Palouse River Chlorinated Pesticide and PCB Total Maximum Daily Load

Water Quality Improvement Report and Implementation Plan

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For more information contact:

Publications Coordinator
Environmental Assessment Program
P.O. Box 47600
Olympia, WA 98504-7600

E-mail: jlet461@ecy.wa.gov
Phone: (360) 407-6764

Washington State Department of Ecology - www.ecy.wa.gov/

o Headquarters, Lacey	360-407-6000
o Northwest Regional Office, Bellevue	425-649-7000
o Southwest Regional Office, Lacey	360-407-6300
o Central Regional Office, Yakima	509-575-2490
o Eastern Regional Office, Spokane	509-329-3400

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Cover photo: Electrofishing in the North Fork Palouse River (Elaine Snouwaert)

Palouse River
Chlorinated Pesticide and PCB
Total Maximum Daily Load

Water Quality Improvement Report
and
Implementation Plan

by

Art Johnson, Brandee Era-Miller, and Kristin Kinney
Environmental Assessment Program
Olympia, Washington 98504-7710

and

Elaine Snouwaert
TMDL/Watershed Unit
Water Quality Program – Eastern Region
Spokane, Washington 98205-1295

Waterbody Numbers: Palouse River (WA-34-1010),
S.F. Palouse River (WA-34-1020), N.F. Palouse River (WA-34-1030)

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Glossary and Acronyms

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.

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.

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.

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.

Harmonic Mean Flow: One of several methods of calculating an average rate of flow. The harmonic mean is defined as $Q_h = n/\sum(1/Q_i)$ where n is the number of recorded flows Q_i. The harmonic mean is never larger than the geometric mean or the arithmetic mean.

Load Allocation (LA): 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: 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, storm water, 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.

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, including change in temperature, taste, color, turbidity, or odor of the waters, or such discharge of any liquid, gaseous, solid, radioactive, or other substance into any waters of the state as will or is likely to create a nuisance or render such waters harmful, detrimental, or injurious to the public health, safety, or welfare, or to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or to livestock, wild animals, birds, fish, or other aquatic life.

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 snow melt. Stormwater can also come from hard or saturated grass surfaces such as lawns, pastures, playfields, and from gravel roads and parking lots.

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 (WLAs) for point sources, (2) the load allocations (LAs) 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.

Wasteload Allocation (WLA): The portion of a receiving water's loading capacity allocated to existing or future point sources of pollution. WLAs 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

BCF	bioconcentration factor
BHC	benzene hexachloride (hexachlorocyclohexane)
DDD	dichlorodiphenyl dichloroethane
DDE	dichlorodiphenyl dichloroethylene
DDT	dichlorodiphenyl trichloroethylene
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ERO	Ecology Eastern Regional Office
NRCS	Natural Resources Conservation Service
NTR	National Toxics Rule
PCB	polychlorinated biphenyl
RCW	Revised Code of Washington (the laws for Washington State)
TOC	total organic carbon
TSS	total suspended solids
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WDOH	Washington State Department of Health
WSU	Washington State University
WWTP	wastewater treatment plant
USGS	U.S. Geological Survey
cfs	cubic feet per second
mg/L	milligrams per liter (parts per million)
ug/L	micrograms per liter (parts per billion)
ng/L	nanograms per liter (parts per trillion)
ug/Kg	micrograms per kilogram (parts per billion)

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Abstract

The lower Palouse River has been listed by the state of Washington under Section 303(d) of the federal Clean Water Act for non-attainment of the U.S. Environmental Protection Agency (EPA) human health criteria for 4,4'-DDE, heptachlor epoxide, alpha-BHC, dieldrin, and PCB-1260 in edible fish tissue. These chlorinated pesticides, breakdown products, and polychlorinated biphenyls (PCBs) are no longer used in the United States, having been banned in the 1970s and 1980s. EPA requires states to set priorities for cleaning up 303(d) listed waters and to establish a water quality improvement plan or Total Maximum Daily Load (TMDL) for each. A TMDL includes an analysis of how much of a pollutant load a waterbody can assimilate without violating water quality standards.

Part 1 of this report reviews data on the levels and sources of chlorinated pesticides and PCBs in the Palouse River basin. The results are used to: (1) recommend a change in the listing status for 4,4'-DDE, heptachlor epoxide, and alpha-BHC from Category 5 (TMDL required) to Category 1 (meets standards); and (2) propose a fish tissue-based TMDL for dieldrin and PCBs. Wasteload and load allocations are proposed for sources.

Part 2 of this report describes the implementation plan that the Department of Ecology will use to bring the Palouse River into compliance with water quality standards. The plan recommends monitored natural attenuation, as well as stormwater and agricultural best management practices, to reduce dieldrin and PCB levels.

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Executive Summary

Background

Every two years, the Washington State Department of Ecology (Ecology) prepares the 303(d) list of waterbodies that do not meet Washington State water quality standards. The federal Clean Water Act requires that a Total Maximum Daily Load (TMDL) be developed for each waterbody on the list. The TMDL determines the amount of a pollutant that can be discharged to the waterbody and still meet standards and allocates that load among sources. Ecology then works with the local community to develop a strategy to control the pollution and a monitoring plan to assess the effectiveness of the water quality improvement activities.

The lower Palouse River (near Hooper and Winona, Washington) has been 303(d) listed for non-attainment of the human health criteria for 4,4'-DDE, heptachlor epoxide, alpha-BHC, dieldrin, and PCB-1260 in edible fish tissue, based on samples collected by Ecology in 1984 and 1994. These chlorinated pesticides, breakdown products, and polychlorinated biphenyls (PCBs) are no longer used in the United States, having been banned in the 1970s and 1980s for ecological concerns. They are now classed as probable human carcinogens by the U.S. Environmental Protection Agency (EPA).

Study Area

This TMDL is for the Palouse River from the Washington-Idaho border at river mile 123.4, to the Snake River confluence, including the Washington portion of the South Fork (Water Resource Inventory Area 34). The segment of the mainstem between the Washington-Idaho state line and the town of Colfax is locally referred to as the North Fork. The North Fork and South Fork merge at Colfax to form the mainstem of the Palouse River.

The primary land use in the basin is dryland agriculture and rangeland. Soil erosion has been a major challenge in the Palouse. About 40% of the rich Palouse soils have been lost in the last century because of erosion by water. As a result, many farmers have voluntarily implemented erosion control practices. Urban areas make up less than 1% of the basin in Washington. The South Fork Palouse River is particularly influenced by urban pollution sources, having the two largest cities in its drainage: Pullman, Washington, and Moscow, Idaho.

Applicable Water Quality Criteria

Two sets of Washington State water quality criteria apply to the chlorinated pesticides and PCBs that have been detected in the Palouse River: one for aquatic life and one for human health. The human health criteria for carcinogens are primarily at issue in this TMDL and are established to keep the risk of developing cancer to a pre-specified level. In Washington, the risk level is set such that no more than 1 in 1,000,000 (10^{-6}) people would be likely to develop cancer over a lifetime due to fish and water consumption. Almost all of the cancer risk is due to fish consumption.

Numerical TMDL Targets

For the Palouse River chlorinated pesticide and PCB TMDL, the determination as to whether Washington State water quality standards have been achieved will be based on the fish tissue criteria Ecology uses to identify waterbodies that exceed standards and warrant 303(d) listing. These criteria, shown below, are derived from EPA bioconcentration factors and the human health water quality criteria for fish consumption.

Table ES- 1. Numerical Targets for the Palouse River Chlorinated Pesticide and PCB TMDL

Chemical	Human Health WQ Criteria* (parts per trillion)	EPA Bioconcentration Factor	Numerical Fish Tissue Target for TMDL† (parts per billion)
alpha-BHC	13	130	1.7
Heptachlor epoxide	0.11	11,200	1.2
4,4'-DDE	0.59	53,600	32
Dieldrin	0.14	4,670	0.65
Total PCBs	0.17	31,200	5.3

*for fish consumption
†human health criterion x 0.001 (unit conversion factor) x bioconcentration factor

Recent Ecology Studies

Ecology conducted three recent field studies in response to the chlorinated pesticide and PCB listings for the Palouse River: a low-level analysis of chlorinated pesticides in water samples (May 2004); an intensive survey of chlorinated pesticide and PCB residues in fish fillet samples (May–August 2005); and a pilot study of chlorinated pesticides, PCBs, and other contaminants in Pullman stormwater runoff (winter and early spring 2005–06).

