12/2008	0.063	U	0.13	UJ	0.063	U	0.063	U	0.063	U
WENAS	2/11/2008	0.31	UJ	0.5	UJ	0.065	U	0.17	UJ	0.065	U
WIDE HOL	2/12/2008	0.081	UJ	0.20	J	0.065	U	0.065	U	0.61	J
ZILLAH	2/12/2008	0.15	UJ	0.063	U	0.063	U	0.063	U	0.063	U
ZILLAH REP	2/12/2008	0.09	UJ	0.063	U	0.063	U	0.063	U	0.063	U
COLD CR.	dry										
WAUNA	dry										

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J = estimated
REJ = rejected
na = not analyzed

Field ID	Collection Date	Methoxychlor (ng/L)		Total Suspended Solids (mg/L)		Turbidity (NTU)		Conductivity (umhos/cm)	
AHTANUM	2/11/2008	0.062	UJ	12		7.8		205	
AMON CK	2/13/2008	0.075	UJ	32		10		759	
CORRAL	2/13/2008	0.15	UJ	9		4.3		579	
COULEE DR	2/12/2008	0.062	UJ	8		5.4		298	
COWICHEE	2/11/2008	0.065	UJ	9		8.1		188	
DID7	2/13/2008	0.094	UJ	5		3.9		625	
DRAIN 31	2/13/2008	0.58	UJ	2		2.2		834	
EAST TOP	2/12/2008	0.64	UJ	12		6.8		296	
GRANDVIEW	2/13/2008	1.3	J	8		4.1		593	
MARION	2/12/2008	0.061	UJ	19		7.4		376	
SATUS 303	2/13/2008	1.4	UJ	1	U	0.5		1080	
SATUS CK	2/12/2008	0.25	UJ	19		7.9		123	
SELAH CK	2/11/2008	1.8	UJ	30		39		210	
SELAH DCH	2/11/2008	1.0	UJ	30		9.7		681	
SOUTH DR	2/13/2008	0.063	UJ	4		4.4		766	
SOUTH REP	2/13/2008	0.064	UJ	5		3.1		768	
SUB 35	2/12/2008	0.061	UJ	23		9.7		350	
TAYLOR D	2/11/2008	0.063	UJ	3		3.4		540	
TOP CK	2/12/2008	0.063	UJ	10		7.9		338	
WENAS	2/11/2008	0.66	UJ	7		6.5		281	
WIDE HOL	2/12/2008	0.17	UJ	2		1.0		540	
ZILLAH	2/12/2008	0.16	UJ	4		2.8		530	
ZILLAH REP	2/12/2008	0.063	UJ	4		2.6		534	
COLD CR.	dry								
WAUNA	dry								

U = not detected at or above reported value
J = estimated
REJ = rejected
na = not analyzed

Appendix L. Washington State Department of Health Fish Consumption Advisory

Washington State Department of Health

News Release

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For immediate release: April 30, 2009 (09-075)

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Yakima River fish consumption advisory lifted due to lower DDT levels
Other fish will be added due to increased PCB monitoring and detection

OLYMPIA — Dropping levels of DDT found in fish in the Yakima River have led state health officials to drop advisories to limit meals from certain fish species from the river. Recent data on PCBs, though, has resulted in new advice on eating common carp from the Yakima.

Since 1993 the Department of Health has recommended people eat no more than one meal a week of bottom fish from the Yakima River to avoid DDT exposure. At that time, DDT levels in Yakima River bottom fish were among the highest reported in the nation. The advisory was for largescale and bridgelip sucker, mountain whitefish, channel catfish, northern pikeminnow, and common carp. DDT is a pesticide that was used in agriculture; its use was banned in the 1970s.

A Department of Ecology study completed in 2007 found erosion control projects put in place by Yakima basin irrigators helped reduce DDT and its byproducts in fish from the Yakima River. The state health department evaluated the new data and determined the fish advisories based on DDT levels are no longer needed. The declining levels of DDT in resident bottom fish from the river, along with proper cleaning and cooking, allow people to eat them safely without limits.

"Fish is an excellent low-fat food and a great source of protein, vitamins, and minerals," said State Health Officer Dr. Maxine Hayes. "It's important to include a variety of fish as part of a healthy diet. And while the news on DDT in Yakima River fish is good, we recently learned that PCBs in carp from the lower Yakima are high enough to warrant a meal limit. This is especially true for young children and women who might one day become pregnant."

"Yakima Valley irrigators really stepped up and deserve recognition for tackling a tough problem on one of Washington's great rivers," said Department of Ecology Director Jay Manning. "Like most watersheds, there's more work to be done, but this community has shown it can take on these types of challenges."

Data from the Ecology fish tissue study showed PCB levels in common carp in the lower section of the river indicate a need for a limit of one meal per week. This advisory includes carp taken from the lower Yakima River from the city of Prosser to the mouth near Richland.

PCB levels for other species sampled throughout the river system were below levels of health concern for people. Meanwhile, the statewide mercury advisory for women who are or might become pregnant, nursing mothers, and young children remains in effect. State health officials advise people in these groups not to eat northern pikeminnow, and to limit largemouth and smallmouth bass to two meals per month.

PCBs and mercury are long-lasting chemicals that are found worldwide. They can cause behavior and learning deficits in children exposed in the womb. Banned since 1977, PCBs were used as insulating fluid in electrical transformers, lubricants, and hydraulic fluids. Mercury occurs naturally but also comes from coal-fired electric plants and improper disposal of fluorescent bulbs, thermometers, thermostats, and electrical switches.

To reduce your exposure to PCBs in common carp from the Yakima River, the Department of Health recommends you:

- Limit your consumption of common carp caught from Prosser to the mouth of the river near Richland to no more than one meal per week.

- Cook and clean fish to reduce contaminants; remove fat, skin, and organs and allow fat to drip off during cooking. Filleting reduces PCB, but not mercury contamination.

Learn more about the Yakima River fish advisory, other fish consumption advisories, and healthy fish choices (www.doh.wa.gov/fish/) on the state health department Web site.

Appendix M. SPMD Data, 2007-08

Appendix M-1. SPMD Data for Spring 2007.

Sample No.	Field ID	Residue in SPMD (ng/sample)				Water Column Concentration (ng/L, dissolved)			
		Toxaphene		Total PCBs		Toxaphene		Total PCBs	
7234180	EASTON	50	UJ	95	J	0.077	UJ	0.084	U
7234181	EASTON BLANK	50	UJ	148	J	- -			J
7234182	TOWNE DIV	50	UJ	159	J	0.095	UJ	0.12	J
7244015	WILSON CR†	332	J	124	J	0.50	J	0.007	J
7234184	ROZA DAM	100	J	165	J	0.19	J	0.018	J
7234185	NACHES R	73	J	257	J	0.11	J	0.063	J
7234186	MOXEE	470		198	J	0.71		0.024	J
7234187	SUNNYSIDE	150	J	187	J	0.23	J	0.020	J
7234188	GRANGER	550	J	338	J	0.84	J	0.095	J
7234189	SULPHUR	1,900	J	418	J	2.96	J	0.16	J
7234190	SULPHUR REP	1,700	J	532	J	2.73	J	0.27	J
7234191	SULPHUR BLANK	50	U	150	J	- -		- -	
7234192	PROSSER	200		194	J	0.30		0.021	J
7234193	PROSSER REP	210	J	268	J	0.33	J	0.075	J
7234194	SPRING CR	270	J	198	J	0.42	J	0.024	J
7234195	HORN RAPIDS	240		246	J	0.36		0.045	J

Note: Dissolved PCB concentrations calculated after subtracting average field blank residue (149 ng).
*Laboratory blank for SPMD preparation prior to field deployment.
†Collected Spring 2008.
U = not detected.
UJ = not detected, reporting limit is an estimate.
J= estimated concentration.

Appendix M-2. SPMD Data for Winter 2007.

Sample No.	Field ID	Residue in SPMD (ng/sample)				Water Column Concentration (ng/L, dissolved)			
		Toxaphene		Total PCBs		Toxaphene		Total PCBs	
7484250	EASTON	50	U	136	J	0.083	U	0.11	J
7484251	EASTON BLANK	50	UJ	104	J	- -		- -	
7484252	TOWNE DIV	50	U	152	J	0.084	U	0.13	J
7484253	WILSON CR	78	J	128	J	0.12	J	0.084	J
7484254	ROZA DAM	50	U	120	J	0.081	U	0.086	J
7484255	NACHES R	50	UJ	119	J	0.084	UJ	0.099	J
7484256	MOXEE	88	J	146	J	0.14	J	0.11	J
7484257	SUNNYSIDE	66	J	116	J	0.10	J	0.065	J
7484258	GRANGER	190	J	249	J	0.30	J	0.15	J
7484259	SULPHUR	452	J	191	J	0.68	J	0.084	J
7484260	SULPHUR BLANK	50	UJ	108	J	- -		- -	
7484261	PROSSER	86	J	104	J	0.13	J	0.056	J
7484262	PROSSER REP	86	J	132	J	0.13	J	0.053	J
7484263	SPRING CR	110	J	138	J	0.19	J	0.12	J
7484264	HORN RAPIDS	68	J	124	J	0.10	J	0.063	J

Note: Dissolved PCB concentrations calculated after subtracting average field blank residue (106 ng).
*Laboratory blank for SPMD preparation prior to field deployment.
U = not detected.
UJ = not detected, reporting limit is an estimate.
J= estimated concentration.

Appendix N. Wastewater Treatment Plant Effluent Data, 2007-08

Sample No.	Field ID	Collection Date	Flow (mgd)	4,4'-DDD (ng/L)		4,4'-DDE (ng/L)		4,4'-DDT (ng/L)	
7248002	CLE ELUM WP	6/12/2007	0.460	na		na		na	
7248001	ELLENSBURG WP	6/12/2007	3.69	na		na		na	
7248014	ELLENSBURG REP	6/12/2007	- -	na		na		na	
7248000	KITTITAS WP	6/12/2007	0.212	na		na		na	
7238100	SELAH WP	6/7/2007	1.05	2.1	UJ	2.1	UJ	2.1	UJ
7238101	NACHES WP	6/7/2007	0.101	2.1	UJ	2.1	UJ	2.1	UJ
7238102	COWICHE WP	6/7/2007	0.176	2.0	UJ	2.0	UJ	2.0	UJ
7238103	YAKIMA WP	6/7/2007	11.9	2.1	UJ	2.1	UJ	2.1	UJ
7238118	YAKIMA REP	6/7/2007	- -	2.1	UJ	2.1	UJ	2.1	UJ
7248003	MOXEE WP	6/12/2007	0.175	2.0	UJ	2.0	UJ	2.0	UJ
7248004	BUENA WP	6/12/2007	0.750	2.0	UJ	2.0	UJ	2.0	UJ
7248005	ZILLAH WP	6/12/2007	0.240	2.1	UJ	2.1	UJ	2.1	UJ
7248006	GRANGER WP	6/12/2007	0.178	2.1	UJ	2.1	UJ	2.1	UJ
7248007	SUNNYSIDE WP	6/12/2007	1.07	2.0	UJ	2.0	UJ	2.0	UJ
7248008	SS PORT WP	6/12/2007	0.534	2.0	UJ	2.0	UJ	2.0	UJ
7248009	MABTON WP	6/12/2007	0.110	2.0	UJ	2.0	UJ	2.0	UJ
7248010	GRANDVIEW WP	6/12/2007	1.75	2.0	UJ	2.0	UJ	2.0	UJ
7248011	PROSSER WP	6/14/2007	0.918	2.2	UJ	2.2	UJ	2.2	UJ
7248012	BENTONC WP	6/14/2007	0.185	2.1	UJ	2.1	UJ	2.1	UJ
7248013	W RICHLAND	6/14/2007	0.581	2.1	UJ	2.1	UJ	2.1	UJ
7248015	TRNSFR BLANK	6/12/2007	- -	2.0	UJ	2.0	UJ	2.0	UJ
7388847	CLE ELUM WP	9/18/2007	0.380	na		na		na	
7388846	ELLENSBURG WP	9/18/2007	2.54	na		na		na	
7388845	KITTITAS WP	9/18/2007	0.252	na		na		na	
7388848	SELAH WP	9/20/2007	1.05	5.1	UJ	5.1	UJ	5.1	UJ
7388849	NACHES WP	9/20/2007	0.112	5.0	UJ	5.0	UJ	5.0	UJ
7388850	COWICHE WP	9/20/2007	0.165	5.1	UJ	5.1	UJ	5.1	UJ
7388851	YAKIMA WP	9/20/2007	12.8	5.1	UJ	5.1	UJ	5.1	UJ
7398827	MOXEE WP	9/25/2007	0.170	4.9	UJ	4.9	UJ	4.9	UJ
7398828	BUENA WP	9/25/2007	0.080	5.2	UJ	5.2	UJ	5.2	UJ
7398829	ZILLAH WP	9/25/2007	0.222	5.3	U	5.3	UJ	5.3	U
7398830	GRANGER WP	9/25/2007	0.193	5.1	U	5.1	UJ	5.1	U
7398834	SUNNYSIDE WP	9/25/2007	1.16	5.1	UJ	5.1	UJ	5.1	UJ
7398839	SUNYSIDE REP	9/25/2007	- -	5.2	UJ	5.2	UJ	5.2	UJ
7398835	SS PORT WP	9/25/2007	1.39	5.1	UJ	5.1	UJ	5.1	UJ
7398837	MABTON WP	9/25/2007	0.114	5.1	U	5.1	UJ	5.1	U
7398836	GRANDVIEW WP	9/25/2007	1.42	5.2	UJ	5.2	UJ	5.2	UJ
7398831	PROSSER WP	9/27/2007	0.956	5.3	UJ	5.3	UJ	5.3	UJ
7398832	BENTON WP	9/27/2007	0.189	5.4	UJ	5.4	UJ	5.4	UJ
7398833	W RICHLAND	9/27/2007	0.956	5.5	UJ	5.5	UJ	5.5	UJ
7398838	W RICHLAND REP	9/27/2007	- -	5.5	UJ	5.5	UJ	5.5	UJ
7398840	TRNSFR BLANK			na		na		na	
7'398841	BOTTLE BLNK			na		na		na	

U = not detected at or above reported value J = estimated REJ = rejected na = not analyzed LS = lost in shipment

Field ID	Collection Date	Dieldrin (ng/L)		Chlorpyrifos (ng/L)		Endosulfan I (ng/L)		Endosulfan II (ng/L)		Endosulfan Sulfate (ng/L)	
CLE ELUM WP	6/12/2007	na		na		na		na		na	
ELLENSBURG WP	6/12/2007	na		na		na		na		na	
ELLENSBURG REP	6/12/2007	na		na		na		na		na	
KITTITAS WP	6/12/2007	na		na		na		na		na	
SELAH WP	6/7/2007	2.1	U	2.1	U	2.1	U	2.1	U	2.7	J
NACHES WP	6/7/2007	2.1	U	2.1	U	2.1	U	2.1	U	3.5	J
COWICHE WP	6/7/2007	2.0	U	8.7	J	2.0	U	12		29	J
YAKIMA WP	6/7/2007	2.1	U	5.3		2.1	U	2.1	U	2.1	U
YAKIMA REP	6/7/2007	2.1	U	6.1		2.1	U	2.1	U	2.1	U
MOXEE WP	6/12/2007	2.0	U	3.2		2.0	U	2.0	U	2.7	J
BUENA WP	6/12/2007	2.0	U	2.2	J	2.0	U	2.0	U	6.7	J
ZILLAH WP	6/12/2007	2.1	U	4.2		2.1	U	2.1	U	5.4	J
GRANGER WP	6/12/2007	2.1	U	4.1		2.1	U	2.1	U	8.0	J
SUNNYSIDE WP	6/12/2007	2.0	U	2.0	J	2.0	U	2.0	U	4.5	J
SS PORT WP	6/12/2007	2.0	UJ	2.0	UJ	2.0	UJ	2.0	UJ	2.5	J
MABTON WP	6/12/2007	2.0	U	2.4	J	2.0	U	2.0	U	6.7	J
GRANDVIEW WP	6/12/2007	2.0	U	2	U	2	U	2.0	U	2.0	J
PROSSER WP	6/14/2007	2.2	U	2.2	U	2.2	U	2.2	U	2.2	U
BENTONC WP	6/14/2007	2.1	U	2.1	U	2.1	U	2.1	U	3.3	J
W RICHLAND	6/14/2007	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U
TRNSFR BLANK	6/12/2007	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
CLE ELUM WP	9/18/2007	na		na		na		na		na	
ELLENSBURG WP	9/18/2007	na		na		na		na		na	
KITTITAS WP	9/18/2007	na		na		na		na		na	
SELAH WP	9/20/2007	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U
NACHES WP	9/20/2007	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
COWICHE WP	9/20/2007	5.1	U	5.1	U	5.1	U	33		12	
YAKIMA WP	9/20/2007	5.1	U	7.2	UJ	5.1	U	5.1	U	5.1	U
MOXEE WP	9/25/2007	4.9	UJ	4.9	UJ	4.9	UJ	4.9	UJ	4.9	UJ
BUENA WP	9/25/2007	5.2	U	5.2	U	5.2	U	5.2	U	5.2	U
ZILLAH WP	9/25/2007	5.3	U	5.3	U	5.3	U	5.3	U	16	
GRANGER WP	9/25/2007	5.1	U	5.1	U	5.1	U	5.1	U	7.1	
SUNNYSIDE WP	9/25/2007	5.1	U	5.1	U	5.1	U	5.1	U	8.3	
SUNYSIDE REP	9/25/2007	5.2	U	5.2	U	5.2	U	5.2	U	5.8	J
SS PORT WP	9/25/2007	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ
MABTON WP	9/25/2007	5.1	U	5.1	U	5.1	U	5.1	U	8.4	
GRANDVIEW WP	9/25/2007	5.2	U	5.2	U	5.2	U	5.2	U	5.2	U
PROSSER WP	9/27/2007	5.3	U	5.3	U	5.3	U	5.3	U	5.3	U
BENTON WP	9/27/2007	5.4	U	5.4	U	5.4	U	5.4	U	5.4	U
W RICHLAND	9/27/2007	5.5	U	5.5	U	5.5	U	5.5	U	5.5	U
W RICHLAND REP	9/27/2007	5.5	U	5.5	U	5.5	U	5.5	U	5.5	U
TRNSFR BLANK		na		na		na		na		na	
BOTTLE BLNK		na		na		na		na		na	

U = not detected at or above reported value J = estimated REJ = rejected na = not analyzed LS = lost in shipment

Field ID	Collection Date	Cis-Chlordane (ng/L)		Cis-Nonachlor (ng/L)		Trans-Chlordane (ng/L)		Trans-Nonachlor (ng/L)		Oxychlordane (ng/L)	
CLE ELUM WP	6/12/2007	na		na		na		na		na	
ELENSBURG WP	6/12/2007	na		na		na		na		na	
ELENSBRG REP	6/12/2007	na		na		na		na		na	
KITTITAS WP	6/12/2007	na		na		na		na		na	
SELAH WP	6/7/2007	2.1	UJ	2.1	UJ	2.1	UJ	2.1	UJ	2.1	UJ
NACHES WP	6/7/2007	2.1	UJ	2.1	UJ	2.1	UJ	2.1	UJ	2.1	UJ
COWICHE WP	6/7/2007	2.0	UJ	2.0	UJ	2.0	UJ	2.0	UJ	2.0	UJ
YAKIMA WP	6/7/2007	2.1	UJ	2.1	UJ	2.1	UJ	2.1	UJ	2.1	UJ
YAKIMA REP	6/7/2007	2.1	UJ	2.1	UJ	2.1	UJ	2.1	UJ	2.1	UJ
MOXEE WP	6/12/2007	2.0	UJ	2.0	UJ	2.0	UJ	2.0	UJ	2.0	UJ
BUENA WP	6/12/2007	2.0	UJ	2.0	UJ	2.0	UJ	2.0	UJ	2.0	UJ
ZILLAH WP	6/12/2007	2.1	UJ	2.1	UJ	2.1	UJ	2.1	UJ	2.1	UJ
GRANGER WP	6/12/2007	2.1	UJ	2.1	UJ	2.1	UJ	2.1	UJ	2.1	UJ
SUNNYSIDE WP	6/12/2007	2.0	UJ	2.0	UJ	2.0	UJ	2.0	UJ	2.0	UJ
SS PORT WP	6/12/2007	2.0	UJ	2.0	UJ	2.0	UJ	2.0	UJ	2.0	UJ
MABTON WP	6/12/2007	2.0	UJ	2.0	UJ	2.0	UJ	2.0	UJ	2.0	UJ
GRANDVIEW WP	6/12/2007	2.0	UJ	2.0	UJ	2.0	UJ	2.0	UJ	2.0	UJ
PROSSER WP	6/14/2007	2.2	UJ	2.2	UJ	2.2	UJ	2.2	UJ	2.2	UJ
BENTONC WP	6/14/2007	2.1	UJ	2.1	UJ	2.1	UJ	2.1	UJ	2.1	UJ
W RICHLAND WP	6/14/2007	2.1	UJ	2.1	UJ	2.1	UJ	2.1	UJ	2.1	UJ
TRNSFR BLNK	6/12/2007	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
CLE ELUM WP	9/18/2007	na		na		na		na		na	
ELENSBURG WP	9/18/2007	na		na		na		na		na	
KITTITAS WP	9/18/2007	na		na		na		na		na	
SELAH WP	9/20/2007	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ
NACHES WP	9/20/2007	5.0	UJ	5.0	UJ	5.0	UJ	5.0	UJ	5.0	UJ
COWICHE WP	9/20/2007	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ
YAKIMA WP	9/20/2007	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ
MOXEE WP	9/25/2007	4.9	UJ	4.9	UJ	4.9	UJ	4.9	UJ	4.9	UJ
BUENA WP	9/25/2007	5.2	UJ	5.2	UJ	5.2	UJ	5.2	UJ	5.2	UJ
ZILLAH WP	9/25/2007	5.3	U	5.3	U	5.3	U	5.3	U	5.3	U
GRANGER WP	9/25/2007	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U
SUNNYSIDE WP	9/25/2007	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ
SUNYSIDE REP	9/25/2007	5.2	UJ	5.2	UJ	5.2	UJ	5.2	UJ	5.2	UJ
SS PORT WP	9/25/2007	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ
MABTON WP	9/25/2007	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U
GRANDVIEW WP	9/25/2007	5.2	UJ	5.2	UJ	5.2	UJ	5.2	UJ	5.2	UJ
PROSSER WP	9/27/2007	5.3	UJ	5.3	UJ	5.3	UJ	5.3	UJ	5.3	UJ
BENTON WP	9/27/2007	5.4	UJ	5.4	UJ	5.4	UJ	5.4	UJ	5.4	UJ
W RICHLAND WP	9/27/2007	5.5	UJ	5.5	UJ	5.5	UJ	5.5	UJ	5.5	UJ
W RICHLAND REP	9/27/2007	5.5	UJ	5.5	UJ	5.5	UJ	5.5	UJ	5.5	UJ
TRNSFR BLANK		na		na		na		na		na	
BOTTLE BLANK		na		na		na		na		na	

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Field ID	Collection Date	Chlordane (technical) (ng/L)		Toxaphene (ng/L)		Alpha-BHC (ng/L)		Beta-BHC (ng/L)		Delta-BHC (ng/L)		Lindane (ng/L)	
CLE ELUM WP	6/12/2007	na		na		na		na		na		na	
ELLENSBURG WP	6/12/2007	na		na		na		na		na		na	
ELLENSBURG REP	6/12/2007	na		na		na		na		na		na	
KITTITAS WP	6/12/2007	na		na		na		na		na		na	
SELAH WP	6/7/2007	26.0	UJ	26	UJ	2.1	UJ	2.1	UJ	2.1	UJ	2.1	UJ
NACHES WP	6/7/2007	26.0	UJ	26	UJ	2.1	UJ	2.1	UJ	2.1	UJ	2.1	UJ
COWICHE WP	6/7/2007	25.0	UJ	25	UJ	2.0	UJ	2.0	UJ	2.0	UJ	2.0	UJ
YAKIMA WP	6/7/2007	26.0	UJ	26	UJ	2.1	UJ	2.5	UJ	2.1	UJ	2.1	UJ
YAKIMA REP	6/7/2007	26.0	UJ	26	UJ	2.1	UJ	3.0	UJ	2.1	UJ	2.1	UJ
MOXEE WP	6/12/2007	25.0	UJ	25	UJ	2.0	UJ	2.0	UJ	2.0	UJ	2.0	UJ
BUENA WP	6/12/2007	25.0	UJ	25	UJ	2.0	UJ	2.0	UJ	2.0	UJ	2.0	UJ
ZILLAH WP	6/12/2007	26.0	UJ	26	UJ	2.1	UJ	2.1	UJ	2.1	UJ	2.1	UJ
GRANGER WP	6/12/2007	26.0	UJ	26	UJ	2.1	UJ	2.1	UJ	2.1	UJ	2.1	UJ
SUNNYSIDE WP	6/12/2007	25.0	UJ	25	UJ	2.0	UJ	2.0	UJ	2.0	UJ	2.0	UJ
SS PORT WP	6/12/2007	26.0	UJ	26	UJ	2.0	UJ	2.0	UJ	2.0	UJ	2.0	UJ
MABTON WP	6/12/2007	25.0	UJ	25	UJ	2.0	UJ	2.0	UJ	2.0	UJ	2.0	UJ
GRANDVIEW WP	6/12/2007	25.0	UJ	25	UJ	2.0	UJ	2.0	UJ	2.0	UJ	2.0	UJ
PROSSER WP	6/14/2007	27.0	UJ	27	UJ	2.2	UJ	2.2	UJ	2.2	UJ	2.2	UJ
BENTONC WP	6/14/2007	26.0	UJ	26	UJ	2.1	UJ	2.1	UJ	2.1	UJ	2.1	UJ
W RICHLAND	6/14/2007	26.0	UJ	26	UJ	2.1	UJ	2.1	UJ	2.1	UJ	2.1	UJ
TRNSFR BLANK	6/12/2007	25.0	UJ	25	UJ	2.0	UJ	2.0	UJ	2.0	UJ	2.0	UJ
CLE ELUM WP	9/18/2007	na		na		na		na		na		na	
ELLENSBURG WP	9/18/2007	na		na		na		na		na		na	
KITTITAS WP	9/18/2007	na		na		na		na		na		na	
SELAH WP	9/20/2007	na		26	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ
NACHES WP	9/20/2007	na		25	UJ	5.0	UJ	5.0	UJ	5.0	UJ	5.0	UJ
COWICHE WP	9/20/2007	na		25	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ
YAKIMA WP	9/20/2007	na		26	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ
MOXEE WP	9/25/2007	na		25	UJ	4.9	UJ	4.9	UJ	4.9	UJ	4.9	UJ
BUENA WP	9/25/2007	na		26	UJ	5.2	UJ	5.2	UJ	5.2	UJ	5.2	UJ
ZILLAH WP	9/25/2007	na		26	U	5.3	U	5.3	U	5.3	UJ	5.3	U
GRANGER WP	9/25/2007	na		25	U	5.1	U	5.1	U	5.1	UJ	5.1	U
SUNNYSIDE WP	9/25/2007	na		26	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ
SUNYSIDE REP	9/25/2007	na		26	UJ	5.2	UJ	5.2	UJ	5.2	UJ	5.2	UJ
SS PORT WP	9/25/2007	na		26	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ
MABTON WP	9/25/2007	na		26	U	5.1	U	5.1	U	5.1	UJ	5.1	U
GRANDVIEW WP	9/25/2007	na		26	UJ	5.2	UJ	5.2	UJ	5.2	UJ	5.2	UJ
PROSSER WP	9/27/2007	na		26	UJ	5.3	UJ	5.3	UJ	5.3	UJ	5.3	UJ
BENTON WP	9/27/2007	na		27	UJ	5.4	UJ	5.4	UJ	5.4	UJ	5.4	UJ
W RICHLAND	9/27/2007	na		27	UJ	5.5	UJ	5.5	UJ	5.5	UJ	5.5	UJ
W RICHLAND REP	9/27/2007	na		27	UJ	5.5	UJ	5.5	UJ	5.5	UJ	5.5	UJ
TRNSFR BLANK		na		na		na		na		na		na	
BOTTLE BLNK		na		na		na		na		na		na	