None of the fish fillet samples exceeded human health criteria for alpha-BHC or heptachlor epoxide, and the average 4,4'-DDE concentration met the criterion in all areas. Dieldrin and PCBs were close to human health criteria levels in both upper and lower mainstem fish. There were moderate PCB and dieldrin exceedances in the South Fork. There were no exceedances in the North Fork for PCBs, dieldrin, or the other 303(d) listed pesticides. These results are consistent with the low-level pesticide analysis of river water conducted the previous year.

Ecology issued the Phase II Municipal Stormwater Permit for Eastern Washington that became effective February 16, 2007 under the National Pollutant Discharge Elimination System (NPDES). Pullman will be regulated under Phase II. Three Pullman storm drains were selected for sampling as being representative of the city as a whole: Stadium Way, College Street, and Benewah Street. The drains were sampled during three storm events. 303(d) pesticides and

PCBs were detected in all of the Pullman storm drain samples. Dieldrin and PCBs were present in the highest concentrations and substantially exceeded human health criteria.

TMDL Analysis

Loading capacity is the maximum amount of a pollutant that can be delivered to a waterbody and still achieve water quality standards. The loading capacity of the Palouse River was calculated for 303(d) listed chemicals by multiplying streamflow by the human health water quality criterion. The river's loading capacity for most chemicals is substantially less than one gram per day.

The 2005 fish tissue data were used to calculate the chlorinated pesticide and PCB concentrations in the water column and to make a comparison with the water quality criteria. This analysis determined the current status of the river with respect to loading capacity for 303(d) pesticides and PCBs. The results are shown in Table ES-2.

Table ES- 2. Loading Capacity Status for 303(d) Listed Pesticides and PCBs in the Palouse River, Based on Fish Tissue Concentrations and EPA Bioconcentration Factors (Values greater than 1 exceed loading capacity)

Chemical	Exceedance Factors (Estimated ambient water concentration / human health water quality criterion)			
	Lower Mainstem	Upper Mainstem	South Fork	North Fork
alpha-BHC	<1	<1	<1	<1
Heptachlor epoxide	<1	<1	<1	<1
4,4'-DDE	<1	<1	<1	<1
Dieldrin	1.7	1.3	2.4	<1
Total PCBs	<1	1.4	3.4	<1

The loading capacity analysis indicates that:

1. The South Fork Palouse River exceeds loading capacity for dieldrin and PCBs by factors of 2 to 3, respectively.
2. The mainstem Palouse River (below Colfax) slightly exceeds loading capacity for dieldrin and PCBs.
3. The North Fork Palouse River is below loading capacity.

The focus of the TMDL is therefore to reduce dieldrin and PCB levels in the mainstem and, especially, the South Fork.

A TMDL must identify the total allowed pollutant amount and its components: appropriate wasteload allocations (WLAs) for point sources; load allocations (LAs) for nonpoint sources; and natural background. The allocations proposed for dieldrin and PCBs in the Palouse River are shown in Table ES-3.

Table ES-3. Wasteload and Load Allocations for Dieldrin and PCBs in the Palouse River (grams per day)

Source	Total PCBs	Dieldrin
South Fork Palouse River		
Wasteload Allocations		
Pullman WWTP (interim WLA)	0.0022	0.0018
Albion WWTP (interim WLA)	0.0001	0.0001
Stormwater	BMPs	BMPs
Load Allocations		
Nonpoint	0.010	0.008
Natural Background	0	0
Margin of Safety	0.0032	0.0026
Total Allocations	0.016	0.013
TMDL	0.016	0.013
Mainstem Palouse River		
Wasteload Allocations		
Colfax WWTP (interim WLA)	0.0004	0.0003
Load Allocations		
Nonpoint	0.026	0.021
Natural Background	0	0
Margin of Safety	0.0064	0.0052
Total Allocations	0.032	0.026
TMDL	0.032	0.026

The data available to determine if wastewater treatment plant (WWTP) discharges were causing or contributing to exceedances of human health criteria for dieldrin or PCBs in the Palouse River were extremely limited. Although Ecology suspects that the main sources of PCB and dieldrin are from nonpoint sources, the widespread presence of these contaminants in the environment increases the likelihood they are present in the WWTP effluents. Other water quality assessments of WWTPs have found PCBs and dieldrin in wastewater effluent (Golding, 2001; Serdar, 2003; Johnson et al., 2004). Therefore WLAs were assigned for the three WWTPs that discharge to parts of the river where loading capacity is exceeded. Because the receiving waters already exceed loading capacity, the WLAs were set to meet the human health criteria at the end of pipe for each facility’s design flow. These are interim WLAs that will be revised as more knowledge is gained about the levels being discharged.

Because of the variability of storm events, EPA recommends that effluent limits for NPDES-regulated municipal stormwater discharges be expressed as best management practices (BMPs) rather than as numeric limits. BMPs for Pullman stormwater are included as part of the implementation plan for this TMDL (Part 2 of this report).

For nonpoint sources, the LAs for dieldrin and PCBs were set equal to the loading capacities minus the sum of the WLAs and margin of safety. Because dieldrin and PCBs are man-made chemicals, there is no contribution from natural background. Therefore the LA for natural background is zero for both chemicals. A 20% margin of safety was included in the allocations to account for uncertainty in understanding the relationship between pollutant discharges and water quality impacts.

As with other chemicals banned by EPA, environmental concentrations of dieldrin and PCBs have decreased over time. The effects of the ban are evident in fish that have been analyzed from the lower Palouse River, where the concentrations measured in 2005 are one to two orders of magnitude lower than those recorded in 1984 and 1995. Reduced soil erosion in the Palouse watershed has probably also played a part in lowering contaminant residues in the fish.

Estimates of further reductions required to meet the numerical TMDL targets and bring the river into compliance with water quality standards are shown in Table ES-4.

Table ES-4. Estimates of Reductions Needed in Fish Tissue Concentrations of Dieldrin and PCBs to Meet Water Quality Standards in the Palouse River

	Lower Mainstem	Upper Mainstem	South Fork	North Fork
Dieldrin	41%	23%	59%	0%
Total PCBs	0%	26%	71%	0%

It is proposed that natural attenuation, monitoring, and BMPs be relied on to bring the Palouse River into compliance with water quality standards for dieldrin and PCBs. A monitored natural attenuation approach is warranted because (1) the levels are low relative to human health criteria, (2) the chemicals of concern are no longer used, (3) fish tissue concentrations have decreased over the past 10–20 years and will continue to decrease without further action being taken, and (4) a monitored natural attenuation approach is consistent with EPA-approved TMDLs in other states with similar 303(d) listings. The Washington State Department of Health has reviewed the fish tissue data for the Palouse River and does not consider a fish consumption advisory to be warranted.

Monitoring Plan

Additional monitoring, inspections, and investigations are planned or recommended in four areas for this TMDL:

- Conduct periodic fish tissue monitoring for dieldrin and PCBs.
- Evaluate wastewater treatment facilities (including the collection systems) as potential dieldrin and PCB sources.
- Identify and clean up sources of dieldrin and PCBs to the Pullman storm drain system.
- Identify and clean up abandoned landfills and old dumps vulnerable to high water events or surface runoff during storms.

Recommendations

1. The 303(d) Category 5 listings (Polluted Waters that Require a TMDL) for 4,4'-DDE, heptachlor epoxide, and alpha-BHC in the Palouse River should be moved to Category 1 (Meets Tested Standards for Clean Waters).
2. Ecology should periodically monitor fish tissue for dieldrin and PCBs in the mainstem Palouse River below Colfax and in the South Fork Palouse River to assure levels are continuing to decline at the expected rate. A monitoring frequency of once every five years is recommended.
3. PCBs and dieldrin should be monitored in the influent and effluent of the Pullman, Albion, and Colfax WWTPs.
4. In light of elevated concentrations of dieldrin and PCBs in Pullman stormwater and the potential for adverse water quality impacts, Ecology, the City of Pullman, and Washington State University should work cooperatively to identify and clean up sources of these chemicals to the storm drain system.
5. An effort should be made to identify abandoned landfills and old dumps vulnerable to high water events or surface runoff during storms, determine if they are sources of dieldrin or PCBs to the Palouse River, and remediate as needed.
6. It is anticipated that most sources of dieldrin and PCB are from nonpoint sources. However, if levels do not continue to decline in Palouse River fish as anticipated, then the Moscow, Idaho WWTP should be re-evaluated as a possible contributor to the problem. Initially this could consist of sampling Paradise Creek to quantify dieldrin and PCB loading from the Moscow area.
7. Chemical analysis of the above samples should employ detection limits low enough to compare to human health water quality criteria.