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Field ID	Collection Date	Aldrin (ng/L)		Endrin (ng/L)		Endrin Aldehyde (ng/L)		Endrin Ketone (ng/L)		Heptachlor (ng/L)		Heptachlor Epoxide (ng/L)	
CLE ELUM WP	6/12/2007	na		na		na		na		na		na	
ELLENSBURG WP	6/12/2007	na		na		na		na		na		na	
ELLENSBURG REP	6/12/2007	na		na		na		na		na		na	
KITTITAS WP	6/12/2007	na		na		na		na		na		na	
SELAH WP	6/7/2007	2.1	U	2.1	U	2.1	UJ	2.1	U	2.1	UJ	2.1	U
NACHES WP	6/7/2007	2.1	U	2.1	U	2.1	U	2.1	U	2.1	UJ	2.1	U
COWICHE WP	6/7/2007	2.0	U	2.0	U	2.0	UJ	2.0	U	2.0	UJ	2.0	U
YAKIMA WP	6/7/2007	2.1	U	2.1	UJ	2.1	UJ	2.1	U	2.1	UJ	2.1	U
YAKIMA REP	6/7/2007	2.1	U	2.2	UJ	2.1	UJ	2.1	U	2.1	UJ	2.1	U
MOXEE WP	6/12/2007	2.0	U	2.0	U	2.0	UJ	2.0	U	2.0	UJ	2.0	U
BUENA WP	6/12/2007	2.0	U	2.0	U	2.0	UJ	2.0	U	2.0	UJ	2.0	U
ZILLAH WP	6/12/2007	2.1	U	2.1	U	2.1	UJ	2.1	U	2.1	UJ	2.1	U
GRANGER WP	6/12/2007	2.1	U	2.1	U	2.1	UJ	2.1	U	2.1	UJ	2.1	U
SUNNYSIDE WP	6/12/2007	2.0	U	2.0	U	2.0	UJ	2.0	U	2.0	UJ	2.0	U
SS PORT WP	6/12/2007	2.0	UJ	2.0	UJ	2.0	UJ	2.0	UJ	2.0	UJ	2.0	UJ
MABTON WP	6/12/2007	2.0	U	2.0	U	2.0	UJ	2.0	U	2.0	UJ	2.0	U
GRANDVIEW WP	6/12/2007	2.0	U	2.0	U	2.0	UJ	2.0	U	2.0	UJ	2.0	U
PROSSER WP	6/14/2007	2.2	U	2.2	U	2.2	UJ	2.2	U	2.2	UJ	2.2	U
BENTONC WP	6/14/2007	2.1	U	2.1	U	2.1	UJ	2.1	U	2.1	UJ	2.1	U
W RICHLAND	6/14/2007	2.1	U	2.1	U	2.1	UJ	2.1	U	2.1	UJ	2.1	U
TRNSFR BLANK	6/12/2007	2.0	U	2.0	U	2.0	UJ	2.0	U	2.0	UJ	2.0	U
CLE ELUM WP	9/18/2007	na		na		na		na		na		na	
ELLENSBURG WP	9/18/2007	na		na		na		na		na		na	
KITTITAS WP	9/18/2007	na		na		na		na		na		na	
SELAH WP	9/20/2007	5.1	U	5.1	U	5.1	U	5.1	U	5.1	UJ	5.1	U
NACHES WP	9/20/2007	5.0	U	5.0	U	5.0	U	5.0	U	5.0	UJ	5.0	U
COWICHE WP	9/20/2007	5.1	U	5.1	U	5.1	U	5.1	U	5.1	UJ	5.1	U
YAKIMA WP	9/20/2007	5.1	U	5.1	U	5.1	U	5.1	U	5.1	UJ	5.1	U
MOXEE WP	9/25/2007	4.9		4.9	UJ	4.9	UJ	4.9	UJ	4.9	UJ	4.9	UJ
BUENA WP	9/25/2007	5.2	U	5.2	U	5.2	UJ	5.2	U	5.2	UJ	5.2	U
ZILLAH WP	9/25/2007	5.3	U	5.3	U	5.3	UJ	5.3	U	5.3	U	5.3	U
GRANGER WP	9/25/2007	5.1	U	5.1	U	5.1	UJ	5.1	U	5.1	U	5.1	U
SUNNYSIDE WP	9/25/2007	5.1	U	5.1	U	5.1	UJ	5.1	U	5.1	UJ	5.1	U
SUNYSIDE REP	9/25/2007	5.2	U	5.2	U	5.2	UJ	5.2	U	5.2	UJ	5.2	U
SS PORT WP	9/25/2007	5.1		5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ
MABTON WP	9/25/2007	5.1	U	5.1	U	5.1	UJ	5.1	U	5.1	U	5.1	U
GRANDVIEW WP	9/25/2007	5.2	U	5.2	U	5.2	UJ	5.2	U	5.2	UJ	5.2	U
PROSSER WP	9/27/2007	5.3	U	5.3	U	5.3	U	5.3	U	5.3	UJ	5.3	U
BENTON WP	9/27/2007	5.4	U	5.4	U	5.4	U	5.4	U	5.4	UJ	5.4	U
W RICHLAND	9/27/2007	5.5	U	5.5	U	5.5	U	5.5	U	5.5	UJ	5.5	U
W RICHLAND REP	9/27/2007	5.5	U	5.5	U	5.5	U	5.5	U	5.5	UJ	5.5	U
TRNSFR BLANK		na		na		na		na		na		na	
BOTTLE BLNK		na		na		na		na		na		na	

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Field ID	Collection Date	Hexachloro-benzene (ng/L)		Methoxychlor (ng/L)		T-PCBs (pg/L)		Total Suspended Solids (mg/L)		Turbidity (NTU)		Conductivity (umhos/cm)	
CLE ELUM WP	6/12/2007	na		na		719	J	5		2.7		412	
ELLENSBURG WP	6/12/2007	na		na		192	J	4		1.8		381	
ELLENSBURG REP	6/12/2007	na		na		97	J	4		1.9		382	
KITTITAS WP	6/12/2007	na		na		42	J	3		1.7		439	
SELAH WP	6/7/2007	2.1	UJ	2.1	U	7,360		7		2.9		849	
NACHES WP	6/7/2007	2.1	UJ	2.1	U	40	UJ	2		2.1		298	
COWICHE WP	6/7/2007	2.0	UJ	2.0	U	40	UJ	1		1.5		685	
YAKIMA WP	6/7/2007	2.1	UJ	2.1	U	798	J	5		3.7		536	
YAKIMA REP	6/7/2007	2.1	UJ	2.1	U	na		5		3.0		534	
MOXEE WP	6/12/2007	2.0	UJ	2.0	U	47	J	3		2.1		588	
BUENA WP	6/12/2007	2.0	UJ	2.0	U	285	J	7		3.8		743	
ZILLAH WP	6/12/2007	2.1	UJ	2.1	U	403	J	10		4.5		1100	
GRANGER WP	6/12/2007	2.1	UJ	2.1	U	253	J	2		1.5		726	
SUNNYSIDE WP	6/12/2007	2.0	UJ	2.0	U	747	J	2		1.1		801	
SS PORT WP	6/12/2007	2.0	UJ	2.0	UJ	601	J	555		190		2440	
MABTON WP	6/12/2007	2.0	UJ	2.0	UJ	31	J	5		1.7		857	
GRANDVIEW WP	6/12/2007	2.0	UJ	2.0	U	50	UJ	23		8.9		1080	
PROSSER WP	6/14/2007	2.2	UJ	2.2	U	406	J	7		4.0		914	
BENTONC WP	6/14/2007	2.1	UJ	2.1	U	44	J	2		1.2		1260	
W RICHLAND	6/14/2007	2.1	UJ	2.1	U	97	J	3		1.6		963	
TRNSFR BLANK	6/12/2007	2.0	UJ	2.0	U	115	J	na		na		na	
CLE ELUM WP	9/18/2007	na		na		262	J	2		1.7		330	
ELLENSBURG WP	9/18/2007	na		na		318	J	2		1.6		374	
KITTITAS WP	9/18/2007	na		na		143	J	2		0.9		432	
SELAH WP	9/20/2007	5.1	UJ	5.1	U	246	J	11		4.0		868	
NACHES WP	9/20/2007	5.0	UJ	5.0	U	245	J	14		4.4		304	
COWICHE WP	9/20/2007	5.1	UJ	5.1	U	276	J	1		1.4		684	
YAKIMA WP	9/20/2007	5.1	UJ	5.1	U	856	J	7		4.0		515	
MOXEE WP	9/25/2007	4.9	UJ	4.9	UJ	387	J	5		3.8		620	
BUENA WP	9/25/2007	5.2	UJ	5.2	U	288	J	2		1.9		740	
ZILLAH WP	9/25/2007	5.3	U	5.3	U	223	J	3		1.9		1190	
GRANGER WP	9/25/2007	5.1	U	5.1	U	226	J	2		1.2		709	
SUNNYSIDE WP	9/25/2007	5.1	UJ	5.1	U	475	J	2		1.5		830	
SUNYSIDE REP	9/25/2007	5.2	UJ	5.2	U	523	J	2		1.5		828	
SS PORT WP	9/25/2007	5.1	UJ	5.1		163	J	77		22		3160	
MABTON WP	9/25/2007	5.1	U	5.1	U	304	J	3		2.1		672	
GRANDVIEW WP	9/25/2007	5.2	UJ	5.2	U	153	J	65		3.3		1140	
PROSSER WP	9/27/2007	5.3	UJ	5.3	U	375	J	6		3.6		987	
BENTON WP	9/27/2007	5.4	UJ	6.8	UJ	335	J	2		1.2		1240	
W RICHLAND	9/27/2007	5.5	UJ	5.5	U	319	J	6		3.1		1010	
W RICHLAND REP	9/27/2007	5.5	UJ	7.7	UJ	203	J	6		2.0		1010	
TRNSFR BLANK		na		na		10	UJ	na		na		na	
BOTTLE BLNK		na		na		133	J	na		na		na	

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Sample No.	Field ID	Collection Date	Flow (mgd)	4,4'-DDD (ng/L)		4,4'-DDE (ng/L)		4,4'-DDT (ng/L)	
7508100	CLE ELUM WP	12/13/2007	0.471	na		na		na	
7508102	ELLENSBURG WP	12/13/2007	3.239	na		na		na	
7508101	KITTITAS WP	12/13/2007	0.142	na		na		na	
7508103	SELAH WP	12/13/2007	1.347	2.5	UJ	2.5	UJ	2.5	UJ
7508107	SELAH REP	12/13/2007	- -	2.6	UJ	2.6	UJ	2.6	UJ
7508104	NACHES WP	12/12/2007	0.0697	2.5	UJ	2.5	UJ	2.5	UJ
7508105	COWICHE WP	12/12/2007	0.1057	2.6	UJ	2.6	UJ	2.6	UJ
7508106	YAKIMA WP	12/12/2007	9.82	2.7	UJ	2.7	UJ	2.7	UJ
7518105	MOXEE WP	12/18/2007	0.1515	2.5	UJ	2.5	UJ	2.5	UJ
7518103	BUENA WP	12/18/2007	0.080	2.6	UJ	2.6	UJ	2.6	UJ
7518104	ZILLAH WP	12/18/2007	0.2522	2.5	UJ	2.5	UJ	2.5	UJ
7518106	GRANGER WP	12/18/2007	0.171	2.5	UJ	2.5	UJ	2.5	UJ
7518107	SUNNYSIDE WP	12/18/2007	1.100	2.6	UJ	2.6	UJ	2.6	UJ
7518108	SS PORT WP	12/18/2007	0.3097	REJ		REJ		REJ	
7518110	MABTON WP	12/18/2007	0.175	2.7	UJ	2.7	UJ	2.7	UJ
7518109	GRANDVIEW WP	12/18/2007	1.41	2.5	UJ	2.5	UJ	2.5	UJ
7518114	GRANDVIEW	12/18/2007	- -	2.5	UJ	2.5	UJ	2.5	UJ
7518111	PROSSER WP	12/20/2007	0.565	2.6	UJ	2.6	UJ	2.6	UJ
7518112	BENTONC WP	12/20/2007	0.230	2.6	UJ	2.6	UJ	2.6	UJ
7518113	W RICHLAND	12/20/2007	0.549	2.6	UJ	2.6	UJ	2.6	UJ
7518116	BOTTLE BLNK	12/18/2007	- -	2.6	U	2.6	U	2.6	U
7518115	TRNSFR BLANK	12/18/2007	- -	2.5	U	2.5	U	2.5	U
8118825	CLE ELUM WP	3/11/2008	1.315	na		na		na	
8118827	ELLENSBURG WP	3/11/2008	2.750	na		na		na	
8118826	KITTITAS WP	3/11/2008	0.129	na		na		na	
8118828	SELAH WP	3/11/2008	1.132	2.6	U	2.6	U	2.6	U
8118829	NACHES WP	3/13/2008	0.054	2.6	U	2.6	U	2.6	U
8118830	COWICHE WP	3/13/2008	0.211	2.5	U	2.5	U	2.5	U
8118831	YAKIMA WP	3/13/2008	9.240	2.5	U	2.5	U	2.5	U
8118832	YAKIMA REP	3/13/2008	- -	2.6	U	2.6	U	2.6	U
8128840	MOXEE WP	3/18/2008	0.151	2.6	U	2.6	U	2.6	U
8128838	BUENA WP	3/18/2008	0.074	2.6	U	2.6	U	2.6	U
8128839	ZILLAH WP	3/18/2008	0.215	2.6	UJ	2.6	UJ	2.6	UJ
8128841	GRANGER WP	3/18/2008	0.172	2.6	U	2.6	U	2.6	U
8128842	SUNNYSIDE WP	3/18/2008	1.067	2.6	U	2.6	U	2.6	U
8128843	SS PORT WP	3/18/2008	0.538	2.6	UJ	2.6	UJ	2.6	UJ
8128845	MABTON WP	3/18/2008	1.270	2.6	UJ	2.6	UJ	2.6	UJ
8128844	GRANDVIEW WP	3/18/2008	1.080	2.6	U	2.6	U	2.6	U
8128846	PROSSER WP	3/20/2008	0.652	2.6	UJ	2.6	UJ	2.6	UJ
8128849	PROSSER REP	3/20/2008	- -	2.6	U	2.6	U	2.6	U
8128847	BENTONC WP	3/20/2008	0.225	2.6	U	2.6	U	2.6	U
8128848	W RICHLAND	3/20/2008	0.523	2.6	U	2.6	U	2.6	U
8128850	TRNSFR BLANK	3/20/2008	- -	2.6	UJ	2.6	UJ	2.6	UJ
8128851	BOTTLE BLANK	3/20/2008		na		na		na	

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Field ID	Collection Date	Dieldrin (ng/L)		Chlorpyrifos (ng/L)		Endosulfan I (ng/L)		Endosulfan II (ng/L)		Endosulfan Sulfate (ng/L)	
CLE ELUM WP	12/13/2007	na		na		na		na		na	
ELLENSBURG WP	12/13/2007	na		na		na		na		na	
KITTITAS WP	12/13/2007	na		na		na		na		na	
SELAH WP	12/13/2007	2.5	U	2.5	U	2.5	U	3.1		6.1	
SELAH REP	12/13/2007	2.6	U	2.6	U	2.6	U	2.9		6.3	
NACHES WP	12/12/2007	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U
COWICHE WP	12/12/2007	2.6	U	6.7	J	2.9	J	25		21	
YAKIMA WP	12/12/2007	2.7	U	3.3	J	2.7	U	5.4		4.4	J
MOXEE WP	12/18/2007	2.5	U	3.7	J	2.5	U	2.5	U	2.5	U
BUENA WP	12/18/2007	2.6	U	2.6	U	2.6	U	2.6	U	4.5	J
ZILLAH WP	12/18/2007	2.5	U	3.7		2.5	U	2.5	U	6.7	J
GRANGER WP	12/18/2007	2.5	U	5.7	J	2.5	U	2.5	U	2.5	U
SUNNYSIDE WP	12/18/2007	2.6	U	4.8	J	2.6	U	2.6	U	6.2	J
SS PORT WP	12/18/2007	REJ		REJ		REJ		REJ		REJ	
MABTON WP	12/18/2007	2.7	U	2.7	J	2.7	U	2.7	U	2.7	U
GRANDVIEW WP	12/18/2007	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ	3.2	J
GRANDVIEW	12/18/2007	2.5	U	2.5	U	2.5	U	2.5	U	3.1	J
PROSSER WP	12/20/2007	2.6	U	2.6	U	2.6	U	2.6	U	2.6	U
BENTONC WP	12/20/2007	2.6	U	2.6	U	2.6	U	2.6	U	2.6	U
W RICHLAND	12/20/2007	2.6	U	2.6	J	2.6	U	2.6	U	2.6	U
BOTTLE BLNK	12/18/2007	2.6	U	2.6	U	2.6	U	2.6	U	2.6	U
TRNSFR BLANK	12/18/2007	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U
CLE ELUM WP	3/11/2008	na		na		na		na		na	
ELLENSBURG WP	3/11/2008	na		na		na		na		na	
KITTITAS WP	3/11/2008	na		na		na		NA		na	
SELAH WP	3/11/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	4.8	J
NACHES WP	3/13/2008	2.6	U	2.6	U	2.6	U	2.6	U	2.6	U
COWICHE WP	3/13/2008	2.5	U	3.6	J	6.3		32		17	
YAKIMA WP	3/13/2008	2.5	UJ	3.9	J	38	J	7.8	J	4.5	J
YAKIMA REP	3/13/2008	2.6	UJ	2.6	UJ	37	J	8.0	J	5.2	J
MOXEE WP	3/18/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
BUENA WP	3/18/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
ZILLAH WP	3/18/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
GRANGER WP	3/18/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
SUNNYSIDE WP	3/18/2008	2.6	UJ	11	J	2.6	UJ	2.6	UJ	2.6	UJ
SS PORT WP	3/18/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
MABTON WP	3/18/2008	2.6	UJ	9.5	J	3.3	J	2.6	UJ	2.6	UJ
GRANDVIEW WP	3/18/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
PROSSER WP	3/20/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
PROSSER REP	3/20/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
BENTONC WP	3/20/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
W RICHLAND	3/20/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
TRNSFR BLANK	3/20/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
BOTTLE BLANK	3/20/2008	na		na		na		na		na	