Implementation

The implementation plan for this TMDL expands on the recommendations made in Part 1 of the report. It will serve as both the implementation strategy and the implementation plan required by Ecology's memorandum of agreement with EPA.

Waterbody segments found to meet water quality standards during the study will be moved from Category 5 (Polluted Waterbodies Requiring a TMDL) to Category 1 (Meets Tested Standards) on Ecology's Water Quality Assessment. Ecology will rely on natural attenuation, monitoring, and stormwater and agricultural BMPs to bring the mainstem Palouse River and the South Fork Palouse River into compliance with water quality standards. Wasteload allocations for point sources will ensure these facilities are not contributing to elevated levels of PCBs and dieldrin in the rivers. Limited data suggest that compliance with the water quality standards could be achieved by 2012 for dieldrin and PCBs in the mainstem Palouse River, and by 2017 for dieldrin and 2022 for PCBs in the South Fork Palouse River.

Several agencies and programs will work collaboratively to ensure that levels of dieldrin and PCBs continue to decline. Entities that regulate or discharge stormwater and wastewater, regulate landfills, monitor water quality, or provide technical assistance and funding for methods that reduce erosion should participate in this TMDL. Entities that agreed to participate in this implementation plan include the Environmental Assessment and Water Quality programs within the Department of Ecology, Whitman County Health Department, the cities of Pullman, Colfax and Albion, Washington State University, and the conservation districts in the watershed.

The success of the implementation plan will be measured by tracking the progress of implementation actions and reassessing pollutant levels in the Palouse River and South Fork Palouse River fish tissue. If progress is not being made at the predicted rate, the TMDL coordinator and the partner organizations will evaluate other methods and activities that could help the river meet water quality standards.

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Part 1

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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 Clean Water 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, and 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, 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 they are 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 one of 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 a TMDL approved and its 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 – on the 303d list.

TMDL Process Overview

The Clean Water Act requires that a Total Maximum Daily Load or 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. Then Ecology works with the local community to develop a strategy to control the pollution and a monitoring plan to assess effectiveness of the water quality improvement activities.

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 of the 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.

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 it comes from a set of diffuse (nonpoint) sources such as general urban, residential, or 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

Total Maximum Daily Load Analyses: Loading Capacity

Identification of the contaminant loading capacity for a waterbody is an important step in developing a TMDL. EPA defines the loading capacity as "the greatest amount of loading that a waterbody can receive without violating water quality standards" (EPA, 2001). The loading capacity provides a reference for calculating the amount of pollution reduction needed to bring a waterbody into compliance with standards. The portion of the receiving water's loading capacity assigned to a particular source is a load or wasteload allocation. By definition, a TMDL is the sum of the allocations, which must not exceed the loading capacity.

Why is Ecology Conducting a TMDL Study in This Watershed?

Overview

The lower Palouse River (near Hooper and Winona, WA) has been listed by the state of Washington under Section 303(d) of the Clean Water Act for non-attainment of the human health-based water quality criteria for 4,4'-DDE, heptachlor epoxide, alpha-BHC, dieldrin, and PCB-1260. The human health-based criteria were issued to Washington in 1992 by EPA in the National Toxics Rule (NTR) (40CFR131.36). The listings are based on sampling of edible fish tissue conducted by the Washington State Department of Ecology (Ecology) in 1984 and 1994.

These chlorinated pesticides, breakdown products, and polychlorinated biphenyls (PCBs) are no longer used in the United States, having been banned in the 1970s and 1980s for ecological concerns. They are now classed as probable human carcinogens by EPA. Detailed profiles including use, regulations, environmental occurrence, and health effects have been prepared by the Agency for Toxic Substances and Disease Registry and are available at www.atsdr.cdc.gov/toxpro2.html.

Study Area

This TMDL is for the Palouse River from the Washington-Idaho border at river mile (r.m.) 123.4, to the Snake River confluence, including the Washington portion of the South Fork (Water Resource Inventory Area 34).

The Palouse River drains approximately 3,300 square miles of the Columbia Plateau in southeastern Washington and the Idaho Panhandle (Figure 1). Eighty-three percent of the basin is in Washington State, primarily Whitman County.

The headwaters of the Palouse River originate in the forested mountains of Idaho at an elevation of 5,300 ft. It flows for over 165 miles through dryland farming in the central part of the basin and rangeland to the west, before its confluence with the Snake River at an elevation of about 500 ft. Major tributaries to the Palouse are the South Fork Palouse River and Paradise, Rebel Flat, Rock, Union Flat, and Cow Creeks.

The segment of the mainstem between the Washington-Idaho state line and the town of Colfax is locally referred to as the North Fork. The North Fork and South Fork merge at Colfax to form the mainstem of the Palouse River. The North Fork contributes about 83% of the annual mean flow of the Palouse River at Colfax (Ahmed, 2004).

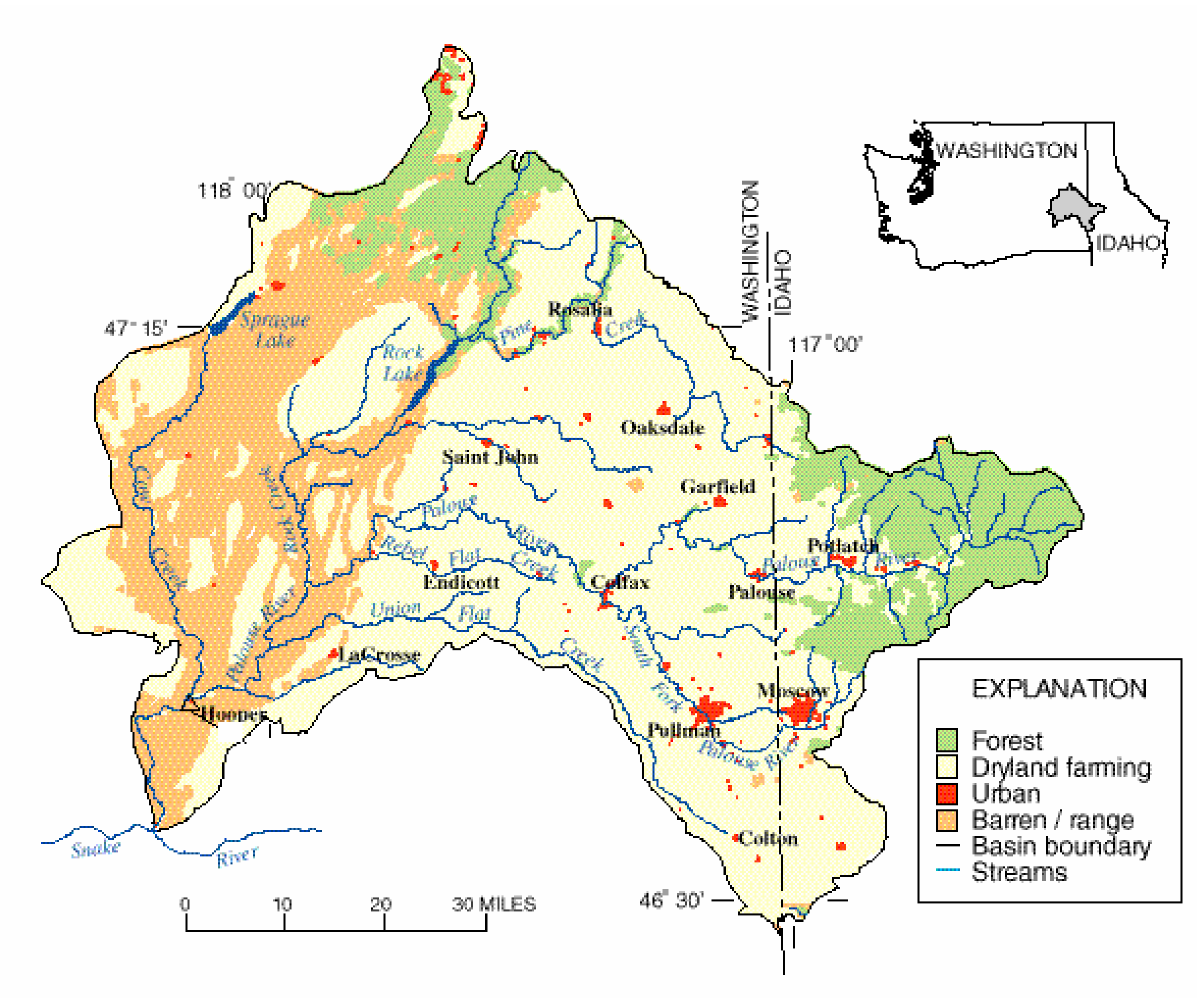

Figure 1. Palouse River Basin (from Ebbert and Roe, 1998)

The primary land use is dryland agriculture (67%), with some rangeland (26%) and forested areas (6%) (Ecology, 2003). Wheat, barley, lentils, and peas are the major crops. Irrigated farming along the Palouse River and its tributaries contributes less than 1% of land use (Wagner and Roberts, 1998).

With a population of only about 47,000, urban areas make up less than 1% of the basin in Washington (Ecology, 2003). The major Washington cities are Pullman (pop. 26,779), Colfax (4,124), and Palouse (1,408). Moscow (21,674) and Potlatch (773) are the largest Idaho cities in the basin.

The South Fork Palouse River is particularly influenced by urban pollution sources, having the two largest cities in its drainage basin. The Moscow wastewater treatment plant (WWTP) discharges to Paradise Creek, and the Pullman WWTP discharges to the South Fork about two miles below the Paradise Creek confluence. Pelletier (1993) developed a TMDL for ammonia in the South Fork. He concluded that "Effluent from…Moscow and Pullman comprise most of the river flow during July-November of a typical year and during any month of the year for design low flows."

Flows in the Palouse River and its tributaries have a strong seasonal variation, with high discharge in the late winter and early spring due to snow melt, and low flow in late summer (Figure 2). Summers are hot and dry; winters are cool with occasional cold snaps. Precipitation increases from west to east, ranging from approximately 13 inches annually in the southwestern part of the basin to over 25 inches in the mountainous headwaters. Approximately 85% of the precipitation occurs between October and May, with 40% occurring between November and January (Wagner and Roberts, 1998).

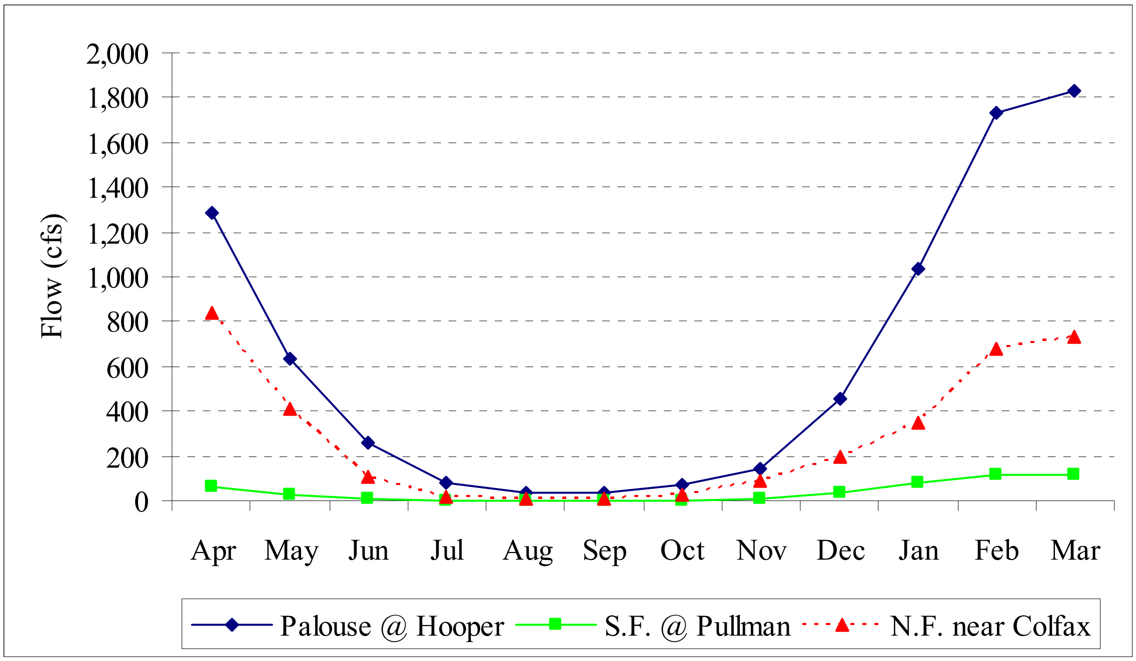

Figure 2. Mean Monthly Flows in the Palouse River [USGS historical data].

Soil erosion has been a major challenge in the Palouse. Farming began in the late 1800s. Erosion became particularly serious in the early 1900s when steep lands once used for hay and pasture were converted to grain production (Ebbert and Roe, 1998; USDA, 1978). About 40% of the rich Palouse soils have been lost in the last century because of erosion by water (Pimentel et al., 1995).

Many farmers have voluntarily implemented erosion control practices in the basin. Since the late 1970s, erosion from cropland has been reduced by at least 10% (Ebbert and Roe, 1998). The United States Geologic Survey (USGS) and Ecology have analyzed the total suspended sediment data for Hooper (Hallock and Ebbert, 1996; Ebbert and Roe, 1998). Although there were indications of improvement, the data were considered inconclusive because the recent period of record was short and because large storm events skewed some of the older data.

The fish fauna in the Palouse River is limited with respect to species generally considered desirable as food. The predominant species of catchable size are large-scale suckers, northern pike minnow, smallmouth bass, and chiselmouth. Of these, only smallmouth bass are locally considered to be a sportfish. Other species known to occur in the drainage include rainbow trout, brown trout, channel catfish, and carp; their distribution is either limited to tributaries (trout), sparse (catfish), or confined to the last few miles of the mainstem (carp).

According to the Washington Department of Fish and Wildlife (WDFW), there is very little sport fishing above Palouse Falls (r.m. 7.0) in the Washington portion of the Palouse River. Because most of the land is privately-owned, there are few places where the public has access to potential fishing sites. There is a limited smallmouth bass fishery on the North Fork and some fishing in Rock Creek for brown trout and smallmouth bass. Rainbow trout are stocked annually in Union Flat Creek, but this fishery is small and mainly for children. While there are certain cultural groups that target specific species in other eastern Washington river basins, WDFW has never observed them fishing in the Palouse. (Personal communication, Bob Weaver/Chris Donely, WDFW).

Pollutants Addressed by This TMDL Study and Implementation Plan

This TMDL study and implementation plan is for the following chemicals in fish tissue and the water column:

- 4,4'-DDE (breakdown product of the insecticide DDT)
- heptachlor epoxide (breakdown product of the insecticide heptachlor)
- alpha-BHC (component of the insecticide benzene hexachloride)
- dieldrin (insecticide)
- PCBs (industrial use chemicals)

The PCB data presented in this report are expressed in terms of Aroclor-equivalents (e.g., PCB-1260) or total PCBs (sum of Aroclor-equivalents or sum of individual PCB compounds, also known as congeners). Aroclor is the trade name of the commercial PCB mixtures predominantly used in the United States. The TMDL is for total PCBs.

The 303(d) listings in Table 1 are specifically addressed by this TMDL study and implementation plan. In addition, the river segments listed in Table 2 were found to contain fish with dieldrin and PCB concentrations above the human health criteria during a 2005 fish tissue study conducted by Ecology and described later in this report.