U = not detected at or above reported value J = estimated REJ = rejected na = not analyzed LS = lost in shipment

Field ID	Collection Date	Cis-Chlordane (ng/L)		Cis-Nonachlor (ng/L)		Trans-Chlordane (ng/L)		Trans-Nonachlor (ng/L)		Oxychlordane (ng/L)	
CLE ELUM WP	12/13/2007	na		na		na		na		na	
ELLENSBURG WP	12/13/2007	na		na		na		na		na	
KITTITAS WP	12/13/2007	na		na		na		na		na	
SELAH WP	12/13/2007	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
SELAH REP	12/13/2007	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
NACHES WP	12/12/2007	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
COWICHE WP	12/12/2007	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
YAKIMA WP	12/12/2007	2.7	UJ	2.7	UJ	2.7	UJ	2.7	UJ	2.7	UJ
MOXEE WP	12/18/2007	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
BUENA WP	12/18/2007	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
ZILLAH WP	12/18/2007	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
GRANGER WP	12/18/2007	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
SUNNYSIDE WP	12/18/2007	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
SS PORT WP	12/18/2007	REJ		REJ		REJ		REJ		REJ	
MABTON WP	12/18/2007	2.7	UJ	2.7	UJ	2.7	UJ	2.7	UJ	2.7	UJ
GRANDVIEW WP	12/18/2007	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
GRANDVIEW	12/18/2007	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
PROSSER WP	12/20/2007	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
BENTONC WP	12/20/2007	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
W RICHLAND	12/20/2007	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
BOTTLE BLNK	12/18/2007	2.6	U	2.6	U	2.6	U	2.6	U	2.6	U
TRNSFR BLANK	12/18/2007	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U
CLE ELUM WP	3/11/2008	na		na		na		na		na	
ELLENSBURG WP	3/11/2008	na		na		na		na		na	
KITTITAS WP	3/11/2008	na		na		na		na		na	
SELAH WP	3/11/2008	2.6	U	2.6	U	2.6	U	2.6	U	2.6	U
NACHES WP	3/13/2008	2.6	U	2.6	U	2.6	U	2.6	U	2.6	U
COWICHE WP	3/13/2008	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U
YAKIMA WP	3/13/2008	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U
YAKIMA REP	3/13/2008	2.6	U	2.6	U	2.6	U	2.6	U	2.6	U
MOXEE WP	3/18/2008	2.6	U	2.6	U	2.6	U	2.6	U	2.6	U
BUENA WP	3/18/2008	2.6	U	2.6	U	2.6	U	2.6	U	2.6	U
ZILLAH WP	3/18/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
GRANGER WP	3/18/2008	2.6	U	2.6	U	2.6	U	2.6	U	2.6	U
SUNNYSIDE WP	3/18/2008	2.6	U	2.6	U	2.6	U	2.6	U	2.6	U
SS PORT WP	3/18/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
MABTON WP	3/18/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
GRANDVIEW WP	3/18/2008	2.6	U	2.6	U	2.6	U	2.6	U	2.6	U
PROSSER WP	3/20/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
PROSSER REP	3/20/2008	2.6	U	2.6	U	2.6	U	2.6	U	2.6	U
BENTONC WP	3/20/2008	2.6	U	2.6	U	2.6	U	2.6	U	2.6	U
W RICHLAND	3/20/2008	2.6	U	2.6	U	2.6	U	2.6	U	2.6	U
TRNSFR BLANK	3/20/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
BOTTLE BLANK	3/20/2008	na		na		na		na		na	

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Field ID	Collection Date	Chlordane (technical) (ng/L)		Toxaphene (ng/L)		Alpha-BHC (ng/L)		Beta-BHC (ng/L)		Delta-BHC		Lindane (ng/L)	
CLE ELUM WP	12/13/2007	na		na		na		na		na		na	
ELLENSBURG WP	12/13/2007	na		na		na		na		na		na	
KITTITAS WP	12/13/2007	na		na		na		na		na		na	
SELAH WP	12/13/2007	na		25	UJ	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
SELAH REP	12/13/2007	na		26	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
NACHES WP	12/12/2007	na		25	UJ	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
COWICHE WP	12/12/2007	na		26	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
YAKIMA WP	12/12/2007	na		27	UJ	2.7	UJ	2.7	UJ	2.7	UJ	2.7	UJ
MOXEE WP	12/18/2007	na		25	UJ	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
BUENA WP	12/18/2007	na		26	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
ZILLAH WP	12/18/2007	na		25	UJ	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
GRANGER WP	12/18/2007	na		25	UJ	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
SUNNYSIDE WP	12/18/2007	na		26	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
SS PORT WP	12/18/2007	na		REJ		REJ		REJ		REJ		REJ	
MABTON WP	12/18/2007	na		27	UJ	2.7	UJ	2.7	UJ	2.7	UJ	2.7	UJ
GRANDVIEW WP	12/18/2007	na		25	UJ	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
GRANDVIEW	12/18/2007	na		25	UJ	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
PROSSER WP	12/20/2007	na		26	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
BENTONC WP	12/20/2007	na		26	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
W RICHLAND	12/20/2007	na		26	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
BOTTLE BLNK	12/18/2007	na		26	U	2.6	U	2.6	U	2.6	U	2.6	U
TRNSFR BLANK	12/18/2007	na		25	U	2.5	U	2.5	U	2.5	U	2.5	U
CLE ELUM WP	3/11/2008	na		na		na		na		na		na	
ELLENSBURG WP	3/11/2008	na		na		na		na		na		na	
KITTITAS WP	3/11/2008	na		na		na		na		na		na	
SELAH WP	3/11/2008	na		26	U	2.6	U	2.6	U	13	U	2.6	U
NACHES WP	3/13/2008	na		26	U	2.6	U	2.6	U	13	U	2.6	U
COWICHE WP	3/13/2008	na		25	U	2.5	U	2.5	U	13	U	2.5	U
YAKIMA WP	3/13/2008	na		25	U	2.5	U	7.6	UJ	13	U	11	
YAKIMA REP	3/13/2008	na		26	U	2.6	U	7.3	UJ	13	U	15	
MOXEE WP	3/18/2008	na		26	U	2.6	U	2.6	U	13	U	2.6	U
BUENA WP	3/18/2008	na		26	U	2.6	U	2.6	U	13	U	2.6	U
ZILLAH WP	3/18/2008	na		26	UJ	2.6	UJ	2.6	UJ	13	UJ	2.6	UJ
GRANGER WP	3/18/2008	na		26	U	2.6	U	2.6	U	13	U	2.6	U
SUNNYSIDE WP	3/18/2008	na		26	U	2.6	U	2.6	U	13	U	7.4	
SS PORT WP	3/18/2008	na		26	UJ	2.6	UJ	2.6	UJ	13	UJ	2.6	UJ
MABTON WP	3/18/2008	na		26	UJ	2.6	UJ	2.6	UJ	13	UJ	2.6	UJ
GRANDVIEW WP	3/18/2008	na		26	U	2.6	U	2.6	U	13	U	2.6	U
PROSSER WP	3/20/2008	na		26	UJ	2.6	UJ	2.6	UJ	13	UJ	2.6	UJ
PROSSER REP	3/20/2008	na		26	U	2.6	U	2.6	U	13	UJ	2.6	U
BENTONC WP	3/20/2008	na		26	U	2.6	U	2.6	U	13	U	2.6	U
W RICHLAND	3/20/2008	na		26	U	2.6	U	2.6	U	13	U	2.6	U
TRNSFR BLANK	3/20/2008	na		26	UJ	2.6	UJ	2.6	UJ	13	UJ	2.6	UJ
BOTTLE BLANK	3/20/2008	na		na		na		na		na		na	

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Field ID	Collection Date	Aldrin (ng/L)		Endrin (ng/L)		Endrin Aldehyde (ng/L)		Endrin Ketone (ng/L)		Heptachlor (ng/L)		Heptachlor Epoxide (ng/L)	
CLE ELUM WP	12/13/2007	na		na		na		na		na		na	
ELLENSBURG WP	12/13/2007	na		na		na		na		na		na	
KITTITAS WP	12/13/2007	na		na		na		na		na		na	
SELAH WP	12/13/2007	2.5	U	2.5	U	2.5	U	2.5	U	2.5	UJ	2.5	U
SELAH REP	12/13/2007	2.6	U	2.6	U	2.6	U	2.6	U	2.6	UJ	2.6	U
NACHES WP	12/12/2007	2.5	U	2.5	U	2.5	U	2.5	U	2.5	UJ	2.5	U
COWICHE WP	12/12/2007	2.6	U	2.6	U	2.6	U	2.6	U	2.6	UJ	2.6	U
YAKIMA WP	12/12/2007	2.7	U	2.7	U	2.7	U	2.7	U	2.7	UJ	2.7	U
MOXEE WP	12/18/2007	2.5	U	2.5	U	2.5	U	2.5	U	2.5	UJ	2.5	U
BUENA WP	12/18/2007	2.6	U	2.6	U	2.6	U	2.6	U	2.6	UJ	2.6	U
ZILLAH WP	12/18/2007	2.5	U	2.5	U	2.5	U	2.5	U	2.5	UJ	2.5	U
GRANGER WP	12/18/2007	2.5	U	2.5	U	2.5	U	2.5	U	2.5	UJ	2.5	U
SUNNYSIDE WP	12/18/2007	2.6	U	2.6	U	2.6	U	2.6	U	2.6	UJ	2.6	U
SS PORT WP	12/18/2007	REJ		REJ		REJ		REJ		REJ		REJ	
MABTON WP	12/18/2007	2.7	U	2.7	U	2.7	U	2.7	U	2.7	UJ	2.7	U
GRANDVIEW WP	12/18/2007	2.5	UJ	2.5	UJ	2.5	UJ	2.5	U	2.5	UJ	2.5	UJ
GRANDVIEW	12/18/2007	2.5	U	2.5	U	2.5	U	2.5	U	2.5	UJ	2.5	U
PROSSER WP	12/20/2007	2.6	U	2.6	U	2.6	UJ	2.6	U	2.6	UJ	2.6	U
BENTONC WP	12/20/2007	2.6	U	2.6	U	2.6	UJ	2.6	U	2.6	UJ	2.6	U
W RICHLAND	12/20/2007	2.6	U	2.6	U	2.6	UJ	2.6	U	2.6	UJ	2.6	U
BOTTLE BLNK	12/18/2007	2.6	U	2.6	U	2.6	U	2.6	U	2.6	U	2.6	U
TRNSFR BLANK	12/18/2007	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U
CLE ELUM WP	3/11/2008	na		na		na		na		na		na	
ELLENSBURG WP	3/11/2008	na		na		na		na		na		na	
KITTITAS WP	3/11/2008	na		na		na		na		na		na	
SELAH WP	3/11/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	U	2.6	UJ
NACHES WP	3/13/2008	2.6	U	2.6	U	2.6	U	2.6	U	2.6	U	2.6	U
COWICHE WP	3/13/2008	2.5	U	2.5	U	2.7	UJ	2.5	U	2.5	U	2.5	U
YAKIMA WP	3/13/2008	2.5	UJ	2.5	J	3.6	UJ	2.5	UJ	2.5	U	2.5	UJ
YAKIMA REP	3/13/2008	2.6	UJ	2.6	UJ	3.7	UJ	2.6	UJ	2.6	U	2.6	UJ
MOXEE WP	3/18/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	U	2.6	UJ
BUENA WP	3/18/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	U	2.6	UJ
ZILLAH WP	3/18/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
GRANGER WP	3/18/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	U	2.6	UJ
SUNNYSIDE WP	3/18/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	U	2.6	UJ
SS PORT WP	3/18/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
MABTON WP	3/18/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
GRANDVIEW WP	3/18/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	U	2.6	UJ
PROSSER WP	3/20/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
PROSSER REP	3/20/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	U	2.6	UJ
BENTONC WP	3/20/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	U	2.6	UJ
W RICHLAND	3/20/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	U	2.6	UJ
TRNSFR BLANK	3/20/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
BOTTLE BLANK	3/20/2008	na		na		na		na		na		na	

U = not detected at or above reported value J = estimated REJ = rejected na = not analyzed LS = lost in shipment

Field ID	Collection Date	Hexachloro-benzene (ng/L)		Methoxychlor (ng/L)		T-PCBs (pg/L)		Total Suspended Solids (mg/L)		Turbidity (NTU)		Conductivity (umhos/cm)	
CLE ELUM WP	12/13/2007	na		na		279	J	2		1.5		463	
ELLENSBURG WP	12/13/2007	na		na		2,067	J	4		2.2		443	
KITTITAS WP	12/13/2007	na		na		376	J	1	U	0.7		445	
SELAH WP	12/13/2007	2.5	UJ	2.5	U	322	J	8		3.9		931	
SELAH REP	12/13/2007	2.6	UJ	2.6	U	342	J	7		3.5		930	
NACHES WP	12/12/2007	2.5	UJ	2.5	U	380	J	3		2.4		412	
COWICHE WP	12/12/2007	2.6	UJ	2.6	U	857	J	2		1.7		638	
YAKIMA WP	12/12/2007	2.7	UJ	2.7	U	932	J	3		2.4		548	
MOXEE WP	12/18/2007	2.5	UJ	2.8	UJ	192	J	5		2.8		673	
BUENA WP	12/18/2007	2.6	UJ	2.6	U	267	J	2		1.5		740	
ZILLAH WP	12/18/2007	2.5	UJ	2.9	UJ	285	J	3		2.0		1300	
GRANGER WP	12/18/2007	2.5	UJ	2.5	U	299	J	6		5.2		757	
SUNNYSIDE WP	12/18/2007	2.6	UJ	3.3	UJ	967	J	3		1.6		894	
SS PORT WP	12/18/2007	REJ		REJ		510	J	247		6.5		3250	
MABTON WP	12/18/2007	2.7	UJ	2.7	U	284	J	8		4.8		627	
GRANDVIEW WP	12/18/2007	2.5	UJ	2.5	UJ	LS		26		7.5		1140	
GRANDVIEW	12/18/2007	2.5	UJ	2.5	U	121	J	25		6.9		1150	
PROSSER WP	12/20/2007	2.6	UJ	2.9	UJ	599	J	16		5.1		869	
BENTONC WP	12/20/2007	2.6	UJ	2.6	U	260	J	14		4.1		1450	
W RICHLAND	12/20/2007	2.6	UJ	2.6	U	350	J	8		4.6		1060	
BOTTLE BLNK	12/18/2007	2.6	U	2.6	U	579	J	na		na		na	
TRNSFR BLANK	12/18/2007	2.5	U	2.5	U	516	J	na		na		na	
CLE ELUM WP	3/11/2008	na		na		571	J	2		1.5	J	340	
ELLENSBURG WP	3/11/2008	na		na		713	J	4		1.3	J	433	
KITTITAS WP	3/11/2008	na		na		377	J	2		0.8	J	442	
SELAH WP	3/11/2008	2.6	UJ	2.6	UJ	962	J	25		9.2	J	798	
NACHES WP	3/13/2008	2.6	UJ	2.6	UJ	443	J	4		2.8		444	
COWICHE WP	3/13/2008	2.5	UJ	2.7	UJ	680	J	2		1.2		588	
YAKIMA WP	3/13/2008	2.5	UJ	4.9	UJ	1,382	J	4		2.4		645	
YAKIMA REP	3/13/2008	2.6	UJ	5.1	UJ	434	J	4		2.3		644	
MOXEE WP	3/18/2008	2.6	U	2.6	UJ	355	J	5		2.8	J	681	
BUENA WP	3/18/2008	2.6	U	2.6	UJ	626	J	7		3.1	J	759	
ZILLAH WP	3/18/2008	2.6	UJ	2.6	UJ	1,186	J	5		2.2	J	1450	
GRANGER WP	3/18/2008	2.6	U	2.6	UJ	801	J	3		1.8	J	776	
SUNNYSIDE WP	3/18/2008	2.6	U	2.6	UJ	1,106	J	2		1.9	J	840	
SS PORT WP	3/18/2008	2.6	UJ	2.6	UJ	1,323	J	36		12	J	3150	
MABTON WP	3/18/2008	2.6	UJ	2.6	UJ	2,370	J	71		32	J	639	
GRANDVIEW WP	3/18/2008	2.6	U	2.6	UJ	463	J	19		5.4	J	1260	
PROSSER WP	3/20/2008	2.6	UJ	2.6	UJ	493	J	1	U	0.8		997	
PROSSER REP	3/20/2008	2.6	U	2.6	UJ	387	J	1		0.7		996	
BENTONC WP	3/20/2008	2.6	U	2.6	UJ	749	J	3		2.1		1250	
W RICHLAND	3/20/2008	2.6	U	2.6	UJ	531	J	na		1.3		1020	
TRNSFR BLANK	3/20/2008	2.6	UJ	2.6	UJ	184	J	na		na		na	
BOTTLE BLANK	3/20/2008	na		na		640	J	na		na		na	