Table 1. Palouse River 303(d) Listings for Toxics in Edible Fish Tissue (2002/2004 list)

Listing ID	Parameter	Township Range Section	Water Course/ Grid #	Lower Route #	Listing Basis
14190	4,4'-DDE	15N-37E-26	NX00WG	29.009	Hopkins et al. (1985). Excursions beyond the NTR* criterion in a multiple fish composite of edible tissue of largescale sucker and northern squawfish samples at river mile (RM) 19.5 in 1984.
8819	4,4'-DDE	17N-40E-20	NX00WG	75.039	Davis and Serdar (1996). Excursions beyond the NTR criterion in edible squawfish tissue at RM 40.8 in 1994.
14191	alpha-BHC	15N-37E-26	NX00WG	29.009	Hopkins et al. (1985). Excursions beyond the NTR criterion in a multiple fish composite of edible tissue of largescale sucker and northern squawfish samples at RM 19.5 in 1984.
8818	Dieldrin	17N-40E-20	NX00WG	75.039	Davis and Serdar (1996). Excursions beyond the NTR criterion in edible squawfish tissue at RM 40.8 in 1994.
8822	Heptachlor epoxide	17N-40E-20	NX00WG	75.039	Davis and Serdar (1996). Excursions beyond the NTR criterion in edible squawfish tissue at RM 40.8 in 1994.
8820	PCB-1260	17N-40E-20	NX00WG	75.039	Davis and Serdar (1996). Excursions beyond the NTR criterion in edible squawfish tissue at RM 40.8 in 1994.

*EPA National Toxics Rule

Table 2. Additional River Segments Found to be Impaired by Dieldrin and PCBs During Ecology's 2005 Fish Tissue Study

Waterbody and ID	Township Range Section	LL ID #	LL ID Lower Route #	Water Course #	Lower Route #	Location Description
Palouse River WA-34-1010	17N-42E-22	1182144465889	120.461759	NX00WG	118.261	Shields Road Bridge Area
South Fork Palouse River WA-34-1020	16N-44E-19	1173663468898	6.436	ZX82FM	6.272	Near Risbeck
	16N-44E-33		15.903043		15.397	Near Shawnee
	15N-44E-15		22.904577		22.237	Near Albion
	15N-45E-31		32.526		31.499	Downstream of Pullman WWTP

LL = latitude and longitude

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Water Quality Standards and Beneficial Uses

Water quality standards for surface waters of the state of Washington are codified in Chapter 173-201A of the Washington Administrative Code (WAC).

Beneficial Uses

Under the 1997 water quality standards, the mainstem Palouse is a Class B river from the mouth to its confluence with the South Fork Palouse River. The Palouse River from the South Fork confluence to the Idaho border (North Fork Palouse River) is a Class A river. The South Fork Palouse River is Class A to the Idaho border. Beneficial uses for Class A and B waters include, but are not limited to, the following (WAC 173-201A-030):

(i) Water supply (domestic (except Class B), industrial, agricultural).
(ii) Stock watering.
(iii) Fish and shellfish:
> *Salmonid migration, rearing, spawning (except Class B), and harvesting.*
> *Other fish migration, rearing, spawning, and harvesting.*
> *Clam, oyster, and mussel rearing, spawning, and harvesting (except Class B).*
> *Crustaceans and other shellfish (crabs, shrimp, crayfish, scallops, etc.) rearing, spawning, and harvesting.*

(iv) Wildlife habitat.
(v) Recreation (primary contact recreation (Class A), secondary contact recreation (Class B) sport fishing, boating, and aesthetic enjoyment).
(vi) Commerce and navigation.

Recent changes to the water quality standard have reclassified the segment of the Palouse River from the mouth to the Palouse Falls to also include fish spawning and rearing, primary contact recreation, and domestic water supply as beneficial uses.

Toxic Substances

WAC 173-201A-030 states the following with regard to toxic substances:

(vii) Toxic, radioactive, or deleterious material concentrations shall be below those which have the potential either singularly or cumulatively to adversely affect characteristic water uses, cause acute or chronic conditions to the most sensitive biota dependent upon those waters, or adversely affect public health, as determined by the department (see WAC 173-201A-040 and 173-201A-050).

Toxics substances are further addressed in WAC 173-201A-040 as follows (selected sections):

(1) Toxic substances shall not be introduced above natural background levels in waters of the state which have the potential either singularly or cumulatively to adversely affect characteristic

water uses, cause acute or chronic toxicity to the most sensitive biota dependent upon those waters, or adversely affect public health, as determined by the department.

(2) The department shall employ or require chemical testing, acute and chronic toxicity testing, and biological assessments, as appropriate, to evaluate compliance with subsection (1) of this section and to ensure that aquatic communities and the existing and characteristic beneficial uses of waters are being fully protected.

(5) Concentrations of toxic and other substances with toxic propensities not listed in subsection (3) of this section shall be determined in consideration of USEPA Quality Criteria for Water, 1986, as revised, and other relevant information as appropriate. Human health-based water quality criteria used by the state are contained in 40 CFR 131.36 (known as the National Toxics Rule).

(6) Risk-based criteria for carcinogenic substances shall be selected such that the upper-bound excess cancer risk is less than or equal to one in one million.

Water Quality Criteria

Washington State water quality criteria that apply to the chlorinated pesticides and PCBs that have been detected in the Palouse River drainage are shown in Table 3 (from sections (3) and (5) of WAC 173-201A-040). There are two sets of criteria: one for aquatic life and one for human health.

Table 3. Washington State Water Quality Criteria for Chlorinated Pesticides and PCBs Detected in the Palouse River Basin (ng/L; parts per trillion) (The Palouse River is 303(d) listed for the underlined chemicals)

Chemical	Criteria for Protection of Aquatic Life		Criteria for Protection of Human Health	
	Freshwater Chronic*	Freshwater Acute†	Fish Consumption	Water + Fish Consumption
4,4'-DDT	- -	- -	0.59	0.59
<u>4,4'-DDE</u>	- -	- -	0.59	0.59
4,4'-DDD	- -	- -	0.84	0.83
DDT (and metabolites)	1.0	1,100	- -	- -
<u>Dieldrin</u>	1.9	2,500	0.14	0.14
<u>Heptachlor epoxide</u>	- -	- -	0.11	0.10
Hexachlorobenzene	- -	- -	0.77	0.75
gamma-BHC (Lindane)	80	2,000	63	19
<u>alpha-BHC</u>	- -	- -	13	3.9
Endrin	2.3	180	810	760
Chlordane	4.3	2,400	0.59	0.57
<u>PCBs</u>	14	2,000	0.17	0.17

*24-hour average not to be exceeded
†an instantaneous concentration not to be exceeded at any time

Aquatic Life Criteria

The aquatic life criteria are designed to protect for both short-term (acute) and long-term (chronic) effects of toxics exposure. Aquatic life 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 many 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 assigned to the chronic criteria are expressed as 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. Exceedances of aquatic life criteria have rarely been observed in the Palouse River.

Human Health Criteria

Criteria for the protection of human health are contained in the EPA National Toxics Rule (NTR), issued to Washington State in 1992. In freshwaters, the criteria take into account the combined exposure of both drinking the water and eating fish that lived in the water. The criteria are established to protect against non-carcinogenic illness and to 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 (10^{-6}) people with full exposure would be likely to develop cancer in response to that exposure.

Full exposure is defined by set assumptions on body size, fish and water consumption, and the number of years exposed. For example, in Washington the risk is correlated to an average-sized man consuming 6.5 grams per day of fish (approximately 5 pounds per year), drinking 2 liters of water (if a freshwater body), and continuing this pattern for 70 years. People with higher or lower exposure patterns would face higher or lower risks. This basic exposure pattern is the same for both cancer-causing and non-cancer-causing chemicals. The chemicals at issue in the present TDML are all classed as carcinogens. Almost all the cancer risk comes from fish consumption.

Numeric TMDL Targets

For the Palouse River chlorinated pesticide and PCB TMDL, the determination as to whether Washington State water quality standards have been achieved will be based on the fish tissue criteria Ecology uses to identify waterbodies that exceed standards and warrant 303(d) listing (Ecology, 2006). These criteria (Table 4) are derived from EPA bioconcentration factors (BCF[1]) and water column criteria established for fish consumption under the NTR. In essence, the 303(d) fish tissue criteria are the NTR water quality criteria expressed in tissue form.

[1] BCF= C_t/C_w, where C_t is the contaminant concentration in tissue (wet weight) and C_w is the concentration in water.

Table 4. Numerical Targets for the Palouse River Chlorinated Pesticide and PCB TMDL

Chemical	Human Health WQ Criteria* (parts per trillion)	EPA Bioconcentration Factor	Numerical Fish Tissue Target for TMDL† (parts per billion)
alpha-BHC	13	130	1.7
Heptachlor epoxide	0.11	11,200	1.2
4,4'-DDE	0.59	53,600	32
Dieldrin	0.14	4,670	0.65
Total PCBs	0.17	31,200	5.3

*for fish consumption
†human health criterion x 0.001 (unit conversion factor) x bioconcentration factor

Basing the numeric targets on fish tissue rather than water quality criteria applies more directly to the human health concerns at issue in this TMDL. Because fish integrate water column concentrations over time, relatively few fish samples can provide representative data, in contrast to water where a much larger sample size would be required to determine compliance with standards.

Review of Historical Pesticide/PCB Data

The Department of Ecology (Ecology) fish tissue data that resulted in 303(d) listings for the Palouse River are summarized in Table 5 and are compared to the listing criteria. Each of these samples was a composite formed by pooling tissues from five individual fish. Ecology's data requirement for 303(d) listing a waterbody for toxics is that at least three single-fish samples or one composite of at least five fish exceed criteria for protection of human health.

Ecology's fish samples were collected in the lower mainstem Palouse River at Hooper in 1984 (r.m. 19.5) and about 20 miles upstream near Winona in 1994 (r.m. 40.8). The analyses included up to 43 chlorinated pesticides, breakdown products, and PCB mixtures; only detected compounds are shown in Table 5.

Fillets were analyzed from bridgelip sucker (*Catostomus columbianus*) and northern pike minnow (*Ptychocheilus oregonensis*, a.k.a. northern squawfish). 4,4'-DDE was present in the highest concentrations of 73–130 ug/Kg wet weight (parts per billion). Concentrations of dieldrin, heptachlor epoxide, alpha-BHC, and PCB-1260 were 6.3– 6 ug/Kg. Criteria for fish consumption were exceeded by a factor of 2 for PCBs, factors of 2–4 for DDE, and a factor of 5 for heptachlor epoxide. Alpha-BHC and dieldrin concentrations exceeded criteria by factors of 10–20. A whole fish sample had about twice the concentrations found in the fillets.

Ecology also analyzed pesticides in a limited number of water samples collected from the Palouse River near Winona in 1994 (Davis, 1996). Only herbicides were found, none of which are on the 303(d) list. The detection limit for chlorinated pesticides (50 ng/L, parts per trillion) was not low enough to determine if human health criteria were exceeded. PCBs were not analyzed.

USGS has done extensive sampling in the Central Columbia Plateau as part of the National Water Quality Assessment program. Their data on chlorinated pesticides and PCBs in fish and sediment samples collected from the Palouse River basin in 1992 and 1994 are summarized in Tables 6 and 7 (Munn and Gruber, 1997).

USGS analyzed whole largescale suckers collected from the upper Palouse River in Idaho, the North and South Forks, the lower mainstem, Paradise Creek, and Pine Creek. Each data point represents a single sample. Whole fish data cannot be compared to 303(d) criteria, which apply to edible tissue only.

4,4'-DDT, 4,4'-DDE, 4,4'-DDD, hexachlorobenzene, and dieldrin were detected in most of the USGS whole fish samples. The highest total DDT concentrations (DDT+DDE+DDD) were found in the North and South Forks, 180–450 ug/Kg. PCBs were only detected in fish from the North Fork and Paradise Creek (5.0 ug/Kg detection limit). The PCB concentration in the Paradise Creek fish sample was relatively high at 820 ug/Kg. No pesticides or PCBs were detected in fish from the upper Palouse River in Idaho. Alpha-BHC and heptachlor epoxide were not detected in any of the fish samples.

Table 5. Historical Ecology Data on Chlorinated Pesticides and PCBs Detected in Palouse River Fish (ug/Kg wet weight; parts per billion) (Highlighted results are for fillets exceeding 303(d) criteria)

Location:	Palouse R. nr Winona		Palouse R. @ Hooper		
Species:	Largescale Sucker	N. Pike Minnow	Bridgelip Sucker	N. Pike Minnow	303(d) Human Health Criteria
Tissue:	Whole Body	Fillet	Fillet	Fillet	
Date:	Sep-94	Sep-94	Sep-84	Sep-84	
4,4'-DDE	170	73	92	130	32
4,4'-DDD	18	nd	10	5	45
4,4'-DDT	12 J	nd	23	2	32
Total DDT	200	73	125	137	32
Cis-Chlordane	5.7	1.2 J	na	na	
Trans-Chlordane	14	nd	na	na	
Oxychlordane	7.2	2.4 J	na	na	
Cis-Nonachlor	1.7 J	0.75 J	na	na	
Trans-Nonachlor	4.7 J	2.1 J	na	na	
Total Chlordane	33	6.5	na	na	8.3
Dieldrin	13	7 NJ	na	na	0.65
alpha-BHC	nd	nd	37	16	1.7
gamma-BHC (Lindane)	0.27 NJ	0.44 J	na	na	8.2
Heptachlor epoxide	14	6.3	na	na	1.2
Hexachlorobenzene	10	3.6	na	na	6.7
DDMU	2.7 J	nd	na	na	
PCB - 1254	13 J	nd	nd	nd	5.3
PCB - 1260	18 J	11 J	<10	<10	5.3
Total PCBs	31 J	11 J	<10	<10	5.3

Data from: Davis and Serdar (1996) and Hopkins et al. (1985)

J = The analyte was positively identified. The associated numerical value is an estimate.

NJ = There is evidence that the analyte is present. The associated numerical value is an estimate.

nd = not detected

na = not analyzed or not reported

Table 6. USGS Data on Chlorinated Pesticides and PCBs Detected in Whole Body Samples of Largescale Suckers Collected from the Palouse River Basin in 1992 and 1994 (ug/Kg wet weight; parts per billion)

Location	4,4'-DDD	4,4'-DDE	4,4'-DDT	Total DDT	Hexachloro-benzene	Dieldrin	Endrin	Total Chlordane	Total PCBs
Palouse R. @ Harvard (ID)	nd	nd	nd	nd	nd	nd	nd	nd	nd
N.F. Palouse R. @ Colfax	nd	160	24	180	26	32	nd	nd	nd
"	22	400	29	450	33	22	nd	53	70
S.F. Palouse @ Colfax	nd	340	nd	340	16	nd	nd	nd	nd
Palouse R. @ Hooper	5.1	87	7.0	99	14	7.8	9.2	nd	nd
Paradise Creek	58	120	nd	180	11	nd	nd	nd	820
Pine Creek	6.9	120	8.6	140	27	21	10	14	nd

Data from Munn and Gruber (1997)
nd = not detected

Table 7. USGS Data on Chlorinated Pesticides and PCBs Detected in Sediment Samples Collected from the Palouse River Basin in 1992 and 1994 (ug/Kg organic carbon; parts per billion)

Location	4,4'-DDD	4,4'-DDE	4,4'-DDT	Total DDT	Hexachloro-benzene	Lindane	Dieldrin	Total Chlordane	Total PCBs
Palouse R. @ Harvard (ID)	nd	nd	nd	nd	nd	nd	nd	nd	nr
"	nd	nd	nd	nd	nd	nd	nd	nd	nr
N.F. Palouse R. @ Colfax	150	530	160	840	330	170	110	nd	nr
"	nd	320	92	410	470	140	150	610	nr
S.F. Palouse @ Pullman	nd	380	nd	430	nd	nd	nd	nd	nr
S.F. Palouse @ Colfax	120	230	nd	350	nd	nd	nd	nd	nr
Palouse R. @ Hooper	nd	230	nd	230	180	nd	nd	nd	nr
Paradise Creek	nd	180	110	290	nd	nd	100	140	nr
Union Flat Creek	240	1,000	130	1,400	370	130	nd	nd	nr
Pine Creek	nd	nd	nd	nd	92	nd	nd	nd	nr

Data from Munn and Gruber (1997)
nd = not detected
nr = analyzed but data not reported

Generally similar results were obtained on the USGS sediment samples. (Note that these data are normalized to total organic carbon.) Total DDT concentrations were again elevated in the North and South Forks. The highest total DDT concentration, 1,400 ug/Kg_{oc}, was reported in Union Flat Creek. PCBs were apparently not detected at or above 1.0 ug/Kg_{oc} in the sediments, but the report is unclear on this point. Once again, alpha-BHC and heptachlor epoxide were not detected. There are no state standards or 303(d) criteria for pesticides or PCBs in freshwater sediments.

Wagner and Roberts (1998) report USGS pesticide data for 72 filtered water samples from the Palouse basin, including the lower mainstem, North and South Forks, Paradise Creek, Rebel Flat Creek, Pine Creek, Rock Creek, and Union Flat Creek. The sampling was done in 1993–95. As with Ecology's water samples, herbicides were the most frequently detected compounds.