U = not detected at or above reported value J = estimated REJ = rejected na = not analyzed LS = lost in shipment

Appendix O. Fruit Packer and Vegetable Processor Effluent Data, 2007-08

Sample No.	Field ID	Collection Date	Flow (mgd)	4,4'-DDD (ng/L)		4,4'-DDE (ng/L)		4,4'-DDT (ng/L)	
7308986	ANDRUS	7/26/2007	0.0048	0.35	J	3.1	J	3.0	J
7308983	APPLE KING	7/26/2007	0.0058	1.1	J	1.7	J	0.062	UJ
7308984	GILBERT	7/26/2007	0.0054	0.063	UJ	0.096	J	0.063	UJ
7314010	SNOKIST	7/30/2007	0.162	0.061	U	0.061	U	0.097	J
7308987	TWIN CITY	7/26/2007	0.261	0.064	UJ	0.064	UJ	0.064	UJ
7308982	ZIRKLE FRUIT	7/26/2007	0.166	0.12	J	0.21	UJ	0.063	UJ
7308988	ZIRKLE REP	7/26/2007	- -	0.13	J	0.21	J	0.063	UJ
7308989	TRNSFR BLNK	7/26/2007	- -	0.065	UJ	0.065	UJ	0.065	UJ
7418900	ANDRUS	10/10/2007	0.0030	0.84	J	3.0	J	1.2	J
7388864	APPLE KING	9/20/2007	0.0058	1.7		2.7	J	0.061	U
7398820	GILBERT	9/25/2007	0.0054	0.064	UJ	0.064	UJ	0.064	UJ
7388865	SNOKIST	9/20/2007	1.0360	0.62		0.062	UJ	0.062	U
7398821	TWIN CITY	9/27/2007	0.3910	0.061	UJ	0.061	UJ	0.061	UJ
7398823	TWIN REP	9/27/2007	- -	0.061	UJ	0.061	UJ	0.061	UJ
7388863	ZIRKLE FRUIT	9/18/2007	0.0827	0.23	J	0.69	J	0.063	U
7508111	ANDRUS	12/12/2007	0.0030	0.44	J	0.37	J	0.067	J
7508109	APPLE KING	12/12/2007	0.0058	0.39	J	0.44	J	0.068	J
7508112	APPLE REP	12/12/2007	- -	0.44	J	0.45	J	0.088	J
7518100	GILBERT	12/18/2007	0.0054	0.067	J	1.6	J	1.7	J
7508110	SNOKIST	12/12/2007	0.25	0.062	UJ	0.062	UJ	0.062	UJ
7518101	CON AGRA*	12/18/2007	0.23	0.063	U	0.063	U	0.063	U
7508108	ZIRKLE FRUIT	12/13/2007	0.11	0.062	J	0.65	J	0.24	J
7508113	TRNSFR BLNK	12/12/2007	- -	0.063	U	0.063	U	0.063	U
- -	ANDRUS	- -	not processing						
8118821	APPLE KING	3/13/2008	0.0058	0.52	J	1.2	J	0.16	J
8128833	GILBERT	3/18/2008	0.0054	1.6	J	6.8		4.6	J
8128835	SNOKIST	3/20/2008	0.21	0.12	J	0.067		0.063	U
8128836	SNOKIST REP	3/20/2008	- -	0.063	U	0.063	U	0.063	U
8128834	CON AGRA*	3/19/2008	0.34	0.063	UJ	0.063	UJ	0.063	UJ
8118820	ZIRKLE	3/11/2008	0.089	0.49	J	0.37	J	0.18	J
8128837	TRNSFR BLNK	3/19/2008	- -	0.063	U	0.063	U	0.063	UJ

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na = not analyzed
*Twin City sold to Con Agra Foods Oct 07

Field ID	Collection Date	Dieldrin (ng/L)		Chlorpyrfos (ng/L)		Cis-Chlordane (ng/L)		Cis-Nonachlor (ng/L)		Trans-Chlordane (ng/L)		Trans-Nonachlor (ng/L)	
ANDRUS	7/26/2007	0.87	J	2.9	J	0.062	UJ	0.062	UJ	0.062	UJ	0.062	UJ
APPLE KING	7/26/2007	1.9	J	1.0	UJ	0.062	UJ	0.062	UJ	0.062	UJ	0.062	UJ
GILBERT	7/26/2007	0.08	J	0.26	J	0.063	UJ	0.063	UJ	0.063	UJ	0.063	UJ
SNOKIST	7/30/2007	0.43	J	0.99		0.061	U	0.061	U	0.061	U	0.061	U
TWIN CITY	7/26/2007	2.5	J	1.2	UJ	0.064	UJ	0.064	UJ	0.088	J	0.064	UJ
ZIRKLE FRUIT	7/26/2007	0.84	UJ	7.9	UJ	0.063	UJ	0.063	UJ	0.063	UJ	0.063	UJ
ZIRKLE REP	7/26/2007	1.3	UJ	17	UJ	0.063	UJ	0.063	UJ	0.063	UJ	0.063	UJ
TRNSFR BLNK	7/26/2007	0.065	UJ	0.12	UJ	0.065	UJ	0.065	UJ	0.065	UJ	0.065	UJ
ANDRUS	10/10/2007	0.32	UJ	19	J	0.064	UJ	0.24	UJ	0.064	UJ	0.064	UJ
APPLE KING	9/20/2007	1.1	UJ	1.2	UJ	0.061	U	0.28	UJ	0.23	UJ	0.061	U
GILBERT	9/25/2007	0.86	J	2.5	J	0.064	UJ	1.3	J	0.064	UJ	0.064	UJ
SNOKIST	9/20/2007	0.062	U	0.091	UJ	0.062	U	0.062	U	0.093	UJ	0.062	U
TWIN CITY	9/27/2007	0.078		0.25	J	0.061	U	0.061	U	0.061	U	0.061	U
TWIN REP	9/27/2007	0.061	U	0.42	J	0.061	U	0.061	U	0.061	U	0.061	U
ZIRKLE FRUIT	9/18/2007	0.59	UJ	74	UJ	0.063	U	0.063	U	0.063	U	0.063	U
ANDRUS	12/12/2007	0.082	UJ	1.6	J	0.068	J	0.063	UJ	0.21	J	0.063	UJ
APPLE KING	12/12/2007	1.2		2.4	J	0.063	UJ	0.063	UJ	0.063	UJ	0.18	UJ
APPLE REP	12/12/2007	1.3		2.5	J	0.063	UJ	0.063	UJ	0.063	UJ	0.063	UJ
GILBERT	12/18/2007	0.69	UJ	1.5	UJ	0.063	UJ	0.33	UJ	0.063	UJ	0.16	UJ
SNOKIST	12/12/2007	0.062	UJ	0.25	J	0.062	UJ	0.062	UJ	0.062	UJ	0.062	UJ
CON AGRA*	12/18/2007	0.07	UJ	0.063	UJ	0.063	U	0.063	U	0.063	U	0.063	U
ZIRKLE FRUIT	12/13/2007	2.6	J	3.1	J	0.062	UJ	0.26	UJ	0.062	UJ	0.062	UJ
TRNSFR BLNK	12/12/2007	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U	0.063	U
ANDRUS	- -												
APPLE KING	3/13/2008	0.55	J	6.3	J	0.062	UJ	0.062	UJ	0.083	UJ	0.062	UJ
GILBERT	3/18/2008	0.061	U	2.0		0.23	UJ	0.061	U	0.16	UJ	0.12	UJ
SNOKIST	3/20/2008	0.063	U	1.3		0.063	U	0.063	U	0.063	U	0.063	U
SNOKIST REP	3/20/2008	0.063	U	1.3		0.063	U	0.063	U	0.063	U	0.063	U
CON AGRA*	3/19/2008	0.14	J	0.45	UJ	0.063	UJ	0.063	UJ	0.063	UJ	0.063	UJ
ZIRKLE	3/11/2008	1.1	UJ	3.0	J	0.063	UJ	0.063	UJ	0.063	UJ	0.063	UJ
TRNSFR BLNK	3/19/2008	0.063	U	0.17		0.063	U	0.063	U	0.063	U	0.063	U

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Field ID	Collection Date	Oxychlordane (ng/L)		Toxaphene (ng/L)		Alpha-BHC (ng/L)		Beta-BHC (ng/L)		Delta-BHC (ng/L)	
ANDRUS	7/26/2007	0.062	UJ	3.1	UJ	0.22	J	0.47	UJ	0.073	UJ
APPLE KING	7/26/2007	0.062	UJ	3.1	UJ	0.062	UJ	0.062	UJ	0.073	UJ
GILBERT	7/26/2007	0.063	UJ	3.1	UJ	0.063	UJ	0.063	UJ	0.063	UJ
SNOKIST	7/30/2007	0.061	U	3.1	U	0.11		0.061	U	0.061	U
TWIN CITY	7/26/2007	0.064	UJ	3.8	UJ	0.14	J	0.064	UJ	0.064	UJ
ZIRKLE FRUIT	7/26/2007	0.063	UJ	5.7	UJ	0.063	UJ	0.063	UJ	0.084	UJ
ZIRKLE REP	7/26/2007	0.063	UJ	7.7	UJ	0.063	UJ	0.063	UJ	0.079	UJ
TRNSFR BLNK	7/26/2007	0.065	UJ	3.1	UJ	0.065	UJ	0.065	UJ	0.065	UJ
ANDRUS	10/10/2007	0.064	UJ	16	UJ	0.35		0.064	UJ	0.15	UJ
APPLE KING	9/20/2007	0.061	U	3.1	U	0.061	U	0.061	UJ	0.061	UJ
GILBERT	9/25/2007	0.064	UJ	3.2	UJ	0.064	UJ	0.064	UJ	0.064	UJ
SNOKIST	9/20/2007	0.062	U	3.1	U	0.18		0.13	UJ	0.062	UJ
TWIN CITY	9/27/2007	0.061	U	3.1	U	0.061		0.061		0.061	UJ
TWIN REP	9/27/2007	0.061	U	3.1	U	0.061	U	0.061	U	0.061	U
ZIRKLE FRUIT	9/18/2007	0.063	U	6.3	UJ	0.063	U	0.99	UJ	0.13	UJ
ANDRUS	12/12/2007	0.063	UJ	3.1	UJ	0.063	UJ	0.063	UJ	0.063	UJ
APPLE KING	12/12/2007	0.063	UJ	3.1	U	0.063	UJ	0.086	UJ	0.063	UJ
APPLE REP	12/12/2007	0.063	UJ	3.1	UJ	0.063	UJ	0.063	UJ	0.063	UJ
GILBERT	12/18/2007	0.063	UJ	16	UJ	0.063	UJ	0.074	UJ	0.24	UJ
SNOKIST	12/12/2007	0.062	UJ	3.1	UJ	0.062	UJ	0.062	UJ	0.062	UJ
CON AGRA*	12/18/2007	0.063	U	3.1	U	0.063	U	0.063	U	0.063	UJ
ZIRKLE FRUIT	12/13/2007	0.062	UJ	6.2	UJ	0.17	UJ	0.062	UJ	0.17	UJ
TRNSFR BLNK	12/12/2007	0.063	U	3.2	U	0.063	U	0.063	U	0.063	UJ
ANDRUS	- -										
APPLE KING	3/13/2008	0.062	UJ	3.1	UJ	0.062	UJ	0.062	UJ	0.07	UJ
GILBERT	3/18/2008	0.31	UJ	30	UJ	0.086	UJ	0.061	U	0.061	UJ
SNOKIST	3/20/2008	0.063	U	7.8	UJ	0.063	U	0.44	UJ	0.063	UJ
SNOKIST REP	3/20/2008	0.063	U	7.8	UJ	0.063	U	0.48	UJ	0.063	UJ
CON AGRA*	3/19/2008	0.063	UJ	3.1	UJ	0.063	UJ	0.063	UJ	0.063	UJ
ZIRKLE	3/11/2008	0.063	UJ	16	UJ	0.14	J	0.12	J	0.11	UJ
TRNSFR BLNK	3/19/2008	0.063	U	3.1	U	0.063	U	0.063	U	0.063	UJ

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Field ID	Collection Date	Lindane (ng/L)		Aldrin (ng/L)		Endosulfan I (ng/L)		Endosulfan II (ng/L)		Endosulfan Sulfate (ng/L)	
ANDRUS	7/26/2007	0.062	UJ	0.062	UJ	0.42	J	0.63	J	1.0	J
APPLE KING	7/26/2007	0.062	UJ	0.062	UJ	0.8	J	2.2	J	3.7	J
GILBERT	7/26/2007	0.063	UJ	0.063	UJ	0.72	J	2.1	J	1.3	J
SNOKIST	7/30/2007	0.061	U	0.24	UJ	0.12	J	0.082	J	3.0	J
TWIN CITY	7/26/2007	0.064	UJ	0.064	UJ	1.3	J	0.2	J	7.2	J
ZIRKLE FRUIT	7/26/2007	0.063	UJ	0.37	UJ	1.2	UJ	9.6	J	13	J
ZIRKLE REP	7/26/2007	0.063	UJ	0.063	UJ	1.5	J	12	J	18	J
TRNSFR BLNK	7/26/2007	0.065	UJ	0.065	UJ	0.065	UJ	0.065	UJ	0.065	UJ
ANDRUS	10/10/2007	0.55	J	0.32	UJ	0.32	UJ	93	J	34	J
APPLE KING	9/20/2007	0.065	UJ	0.18	UJ	0.58	J	1.6		2.6	
GILBERT	9/25/2007	0.064	UJ	0.064	UJ	0.064	UJ	0.064	UJ	14	J
SNOKIST	9/20/2007	0.062	U	0.062	U	0.099	J	0.27	J	2.0	
TWIN CITY	9/27/2007	0.077		0.061	UJ	0.65		0.067		1.8	J
TWIN REP	9/27/2007	0.061	U	0.061	UJ	0.61		0.071	J	1.2	
ZIRKLE FRUIT	9/18/2007	0.063	U	0.099	UJ	1.2	J	7.8	J	15	
ANDRUS	12/12/2007	0.075	J	0.73	UJ	1.7	J	12	J	7.7	J
APPLE KING	12/12/2007	0.063	UJ	0.41	UJ	2.4		11		7.4	J
APPLE REP	12/12/2007	0.063	UJ	1.3	UJ	2.7		14	J	9.2	J
GILBERT	12/18/2007	0.18	UJ	1.9	UJ	3.5		13	J	8.0	J
SNOKIST	12/12/2007	0.062	UJ	0.062	UJ	0.062	UJ	0.16	J	1.1	J
CON AGRA*	12/18/2007	0.14		0.27	UJ	0.98	J	0.39	UJ	12	E
ZIRKLE FRUIT	12/13/2007	0.17	UJ	2.6	UJ	4.4		21	J	17	J
TRNSFR BLNK	12/12/2007	0.063	U	0.063	UJ	0.063	U	0.063	UJ	0.063	UJ
ANDRUS	- -										
APPLE KING	3/13/2008	0.062	UJ	0.062	UJ	3.4	J	7.6	J	7.7	J
GILBERT	3/18/2008	0.3	UJ	0.88	UJ	5	J	14	J	53	
SNOKIST	3/20/2008	0.063	U	0.063	U	0.66		0.46		2.0	J
SNOKIST REP	3/20/2008	0.15		0.063	U	0.52		0.33		1.8	J
CON AGRA*	3/19/2008	0.063	UJ	0.063	UJ	0.083	UJ	0.17	J	6.6	J
ZIRKLE	3/11/2008	0.23	J	0.89	UJ	1.3	J	14	J	11	J
TRNSFR BLNK	3/19/2008	0.063	U	0.063	U	0.063	U	0.063	U	0.078	J

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Field ID	Collection Date	Endrin (ng/L)		Endrin Aldehyde (ng/L)		Endrin Ketone (ng/L)		Heptachlor (ng/L)		Heptachlor Epoxide (ng/L)		Hexachloro-benzene (ng/L)	
ANDRUS	7/26/2007	0.062	UJ	0.062	UJ	0.062	UJ	0.062	UJ	1.1	UJ	0.18	UJ
APPLE KING	7/26/2007	0.4	UJ	1.2	UJ	0.24	UJ	0.062	UJ	0.062	UJ	0.062	UJ
GILBERT	7/26/2007	0.1	UJ	0.063	UJ	0.063	UJ	0.063	UJ	0.063	UJ	0.063	UJ
SNOKIST	7/30/2007	0.25	UJ	0.061	U	0.21	UJ	0.061	U	0.061	U	0.061	U
TWIN CITY	7/26/2007	0.064	UJ	0.064	UJ	0.11	UJ	0.064	UJ	0.51	UJ	0.064	UJ
ZIRKLE FRUIT	7/26/2007	0.79	UJ	0.38	UJ	1.0	UJ	0.063	UJ	0.063	UJ	0.084	UJ
ZIRKLE REP	7/26/2007	0.063	UJ	0.063	UJ	0.87	UJ	0.063	UJ	0.93	UJ	0.079	UJ
TRNSFR BLNK	7/26/2007	0.065	UJ	0.065	UJ	0.065	UJ	0.065	UJ	0.065	UJ	0.065	UJ
ANDRUS	10/10/2007	1.7	J	0.32	UJ	2.9	J	11		0.064	UJ	0.17	UJ
APPLE KING	9/20/2007	0.11	UJ	0.061	UJ	0.061	U	0.47	J	0.061	U	0.16	UJ
GILBERT	9/25/2007	0.064	UJ	0.064	UJ	0.36	J	0.47	UJ	0.064	UJ	0.88	J
SNOKIST	9/20/2007	0.062	U	0.44	UJ	0.062	U	0.8	J	0.062	U	0.062	U
TWIN CITY	9/27/2007	0.061	U	0.061	UJ	0.48	J	0.061	UJ	0.12	J	0.061	U
TWIN REP	9/27/2007	0.061	U	0.8	J	0.061	U	0.061	U	0.13		0.061	U
ZIRKLE FRUIT	9/18/2007	0.8	UJ	0.063	UJ	0.063	U	0.12	UJ	0.29	UJ	0.063	U
ANDRUS	12/12/2007	0.063	UJ	0.063	UJ	0.063	UJ	0.18	UJ	0.39	UJ	0.063	UJ
APPLE KING	12/12/2007	0.46	UJ	0.82	UJ	0.063	UJ	0.063	UJ	0.33	UJ	0.063	UJ
APPLE REP	12/12/2007	0.53	UJ	1.5	UJ	0.063	U	0.066	UJ	0.063	U	0.063	UJ
GILBERT	12/18/2007	0.81	UJ	0.063	UJ	0.063	U	0.29	UJ	3.2		0.063	UJ
SNOKIST	12/12/2007	0.062	UJ	0.062	UJ	0.062	UJ	0.062	UJ	0.062	UJ	0.062	UJ
CON AGRA*	12/18/2007	0.063	UJ	0.14	UJ	0.063	UJ	0.063	U	0.13	UJ	0.063	U
ZIRKLE FRUIT	12/13/2007	0.43	UJ	1.3	UJ	0.062	U	0.32	UJ	0.062	U	0.079	UJ
TRNSFR BLNK	12/12/2007	0.063	UJ	0.063	UJ	0.063	U	0.063	U	0.063	U	0.063	U
ANDRUS	- -												
APPLE KING	3/13/2008	0.28	UJ	REJ		0.21	UJ	0.062	UJ	0.19	UJ	0.062	UJ
GILBERT	3/18/2008	0.061	U	REJ		1.2	UJ	0.14	UJ	0.47		0.072	UJ
SNOKIST	3/20/2008	0.063	U	REJ		0.063	U	0.063	U	0.063	U	0.082	J
SNOKIST REP	3/20/2008	0.063	U	REJ		0.063	U	0.063	U	0.063	U	0.11	J
CON AGRA*	3/19/2008	0.063	UJ	REJ		0.063	UJ	0.063	UJ	0.12	J	0.063	UJ
ZIRKLE	3/11/2008	0.13	UJ	REJ		0.063	UJ	0.063	UJ	0.063	UJ	0.063	UJ
TRNSFR BLNK	3/19/2008	0.063	U	REJ		0.063	U	0.063	U	0.063	U	0.063	U

U = not detected at or above reported value
J = estimated
REJ = rejected
na = not analyzed
*Twin City sold to Con Agra Foods Oct 07

Field ID	Collection Date	Methoxychlor (ng/L)		Total Suspended Solids (mg/L)		Turbidity (NTU)		Conductivity (umhos/cm)	
ANDRUS	7/26/2007	0.062	UJ	86		110		679	
APPLE KING	7/26/2007	2.0	UJ	4		18		456	
GILBERT	7/26/2007	0.095	UJ	2		0.7		185	
SNOKIST	7/30/2007	1.4	UJ	24		6.3		996	
TWIN CITY	7/26/2007	2.3	UJ	15		5.3		3,010	
ZIRKLE FRUIT	7/26/2007	1.0	UJ	2		5.4		569	
ZIRKLE REP	7/26/2007	0.063	UJ	2	U	5.3		568	
TRNSFR BLNK	7/26/2007	0.065	UJ	na		na		na	
ANDRUS	10/10/2007	35	J	242		110		603	
APPLE KING	9/20/2007	0.061	UJ	7		9.6		432	
GILBERT	9/25/2007	0.064	UJ	51		28		250	
SNOKIST	9/20/2007	0.062	UJ	4		1.9		529	
TWIN CITY	9/27/2007	0.061	U	2		1.9		2,110	
TWIN REP	9/27/2007	0.061	U	2		2.1		2,100	
ZIRKLE FRUIT	9/18/2007	0.063	UJ	2	U	3.5		718	
ANDRUS	12/12/2007	2.7	UJ	20		28		494	
APPLE KING	12/12/2007	0.84	UJ	3		17		479	
APPLE REP	12/12/2007	0.87	UJ	4		12		480	
GILBERT	12/18/2007	2.3	UJ	68		34		221	
SNOKIST	12/12/2007	0.062	UJ	11		4.1		592	
CON AGRA*	12/18/2007	0.063	UJ	5		3.5		2,310	
ZIRKLE FRUIT	12/13/2007	2.3	UJ	16		18		748	
TRNSFR BLNK	12/12/2007	0.063	UJ	na		na		na	
ANDRUS	- -								
APPLE KING	3/13/2008	0.062	UJ	6		16		518	
GILBERT	3/18/2008	1.1	UJ	24		24	J	225	
SNOKIST	3/20/2008	0.063	U	3		1.3		545	
SNOKIST REP	3/20/2008	0.063	U	3		1.1		543	
CON AGRA*	3/19/2008	0.063	UJ	8		4.3		2,990	
ZIRKLE	3/11/2008	0.063	UJ	19		23		766	
TRNSFR BLNK	3/19/2008	0.063	UJ	na		na		na	

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na = not analyzed
*Twin City sold to Con Agra Foods Oct 07

Appendix P. Stormwater Data, 2007-08

Sample No.	City	Field ID	Collection Date	4,4'-DDD (ng/L)		4,4'-DDE (ng/L)		4,4'-DDT (ng/L)	
7404850	Ellensburg	CANYON RD	10/4/2007	na		na		na	
7404851	Ellensburg	MT VIEW	10/4/2007	na		na		na	
7404852	Ellensburg	CORA	10/4/2007	na		na		na	
7424858	Yakima	HORSE	10/18/2007	2.5	UJ	9.1	J	7.5	J
7424863	Yakima	HORSE REP	10/18/2007	0.29	J	5.8	J	4.7	J
7474858	Yakima	HORSE	11/17/2007	2.5	J	14	J	9.6	J
7474861	Yakima	HORSE REP	11/17/2007	3	J	19	J	13	J
7474859	Yakima	12TH	11/17/2007	3.3	J	18	J	22	J
7474860	Yakima	PERRY T	11/17/2007	2.5	UJ	18	J	13	J
7474862	Yakima	TRAILER	11/17/2007	2.5	UJ	2.5	UJ	2.5	UJ
7474863	Yakima	34TH	11/17/2007	2.5	UJ	3	J	2.5	UJ
7474864	Yakima	TRANSF BLNK	11/17/2007	na		na		na	
7474850	Ellensburg	CANYON RD	11/17/2007	na		na		na	
7474851	Ellensburg	MT VIEW	11/17/2007	na		na		na	
7474852	Ellensburg	CORA	11/17/2007	na		na		na	
7474853	Ellensburg	MUSIC	11/17/2007	na		na		na	
				na		na		na	
7494859	Yakima	12TH	12/2/2007	2.7	UJ	13	J	13	J
7494861	Yakima	12TH REP	12/2/2007	2.6	UJ	13	J	13	J
7494858	Yakima	HORSE	12/2/2007	2.5	UJ	9.8	J	9.9	J
7494860	Yakima	PERRY T	12/2/2007	2.5	UJ	11	J	9.5	J
7494864	Yakima	TRANSF BLNK	12/2/2007	2.5	U	2.5	U	2.5	U
7494850	Ellensburg	CANYON RD	12/3/2007	na		na		na	
7494851	Ellensburg	MT VIEW	12/3/2007	na		na		na	
7494852	Ellensburg	CORA	12/3/2007	na		na		na	
7494853	Ellensburg	MUSIC	12/3/2007	na		na		na	
7494854	Ellensburg	CORA REP	12/3/2007	na		na		na	
7494865	Ellensburg	TRANSF BLNK	12/3/2007	na		na		na	

U = not detected at or above reported value

J = estimated

na = not analyzed

Sample No.	City	Field ID	Collection Date	Dieldrin (ng/L)		Chlor-pyrifos (ng/L)		Endosulfan I (ng/L)		Endosulfan II (ng/L)		Endosulfan Sulfate (ng/L)	
7404850	Ellensburg	CANYON RD	10/4/2007	na		na		na		na		na	
7404851	Ellensburg	MT VIEW	10/4/2007	na		na		na		na		na	
7404852	Ellensburg	CORA	10/4/2007	na		na		na		na		na	
7424858	Yakima/Union	HORSE	10/18/2007	8.3		17	J	4.9		15		26	
7424863	Yakima/Union	HORSE REP	10/18/2007	4.6		9.6	J	5.8		8.7		16	
7474858	Yakima/Union	HORSE	11/17/2007	7.4	UJ	19	J	2.8	J	19	J	21	J
7474861	Yakima/Union	HORSE REP	11/17/2007	9.3	UJ	4.8	J	12		24		26	
7474859	Yakima/Union	12TH	11/17/2007	4.4	J	2.4	UJ	2.4	U	12	J	14	J
7474860	Yakima/Union	PERRY T	11/17/2007	5.1	J	2.5	UJ	2.5	UJ	10	J	12	J
7474862	Yakima/Union	TRAILER	11/17/2007	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
7474863	Yakima/Union	34TH	11/17/2007	2.5	UJ	2.5	UJ	2.5	UJ	4.5	J	7.0	J
7474864	Yakima/Union	TRNSF BLNK	11/17/2007	na		na		na		na		na	
7474850	Ellensburg	CANYON RD	11/17/2007	na		na		na		na		na	
7474851	Ellensburg	MT VIEW	11/17/2007	na		na		na		na		na	
7474852	Ellensburg	CORA	11/17/2007	na		na		na		na		na	
7474853	Ellensburg	MUSIC	11/17/2007	na		na		na		na		na	
7494859	Yakima/Union	12TH	12/2/2007	2.7	UJ	3.8	J	5.4	J	15	J	13	J
7494861	Yakima/Union	12TH REP	12/2/2007	2.9	J	4.3	J	5.2	J	13	J	11	J
7494858	Yakima/Union	HORSE	12/2/2007	2.5	U	3.3		4.9		13	J	9.9	J
7494860	Yakima/Union	PERRY T	12/2/2007	3.0	J	4.5	J	3.0		13	J	10	J
7494864	Yakima/Union	TRNSF BLNK	12/2/2007	2.5	U	2.5	U	2.5	U	2.5	UJ	2.5	UJ
7494850	Ellensburg	CANYON RD	12/3/2007	na		na		na		na		na	
7494851	Ellensburg	MT VIEW	12/3/2007	na		na		na		na		na	
7494852	Ellensburg	CORA	12/3/2007	na		na		na		na		na	
7494853	Ellensburg	MUSIC	12/3/2007	na		na		na		na		na	
7494854	Ellensburg	CORA REP	12/3/2007	na		na		na		na		na	
7494865	Ellensburg	TRNSF BLNK	12/3/2007	na		na		na		na		na	