Table 8 summarizes the chlorinated pesticide data in Wagner and Roberts. Lindane is an insecticide currently approved for use on livestock in the Palouse basin. Lindane was routinely detected in the Palouse River at Hooper, being reported in half of the 44 samples analyzed from this location. Ten out of 28 samples from other sites in the basin also had lindane detected. The median and maximum concentrations at Hooper were 5 and 81 ng/L (parts per trillion), respectively.

Table 8. USGS Data on Chlorinated Pesticides Detected in Water Samples Collected from the Palouse River Basin in 1993-95 (ng/L, dissolved, parts per trillion)

Chemical	Palouse River @ Hooper				Other Palouse Basin Sites			
	MDL*	Median	Maximum	Detections	MDL	Median	Maximum	Detections
Lindane	4	5	81	22	4	<4	47	10
Dieldrin	1	<1	10	3	1	- -	- -	0
4,4'-DDE	6	<6	3	3	6	- -	- -	0
alpha-BHC	2	<2	7	1	2	- -	- -	0

Data from Wagner and Roberts (1998)
*MDL - method detection limit

Other chlorinated pesticides were rarely detected in the USGS water samples. Three samples from the Palouse River at Hooper had detectable concentrations of dieldrin and 4,4'-DDE. Alpha-BHC was detected in one sample. Maximum concentrations were 10, 3, and 7 ng/L, respectively. Detection limits for these compounds were 1 ng/L for dieldrin, 2 ng/L for alpha-BHC, and 6 ng/L for 4, 4'-DDE. Heptachlor epoxide was not analyzed.

The lindane concentrations measured by USGS were at or below the Washington State aquatic life criterion of 80 ng/L for chronic exposure (Table 6). All but one sample met the 1.9 ng/L chronic aquatic life criterion for dieldrin. Detection limits for 4,4'-DDE in the USGS analyses were not low enough to compare with aquatic life criteria; the maximum concentration reported did exceed the 1 ng/L chronic criterion. There are no state aquatic life criteria for heptachlor epoxide, alpha-BHC, or hexachlorobenzene.

Human health criteria are more restrictive than aquatic life criteria, ranging from 0.14 ng/L for dieldrin to 63 ng/L for lindane (Table 3). Approximately 15% of the USGS water samples exceeded human health criteria for lindane. Dieldrin and alpha-BHC concentrations exceeded human health criteria in 4% and 1% of samples, respectively. Detection limits for dieldrin, DDT compounds, and most other pesticides were not low enough to determine compliance with human health criteria in the majority of samples.

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Recent Department of Ecology Studies

Ecology conducted three recent field studies in response to the chlorinated pesticide and PCB listings for the Palouse River; the results of these studies are summarized below. The complete data generated by these efforts can be accessed through Ecology's Environmental Information Management system (EIM, www.ecy.wa.gov/eim/).

The Ecology Manchester Environmental Laboratory prepared written case narratives assessing the quality of these data. The reviews include a description of analytical methods and an assessment of holding times, tuning, initial and continuing calibration verification and degradation checks, method blanks, matrix spike/matrix spike duplicate recoveries, laboratory control samples, surrogate recoveries, laboratory duplicates, and standard reference materials. The case narratives are available on request.

Overall, very few problems were encountered in the analysis of these samples. Some low-level results on fish and water samples were qualified as estimated values. Large amounts of interfering substances were encountered in the stormwater samples; all of the concentrations reported here are estimates.

Low-level Pesticide Analysis

The detection limits in the historical water quality data were not low enough to compare with the human health criteria at issue in the 303(d) listings. Therefore, Ecology analyzed a small set of reconnaissance samples to better determine current pesticide levels in the Palouse River. The analysis employed a large volume injection technique that gives detection limits in the sub-parts per trillion range. PCBs were not analyzed due to the high cost of a low-level analysis.
Four samples were collected (Figure 3). One sample from the Palouse River at Hooper was analyzed for 29 chlorinated pesticides or breakdown products, including all compounds previously detected in the drainage. A second sample from this site and one sample each from the North and South Forks near Colfax were analyzed for DDT compounds only. The results are summarized in Table 9. At the time these samples were taken (May 11, 2004), river flow was 237 cfs at Hooper. Total suspended solids ranged from 3–19 mg/L at the sampling sites.

Six compounds were detected in the Hooper sample. These included three of the four 303(d) listed pesticides – 4,4'-DDE, heptachlor epoxide, and dieldrin, but not alpha-BHC – as well as lindane and endrin. Lindane was present at the highest concentration (0.68 ng/L) but did not exceed human health criteria. This is consistent with earlier USGS findings. Dieldrin exceeded human health criteria by a factor of 3. Heptachlor epoxide was at the criterion. Endrin did not exceed criteria. Other pesticides were not detected at or above 0.31 ng/L.

4,4'-DDE concentrations in the four samples ranged from 0.091 to 0.16 ng/L. The highest concentration was in the South Fork. The human health criterion for 4,4'-DDE is 0.59 ng/L. Neither DDT nor its other major metabolite DDD was detectable at any of these sites. The human health criterion for DDT is 0.59 ng/L; the DDD criterion is 0.84 ng/L.

Overall, these results point to dieldrin as being the major pesticide contaminant of concern at the time these samples were collected.

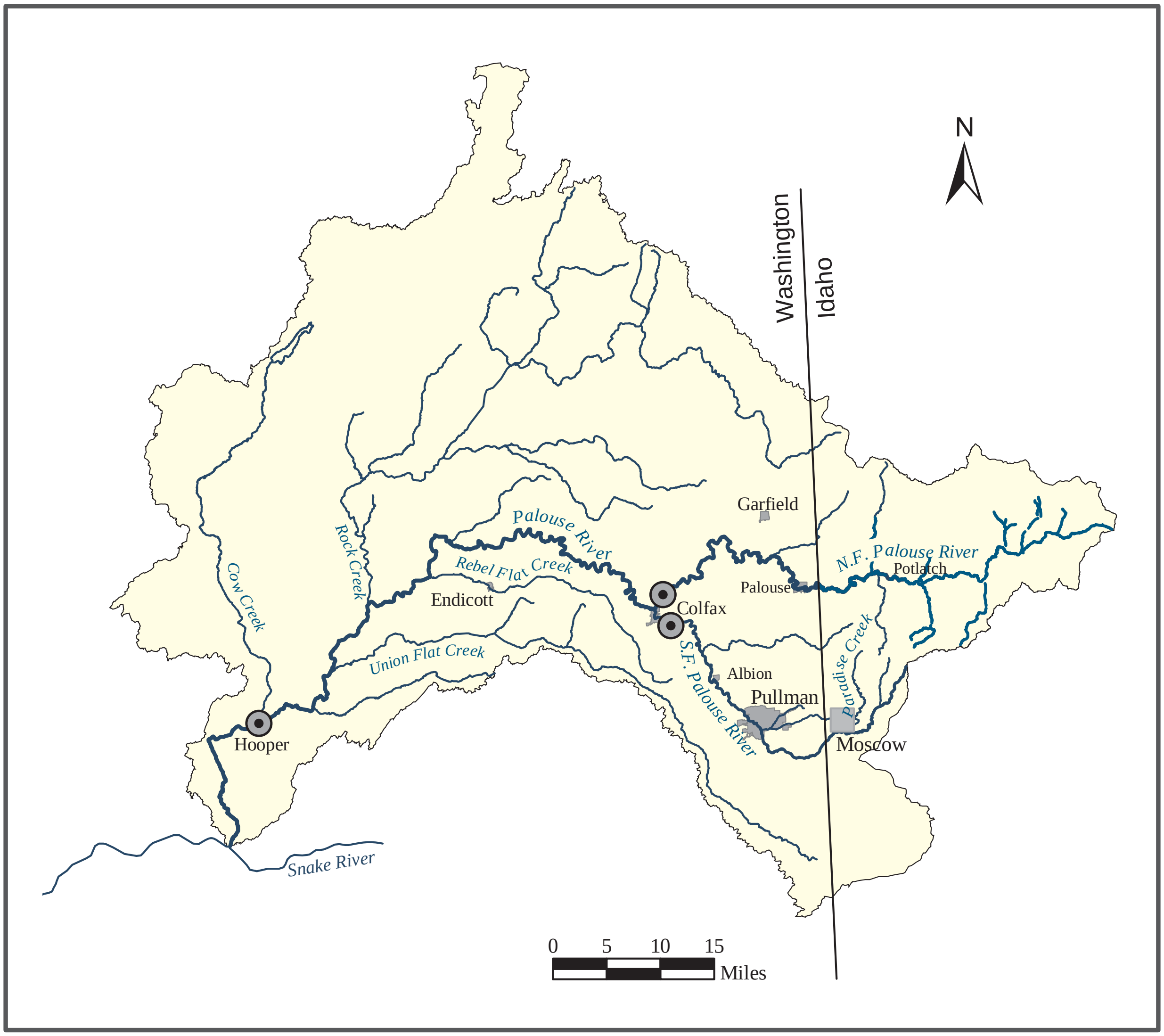

Figure 3. Location of Water Samples Collected by Ecology in May 2004.