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J = estimated

na = not analyzed

City	Field ID	Collection Date	Cis-Chlordane (ng/L)		Cis-Nonachlor (ng/L)		Trans-Chlordane (ng/L)		Trans-Nonachlor (ng/L)	
Ellensburg	CANYON RD	10/4/2007	na		na		na		na	
Ellensburg	MT VIEW	10/4/2007	na		na		na		na	
Ellensburg	CORA	10/4/2007	na		na		na		na	
Yakima/Union	HORSE	10/18/2007	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
Yakima/Union	HORSE REP	10/18/2007	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
Yakima/Union	HORSE	11/17/2007	2.4	UJ	2.4	UJ	2.4	UJ	2.4	UJ
Yakima/Union	HORSE REP	11/17/2007	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
Yakima/Union	12TH	11/17/2007	4.0	J	2.4	UJ	4.1	J	4.5	J
Yakima/Union	PERRY T	11/17/2007	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
Yakima/Union	TRAILER	11/17/2007	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
Yakima/Union	34TH	11/17/2007	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
Yakima/Union	TRNSF BLNK	11/17/2007	na		na		na		na	
Ellensburg	CANYON RD	11/17/2007	na		na		na		na	
Ellensburg	MT VIEW	11/17/2007	na		na		na		na	
Ellensburg	CORA	11/17/2007	na		na		na		na	
Ellensburg	MUSIC	11/17/2007	na		na		na		na	
Yakima/Union	12TH	12/2/2007	2.7	UJ	2.7	UJ	2.7	UJ	2.7	UJ
Yakima/Union	12TH REP	12/2/2007	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
Yakima/Union	HORSE	12/2/2007	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
Yakima/Union	PERRY T	12/2/2007	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
Yakima/Union	TRNSF BLNK	12/2/2007	2.5	U	2.5	U	2.5	U	2.5	U
Ellensburg	CANYON RD	12/3/2007	na		na		na		na	
Ellensburg	MT VIEW	12/3/2007	na		na		na		na	
Ellensburg	CORA	12/3/2007	na		na		na		na	
Ellensburg	MUSIC	12/3/2007	na		na		na		na	
Ellensburg	CORA REP	12/3/2007	na		na		na		na	
Ellensburg	TRNSF BLNK	12/3/2007	na		na		na		na	

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na = not analyzed

City	Field ID	Collection Date	Oxy-chlordane (ng/L)		Alpha-BHC (ng/L)		Beta-BHC (ng/L)		Delta-BHC (ng/L)	
Ellensburg	CANYON RD	10/4/2007	na		na		na		na	
Ellensburg	MT VIEW	10/4/2007	na		na		na		na	
Ellensburg	CORA	10/4/2007	na		na		na		na	
Yakima/Union	HORSE	10/18/2007	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
Yakima/Union	HORSE REP	10/18/2007	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
Yakima/Union	HORSE	11/17/2007	2.4	UJ	2.4	UJ	2.4	UJ	2.4	UJ
Yakima/Union	HORSE REP	11/17/2007	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
Yakima/Union	12TH	11/17/2007	2.4	UJ	2.4	UJ	2.4	UJ	2.4	UJ
Yakima/Union	PERRY T	11/17/2007	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
Yakima/Union	TRAILER	11/17/2007	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
Yakima/Union	34TH	11/17/2007	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
Yakima/Union	TRNSF BLNK	11/17/2007	na		na		na		na	
Ellensburg	CANYON RD	11/17/2007	na		na		na		na	
Ellensburg	MT VIEW	11/17/2007	na		na		na		na	
Ellensburg	CORA	11/17/2007	na		na		na		na	
Ellensburg	MUSIC	11/17/2007	na		na		na		na	
Yakima/Union	12TH	12/2/2007	2.7	UJ	2.7	UJ	2.7	UJ	2.7	UJ
Yakima/Union	12TH REP	12/2/2007	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
Yakima/Union	HORSE	12/2/2007	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
Yakima/Union	PERRY T	12/2/2007	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
Yakima/Union	TRNSF BLNK	12/2/2007	2.5	U	2.5	U	2.5	U	2.5	U
Ellensburg	CANYON RD	12/3/2007	na		na		na		na	
Ellensburg	MT VIEW	12/3/2007	na		na		na		na	
Ellensburg	CORA	12/3/2007	na		na		na		na	
Ellensburg	MUSIC	12/3/2007	na		na		na		na	
Ellensburg	CORA REP	12/3/2007	na		na		na		na	
Ellensburg	TRNSF BLNK	12/3/2007	na		na		na		na	

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J = estimated

na = not analyzed

City	Field ID	Collection Date	Lindane (ng/L)		Toxaphene (ng/L)		Total PCBs (pg/L)		Aldrin (ng/L)		Endrin (ng/L)	
Ellensburg	CANYON RD	10/4/2007	na		na		2,144	J	na		na	
Ellensburg	MT VIEW	10/4/2007	na		na		530	J	na		na	
Ellensburg	CORA	10/4/2007	na		na		352	J	na		na	
Yakima/Union	HORSE	10/18/2007	2.5	UJ	25	UJ	15,999	J	2.5	U	4.4	UJ
Yakima/Union	HORSE REP	10/18/2007	2.5	UJ	25	UJ	1,668	J	2.5	U	2.5	U
Yakima/Union	HORSE	11/17/2007	2.4	UJ	24	UJ	24,467	J	4.0	J	2.9	UJ
Yakima/Union	HORSE REP	11/17/2007	2.5	UJ	25	UJ	32,372	J	3.3	J	4.9	UJ
Yakima/Union	12TH	11/17/2007	2.4	UJ	24	UJ	na		2.6	UJ	2.5	UJ
Yakima/Union	PERRY T	11/17/2007	2.5	UJ	25	UJ	15,490	J	2.5	UJ	2.5	UJ
Yakima/Union	TRAILER	11/17/2007	2.5	UJ	25	UJ	566	J	2.5	UJ	2.5	UJ
Yakima/Union	34TH	11/17/2007	2.5	UJ	25	UJ	734	J	2.5	UJ	2.5	UJ
Yakima/Union	TRNSF BLNK	11/17/2007	na		na		133	J	na		na	
Ellensburg	CANYON RD	11/17/2007	na		na		7,046	J	na		na	
Ellensburg	MT VIEW	11/17/2007	na		na		33,485	J	na		na	
Ellensburg	CORA	11/17/2007	na		na		broken		na		na	
Ellensburg	MUSIC	11/17/2007	na		na		440	J	na		na	
Yakima/Union	12TH	12/2/2007	2.7	UJ	27	UJ	11,135	J	2.7	UJ	2.7	UJ
Yakima/Union	12TH REP	12/2/2007	2.6	UJ	26	UJ	10,989	J	2.6	UJ	2.6	UJ
Yakima/Union	HORSE	12/2/2007	2.5	UJ	25	UJ	2,159	J	2.5	U	2.5	UJ
Yakima/Union	PERRY T	12/2/2007	2.5	UJ	25	UJ	1,994	J	2.5	U	2.5	UJ
Yakima/Union	TRNSF BLNK	12/2/2007	2.5	U	25	U	363	J	2.5	U	2.5	UJ
Ellensburg	CANYON RD	12/3/2007	na		na		6,136	J	na		na	
Ellensburg	MT VIEW	12/3/2007	na		na		1,009	J	na		na	
Ellensburg	CORA	12/3/2007	na		na		1,104	J	na		na	
Ellensburg	MUSIC	12/3/2007	na		na		2,000	J	na		na	
Ellensburg	CORA REP	12/3/2007	na		na		19,815	J	na		na	
Ellensburg	TRNSF BLNK	12/3/2007	na		na		463	J	na		na	

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City	Field ID	Collection Date	Endrin Aldehyde (ng/L)		Endrin Ketone (ng/L)		Heptachlor (ng/L)		Heptachlor Epoxide (ng/L)	
Ellensburg	CANYON RD	10/4/2007	na		na		na		na	
Ellensburg	MT VIEW	10/4/2007	na		na		na		na	
Ellensburg	CORA	10/4/2007	na		na		na		na	
Yakima/Union	HORSE	10/18/2007	11	UJ	3.4	UJ	2.5	UJ	3.4	J
Yakima/Union	HORSE REP	10/18/2007	10	UJ	2.5	U	2.5	UJ	2.5	U
Yakima/Union	HORSE	11/17/2007	7.8	UJ	2.0	U	2.4	UJ	2.8	J
Yakima/Union	HORSE REP	11/17/2007	5.3	UJ	2.6	UJ	2.5	UJ	3.5	J
Yakima/Union	12TH	11/17/2007	2.7	UJ	2.5	UJ	2.4	UJ	2.5	J
Yakima/Union	PERRY T	11/17/2007	4.0	UJ	2.5	UJ	2.5	UJ	2.7	J
Yakima/Union	TRAILER	11/17/2007	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
Yakima/Union	34TH	11/17/2007	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ
Yakima/Union	TRNSF BLNK	11/17/2007	na		na		na		na	
Ellensburg	CANYON RD	11/17/2007	na		na		na		na	
Ellensburg	MT VIEW	11/17/2007	na		na		na		na	
Ellensburg	CORA	11/17/2007	na		na		na		na	
Ellensburg	MUSIC	11/17/2007	na		na		na		na	
Yakima/Union	12TH	12/2/2007	2.7	UJ	2.7	UJ	2.7	UJ	2.7	UJ
Yakima/Union	12TH REP	12/2/2007	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
Yakima/Union	HORSE	12/2/2007	2.5	UJ	2.5	U	2.5	UJ	2.5	U
Yakima/Union	PERRY T	12/2/2007	2.5	UJ	2.5	U	2.5	UJ	2.5	U
Yakima/Union	TRNSF BLNK	12/2/2007	2.5	UJ	2.5	U	2.5	U	2.5	U
Ellensburg	CANYON RD	12/3/2007	na		na		na		na	
Ellensburg	MT VIEW	12/3/2007	na		na		na		na	
Ellensburg	CORA	12/3/2007	na		na		na		na	
Ellensburg	MUSIC	12/3/2007	na		na		na		na	
Ellensburg	CORA REP	12/3/2007	na		na		na		na	
Ellensburg	TRNSF BLNK	12/3/2007	na		na		na		na	

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City	Field ID	Collection Date	Hexachloro-benzene (ng/L)		Methox-ychlor (ng/L)	Total Suspended Solids (mg/L)		Turbidity (NTU)		Conductivity (umhos/cm)	
Ellensburg	CANYON RD	10/4/2007	na		na	127		210	J	192	
Ellensburg	MT VIEW	10/4/2007	na		na	20		39	J	118	
Ellensburg	CORA	10/4/2007	na		na	28		29	J	245	
Yakima/Union	HORSE	10/18/2007	2.5	UJ	11	43		75		91	
Yakima/Union	HORSE REP	10/18/2007	2.5	UJ	6.3	38		75		91	
Yakima/Union	HORSE	11/17/2007	2.4	UJ	16	641		370	J	148	
Yakima/Union	HORSE REP	11/17/2007	2.5	UJ	14	512		330	J	219	
Yakima/Union	12TH	11/17/2007	2.4	UJ	3.3	654		400	J	98	
Yakima/Union	PERRY T	11/17/2007	2.5	UJ	5.1U	323		280	J	165	
Yakima/Union	TRAILER	11/17/2007	2.5	UJ	2.5	1	U	1.4	J	286	
Yakima/Union	34TH	11/17/2007	2.5	UJ	2.5	18		33	J	146	
Yakima/Union	TRNSF BLNK	11/17/2007	na		na	na		na		na	
Ellensburg	CANYON RD	11/17/2007	na		na	206		200	J	51	
Ellensburg	MT VIEW	11/17/2007	na		na	116		140	J	42	
Ellensburg	CORA	11/17/2007	na		na	74		98	J	175	
Ellensburg	MUSIC	11/17/2007	na		na	15		45	J	261	
Yakima/Union	12TH	12/2/2007	2.7	UJ	23	326		400	J	1,990	
Yakima/Union	12TH REP	12/2/2007	2.6	UJ	22	244		450	J	2,020	
Yakima/Union	HORSE	12/2/2007	2.5	UJ	19	111		180	J	661	
Yakima/Union	PERRY T	12/2/2007	2.5	UJ	3.3U	98		230	J	4,710	
Yakima/Union	TRNSF BLNK	12/2/2007	2.5	U	2.5	na		na		na	
Ellensburg	CANYON RD	12/3/2007	na		na	134		280		344	
Ellensburg	MT VIEW	12/3/2007	na		na	52		140		354	
Ellensburg	CORA	12/3/2007	na		na	66		120		342	
Ellensburg	MUSIC	12/3/2007	na		na	47		110		282	
Ellensburg	CORA REP	12/3/2007	na		na	63		120		347	
Ellensburg	TRNSF BLNK	12/3/2007	na		na	na		na		na	

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Sample No.	City	Field ID	Collection Date	4,4'-DDT (ng/L)		4,4'-DDE (ng/L)		4,4'-DDD (ng/L)	
8114859	Yakima/Union	12TH	3/13/2008	33	J	54	J	3.5	J
8114858	Yakima/Union	HORSE	3/13/2008	30	J	52	J	4.1	J
8114861	Yakima/Union	HORSE REP	3/13/2008	30	J	52	J	4.1	J
8114864	Yakima/Union	TRNSF BLNK	3/13/2008	2.6	U	2.6	U	2.6	U
8114862	Yakima/Union	BOTTLE BLNK	3/13/2008	na		na		na	
8134858	Yakima/Union	HORSE	3/28/2008	na		na		na	
8134859	Yakima/Union	12TH	3/28/2008	na		na		na	
8134861	Yakima/Union	HORSE REP	3/28/2008	na		na		na	
8134864	Yakima/Union	TRNSF BLNK	3/28/2008	na		na		na	
8134865	Yakima/Union	BOTTLE BLNK	3/28/2008	na		na		na	
8234850	Ellensburg	CANYON RD	6/3/2008	na		na		na	
8234852	Ellensburg	CORA	6/3/2008	na		na		na	
8234860	Yakima/Union	PERRY T	6/3/2008	9.1		14		2.5	U
8234864	Yakima/Union	BOTTLE BLNK	6/3/2008	2.5	U	2.5	U	2.5	U

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City	Field ID	Collection Date	Dieldrin (ng/L)		Chlor-pyrifos (ng/L)		Endosulfan I (ng/L)		Endosulfan II (ng/L)		Endosulfan Sulfate (ng/L)	
Yakima/Union	12TH	3/13/2008	2.6	UJ	222	J	40	J	47	J	14	J
Yakima/Union	HORSE	3/13/2008	3.1	UJ	159	J	47	J	42	J	5.6	J
Yakima/Union	HORSE REP	3/13/2008	3.1	UJ	156	J	40	J	41	J	6.8	J
Yakima/Union	TRNSF BLNK	3/13/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
Yakima/Union	BOTTLE BLNK	3/13/2008	na		na		na		na		na	
Yakima/Union	HORSE	3/28/2008	na		na		na		na		na	
Yakima/Union	12TH	3/28/2008	na		na		na		na		na	
Yakima/Union	HORSE REP	3/28/2008	na		na		na		na		na	
Yakima/Union	TRNSF BLNK	3/28/2008	na		na		na		na		na	
Yakima/Union	BOTTLE BLNK	3/28/2008	na		na		na		na		na	
Ellensburg	CANYON RD	6/3/2008	na		na		na		na		na	
Ellensburg	CORA	6/3/2008	na		na		na		na		na	
Yakima/Union	PERRY T	6/3/2008	2.5	UJ	6.0	J	84	J	23	J	17	J
Yakima/Union	BOTTLE BLNK	6/3/2008	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ	2.5	UJ

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City	Field ID	Collection Date	Cis-Chlordane (ng/L)		Cis-Nonachlor (ng/L)		Trans-Chlordane (ng/L)		Trans-Nonachlor (ng/L)	
Yakima/Union	12TH	3/13/2008	2.6	UJ	2.6	UJ	2.7	J	2.6	UJ
Yakima/Union	HORSE	3/13/2008	2.6	UJ	2.6	UJ	2.9	J	2.6	UJ
Yakima/Union	HORSE REP	3/13/2008	2.6	UJ	2.6	UJ	3.1	J	2.6	UJ
Yakima/Union	TRNSF BLNK	3/13/2008	2.6	U	2.6	U	2.6	U	2.6	U
Yakima/Union	BOTTLE BLNK	3/13/2008	na		na		na		na	
Yakima/Union	HORSE	3/28/2008	na		na		na		na	
Yakima/Union	12TH	3/28/2008	na		na		na		na	
Yakima/Union	HORSE REP	3/28/2008	na		na		na		na	
Yakima/Union	TRNSF BLNK	3/28/2008	na		na		na		na	
Yakima/Union	BOTTLE BLNK	3/28/2008	na		na		na		na	
Ellensburg	CANYON RD	6/3/2008	na		na		na		na	
Ellensburg	CORA	6/3/2008	na		na		na		na	
Yakima/Union	PERRY T	6/3/2008	2.5	U	2.5	U	2.5	U	2.5	U
Yakima/Union	BOTTLE BLNK	6/3/2008	2.5	U	2.5	U	2.5	U	2.5	U

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City	Field ID	Collection Date	Oxy-chlordane (ng/L)		Alpha-BHC (ng/L)		Beta-BHC (ng/L)		Delta-BHC (ng/L)	
Yakima/Union	12TH	3/13/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
Yakima/Union	HORSE	3/13/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
Yakima/Union	HORSE REP	3/13/2008	2.6	UJ	2.6	UJ	2.6	UJ	2.6	UJ
Yakima/Union	TRNSF BLNK	3/13/2008	2.6	U	2.6	U	2.6	U	2.6	UJ
Yakima/Union	BOTTLE BLNK	3/13/2008	na		na		na		na	
Yakima/Union	HORSE	3/28/2008	na		na		na		na	
Yakima/Union	12TH	3/28/2008	na		na		na		na	
Yakima/Union	HORSE REP	3/28/2008	na		na		na		na	
Yakima/Union	TRNSF BLNK	3/28/2008	na		na		na		na	
Yakima/Union	BOTTLE BLNK	3/28/2008	na		na		na		na	
Ellensburg	CANYON RD	6/3/2008	na		na		na		na	
Ellensburg	CORA	6/3/2008	na		na		na		na	
Yakima/Union	PERRY T	6/3/2008	2.5	U	2.5	U	2.5	U	2.5	U
Yakima/Union	BOTTLE BLNK	6/3/2008	2.5	U	2.5	U	2.5	U	2.5	U

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City	Field ID	Collection Date	Lindane (ng/L)		Toxaphene (ng/L)		Total PCBs (pg/L)		Aldrin (ng/L)		Endrin (ng/L)	
Yakima/Union	12TH	3/13/2008	2.6	UJ	26	UJ	11,207	J	2.6	UJ	2.6	UJ
Yakima/Union	HORSE	3/13/2008	2.6	UJ	32	J	19,584	J	2.6	UJ	2.6	UJ
Yakima/Union	HORSE REP	3/13/2008	2.6	UJ	29	J	16,245	J	6.2	UJ	2.6	UJ
Yakima/Union	TRNSF BLNK	3/13/2008	2.6	U	26	U	57	J	2.6	UJ	2.6	UJ
Yakima/Union	BOTTLE BLNK	3/13/2008	na		na		506	J	na		na	
Yakima/Union	HORSE	3/28/2008	na		na		8,097	J	na		na	
Yakima/Union	12TH	3/28/2008	na		na		7,512	J	na		na	
Yakima/Union	HORSE REP	3/28/2008	na		na		8,502	J	na		na	
Yakima/Union	TRNSF BLNK	3/28/2008	na		na		292	J	na		na	
Yakima/Union	BOTTLE BLNK	3/28/2008	na		na		283	J	na		na	
Ellensburg	CANYON RD	6/3/2008	na		na		na		na		na	
Ellensburg	CORA	6/3/2008	na		na		na		na		na	
Yakima/Union	PERRY T	6/3/2008	2.5	U	25	UJ	na		2.5	UJ	2.5	UJ
Yakima/Union	BOTTLE BLNK	6/3/2008	2.5	U	25	UJ	na		2.5	UJ	2.5	UJ

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City	Field ID	Collection Date	Endrin Aldehyde (ng/L)		Endrin Ketone (ng/L)		Heptachlor (ng/L)		Heptachlor Epoxide (ng/L)	
Yakima/Union	12TH	3/13/2008	2.6	UJ	3.2	UJ	2.6	UJ	2.6	UJ
Yakima/Union	HORSE	3/13/2008	2.6	UJ	2.6	UJ	2.6	UJ	12	J
Yakima/Union	HORSE REP	3/13/2008	2.6	UJ	2.6	UJ	2.6	UJ	8.7	J
Yakima/Union	TRNSF BLNK	3/13/2008	2.6	UJ	2.6	UJ	2.6	U	2.6	UJ
Yakima/Union	BOTTLE BLNK	3/13/2008	na		na		na		na	
Yakima/Union	HORSE	3/28/2008	na		na		na		na	
Yakima/Union	12TH	3/28/2008	na		na		na		na	
Yakima/Union	HORSE REP	3/28/2008	na		na		na		na	
Yakima/Union	TRNSF BLNK	3/28/2008	na		na		na		na	
Yakima/Union	BOTTLE BLNK	3/28/2008	na				na		na	
Ellensburg	CANYON RD	6/3/2008	na		na		na		na	
Ellensburg	CORA	6/3/2008	na		na		na		na	
Yakima/Union	PERRY T	6/3/2008	2.5	UJ	2.5	UJ	2.5	U	2.5	UJ
Yakima/Union	BOTTLE BLNK	6/3/2008	2.5	UJ	2.5	UJ	2.5	U	2.5	UJ

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City	Field ID	Collection Date	Hexachloro-benzene (ng/L)		Methox-ychlor (ng/L)	Total Suspended Solids (mg/L)		Turbidity (NTU)		Conductivity (umhos/cm)	
Yakima/Union	12TH	3/13/2008	2.6	UJ	2.6	290		330		236	
Yakima/Union	HORSE	3/13/2008	17	J	19	450		450		478	
Yakima/Union	HORSE REP	3/13/2008	18	J	7.8	410		500		473	
Yakima/Union	TRNSF BLNK	3/13/2008	2.6	UJ	2.6	na		na		na	
Yakima/Union	BOTTLE BLNK	3/13/2008	na		na						
Yakima/Union	HORSE	3/28/2008	na		na	196		225	J	370	
Yakima/Union	12TH	3/28/2008	na		na	46		60	J	178	
Yakima/Union	HORSE REP	3/28/2008	na		na	na		na		na	
Yakima/Union	TRNSF BLNK	3/28/2008	na		na	na		na		na	
Yakima/Union	BOTTLE BLNK	3/28/2008	na		na	na		na		na	
										na	
Ellensburg	CANYON RD	6/3/2008	na		na	155		235		232	
Ellensburg	CORA	6/3/2008	na		na	63		70		182	
Yakima/Union	PERRY T	6/3/2008	2.5	U	2.5	85		92		93	
Yakima/Union	BOTTLE BLNK	6/3/2008	2.5	U	2.5	na		na		na	

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Appendix Q. Values of Potential Use for Calculating Stormwater Loads to the Yakima River from Sunnyside and Richland (using the Simple Method)

Sunnyside

City Limits (acres)	4,232
Annual Rainfall (in.)	7.0
Fraction of Runoff	0.90
Impervious Fraction	0.22
Runoff Coefficient	0.25
Annual Runoff (in.)	1.79

Richland

Area discharging to Yakima River (acres)	5,990
Annual Rainfall (in.)	7.0
Fraction of Runoff	0.90
Impervious Fraction	0.22
Runoff Coefficient	0.25
Annual Runoff (in.)	1.79

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Appendix R. Glossary, Acronyms, and Abbreviations

Glossary

303(d) list: Section 303(d) of the federal Clean Water Act requires Washington State periodically to prepare a list of all surface waters in the state for which beneficial uses of the water – such as for drinking, recreation, aquatic habitat, and industrial use – are impaired by pollutants. These are water quality limited estuaries, lakes, and streams that fall short of state surface water quality standards, and are not expected to improve within the next two years.

Best Management Practices (BMPs): Physical, structural, and/or operational practices that, when used singularly or in combination, prevent or reduce pollutant discharges.

Bioaccumulative Pollutants: Pollutants that build up in the food chain.

Clean Water Act: Federal Act passed in 1972 that contains provisions to restore and maintain the quality of the nation's waters. Section 303(d) of the Clean Water Act establishes the TMDL program.

Conductivity: A measure of water's ability to conduct an electrical current. Conductivity is related to the concentration and charge of dissolved ions in water.

Designated Uses: Those uses specified in Chapter 173-201A WAC (Water Quality Standards for Surface Waters of the State of Washington) for each waterbody or segment, regardless of whether or not the uses are currently attained.

Exceeds Criteria: Fails to meet criteria.

Existing Uses: Those uses actually attained in fresh and marine waters on or after November 28, 1975, whether or not they are designated uses. Introduced species that are not native to Washington, and put-and-take fisheries comprised of non-self-replicating introduced native species, do not need to receive full support as an existing use.

Grab Sample: A discrete sample from a single point in the water column or sediment surface.

Irrigation Season: In this study, the irrigation season is April through October.

Legacy Pesticide: Banned pesticides no longer used but that persist in the environment.

Load Allocation: The portion of a receiving waters' loading capacity attributed to one or more of its existing or future sources of nonpoint pollution or to natural background sources.

Loading Capacity: The greatest amount of a substance that a waterbody can receive and still meet water quality standards.

Margin of Safety (MOS): Required component of TMDLs that accounts for uncertainty about the relationship between pollutant loads and quality of the receiving waterbody.

Municipal Separate Storm Sewer Systems (MS4): A conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains): (i) owned or operated by a state, city, town, borough, county, parish, district, association, or other public body having jurisdiction over disposal of wastes, stormwater, or other wastes and (ii) designed or used for collecting or conveying stormwater; (iii) which is not a combined sewer; and (iv) which is not part of a Publicly Owned Treatment Works (POTW) as defined in the Code of Federal Regulations at 40 CFR 122.2.

National Pollutant Discharge Elimination System (NPDES): National program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements under the Clean Water Act. The NPDES program regulates discharges from wastewater treatment plants, large factories, and other facilities that use, process, and discharge water back into lakes, streams, rivers, bays, and oceans.

Nonpoint Source: Pollution that enters any waters of the state from any dispersed land-based or water-based activities, including but not limited to atmospheric deposition, surface water runoff from agricultural lands, urban areas, or forest lands, subsurface or underground sources, or discharges from boats or marine vessels not otherwise regulated under the National Pollutant Discharge Elimination System Program. Generally, any unconfined and diffuse source of contamination. Legally, any source of water pollution that does not meet the legal definition of "point source" in section 502(14) of the Clean Water Act.

Parameter: Water quality constituent being measured. A physical, chemical, or biological property whose values determine environmental characteristics or behavior.

Phase I Stormwater Permit: The first phase of stormwater regulation required under the federal Clean Water Act. The permit is issued to medium and large municipal separate storm sewer systems (MS4s) and construction sites of five or more acres.

Phase II Stormwater Permit: The second phase of stormwater regulation required under the federal Clean Water Act. The permit is issued to smaller municipal separate storm sewer systems (MS4s) and construction sites over one acre.

Point Source: Sources of pollution that discharge at a specific location from pipes, outfalls, and conveyance channels to a surface water. Examples of point source discharges include municipal wastewater treatment plants, municipal stormwater systems, industrial waste treatment facilities, and construction sites that clear more than 5 acres of land.

Pollution: Such contamination, or other alteration of the physical, chemical, or biological properties, of any waters of the state. This includes change in temperature, taste, color, turbidity, or odor of the waters. It also includes discharge of any liquid, gaseous, solid, radioactive, or other substance into any waters of the state. This definition assumes that these changes will, or are likely to, create a nuisance or render such waters harmful, detrimental, or injurious to (1) public health, safety, or welfare, or (2) domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or (3) livestock, wild animals, birds, fish, or other aquatic life.

Salmonid: Any fish that belong to the family *Salmonidae*. Basically, any species of salmon, trout, or char. www.fws.gov/le/ImpExp/FactSheetSalmonids.htm

Stormwater: The portion of precipitation that does not naturally percolate into the ground or evaporate but instead runs off roads, pavement, and roofs during rainfall or snowmelt. Stormwater can also come from hard or saturated grass surfaces such as lawns, pastures, playfields, and from gravel roads and parking lots.

Synoptic survey: Data collected simultaneously or over a short period of time.

Surface Waters of the State: Lakes, rivers, ponds, streams, inland waters, salt waters, wetlands and all other surface waters and watercourses within the jurisdiction of Washington State.

Total Maximum Daily Load (TMDL): A distribution of a substance in a waterbody designed to protect it from exceeding water quality standards. A TMDL is equal to the sum of all of the following: (1) individual wasteload allocations for point sources, (2) the load allocations for nonpoint sources, (3) the contribution of natural sources, and (4) a Margin of Safety to allow for uncertainty in the wasteload determination. A reserve for future growth is also generally provided.

Total Suspended Solids (TSS): The suspended particulate matter in a water sample as retained by a filter.

Turbidity: A measure of water clarity. High levels of turbidity can have a negative impact on aquatic life.

Wasteload Allocation: The portion of a receiving water's loading capacity allocated to existing or future point sources of pollution. Wasteload allocations constitute one type of water quality-based effluent limitation.

Watershed: A drainage area or basin in which all land and water areas drain or flow toward a central collector such as a stream, river, or lake at a lower elevation.

Acronyms and Abbreviations

CRO	Central Regional Office (Department of Ecology)
DDD	Dichloro-diphenyl-dichloroethane
DDE	Dichloro-diphenyl-dichloroethylene
DDT	Dichloro-diphenyl-trichloroethane
DOC	Dissolved organic carbon
EAP	Environmental Assessment Program (Department of Ecology)
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
GC/ECD	Gas chromatography/electron capture detection
HRGC/MS	High resolution gas chromatography/mass spectrometry
LVI	Volume injection
N	Number

NTU	Nephelometric turbidity units
PCB	Polychlorinated biphenyl
r.m.	River mile
RSBOJC	Roza-Sunnyside Board of Joint Control
SOP	Standard operating procedure
SPE	Solid phase extraction
SPMD	Semipermeable membrane device
SWMP	Surface Water Monitoring Program for Pesticides in Salmonid Bearing Streams
TMDL	(See Glossary above)
TNVSS	Total non-volatile suspended solids
TOC	Total organic carbon
Trib	Tributary
TSS	(See Glossary above)
USBR	U.S. Bureau of Reclamation
USGS	U.S. Geological Survey
WDOH	Washington State Department of Health
WRIA	Water Resource Inventory Area
WSDA	Washington State Department of Agriculture
WWTP	Wastewater treatment plant