Table 9. Results of a Low-Level Analysis for Chlorinated Pesticides in the Palouse River Water Samples Collected by Ecology on May 11, 2004 (ng/L, parts per trillion)

Site:	Palouse R. @ Hooper		N.F. Palouse @ Colfax	S.F. Palouse @ Colfax
Sample No.:	204008	204005	204006	204007
4,4'-DDE	**0.091** J	**0.092** J	**0.063** J	**0.16** J
4,4'-DDT	0.38 U	0.37 U	0.38 U	0.37 U
4,4'-DDD	0.31 U	0.31 U	0.31 U	0.31 U
2,4'-DDE	0.31 U	na	na	na
2,4'-DDT	0.31 U	na	na	na
2,4'-DDD	0.31 U	na	na	na
gamma-BHC (Lindane)	**0.68**	na	na	na
alpha-BHC	0.31 U	na	na	na
beta-BHC	0.31 U	na	na	na
delta-BHC	0.31 U	na	na	na
Dieldrin	**0.44** J	na	na	na
Endrin	**0.42**	na	na	na
Endrin aldehyde	0.54 U	na	na	na
Endrin ketone	0.31 U	na	na	na
Aldrin	0.31 U	na	na	na
Heptachlor	0.31 U	na	na	na
Heptachlor epoxide	**0.13** J	na	na	na
Endosulfan I	**0.11** J	na	na	na
Endosulfan II	0.82 U	na	na	na
Endosulfan sulfate	0.85 U	na	na	na
Hexachlorobenzene	0.39 U	na	na	na
Oxychlordane	0.31 U	na	na	na
trans-Chlordane	0.31 U	na	na	na
trans-Nonachlor	0.31 U	na	na	na
cis-Chlordane	0.31 U	na	na	na
cis-Nonachlor	0.31 U	na	na	na
Methoxychlor	0.31 U	na	na	na
Mirex	0.31 U	na	na	na
Pentachloroanisole	0.31 U	na	na	na

Note: Detected concentrations in bold font
J = The analyte was positively identified. The associated numerical result is an estimate
U = The analyte was not detected at or above the reported result.
na = not analyzed

Expanded Fish Tissue Survey

The 303(d) listings for the Palouse River were based on fish tissue data that were 10 to 20 years old. Because concentrations were likely to have changed since that time and because the number of samples analyzed were few and restricted to the lower river, Ecology undertook an expanded survey of chlorinated pesticides and PCBs in Palouse River fish during 2005. The objective was to determine if and where 303(d) criteria were exceeded and to make recommendations on the scope and focus for a TMDL.

The design of the fish tissue survey is described in Johnson et al. (2005). Skin-on fillets were analyzed from five fish species collected by electrofishing or gill net in the North Fork, South Fork, and upper and lower mainstem between May and August 2005. Each sample was a composite consisting of pooled fillets from between three to five individuals per species. A total of 204 fish were analyzed for the study. Sampling sites are shown in Figure 4. Only two sites could be sampled on the lower mainstem because access to the river was limited.

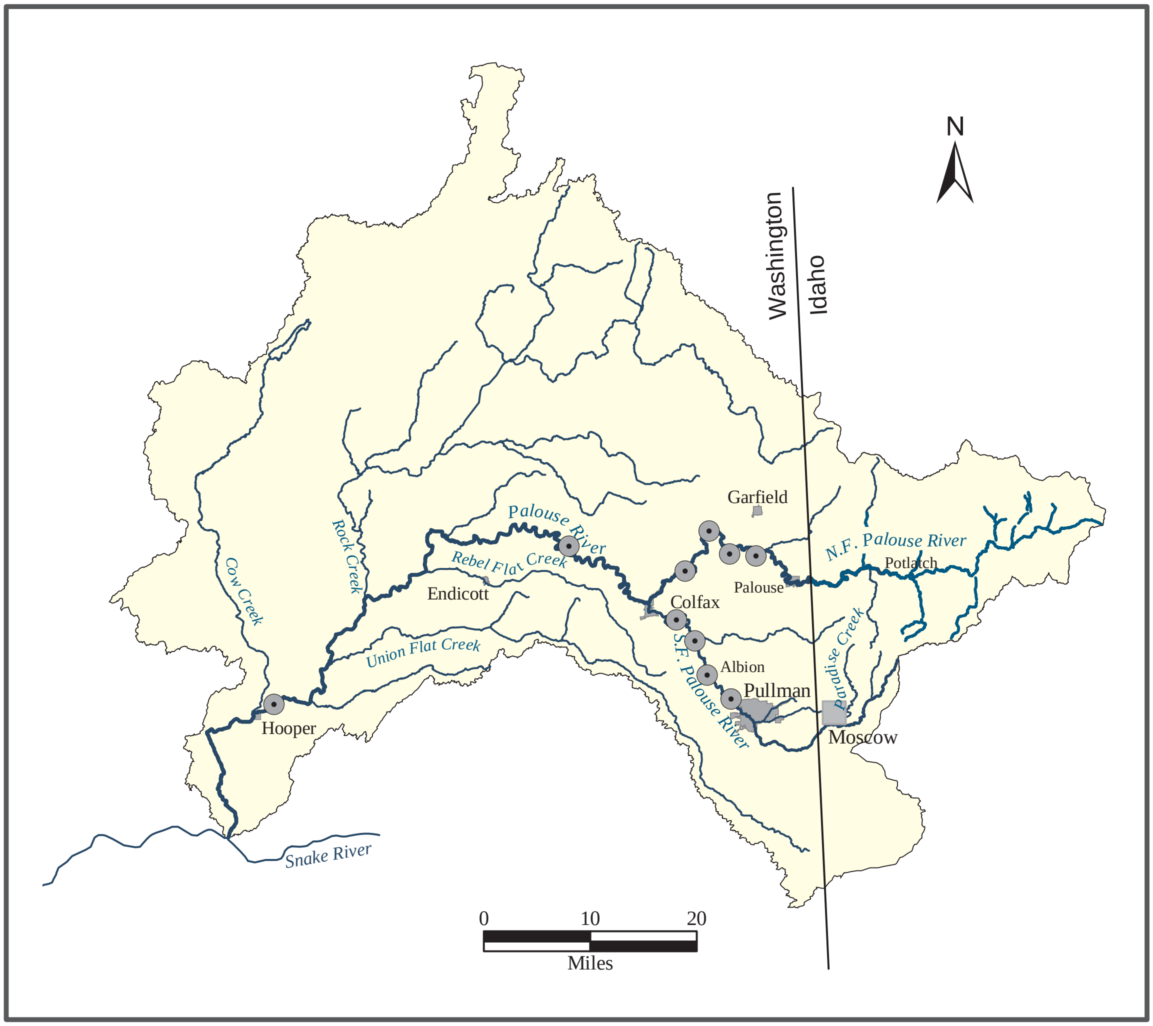

Figure 4. Location of Fish Samples Collected by Ecology in May - August 2005.

The species analyzed were smallmouth bass (*Micropterus dolomieui*), northern pike minnow *Ptychocheilus oregonensis*), largescale sucker (*Catostomus macrocheilus*), chiselmouth (*Arcocheilus alutaceus*), and common carp (*Cyprinus carpio*). Other species generally considered more desirable in this region's sport fishery, such as rainbow trout, brown trout, and catfish, were not found at any location in the river. In most areas only pike minnow, suckers, and chiselmouth were encountered. Biological data on the specimens analyzed can be found in Appendix A.

The fish samples were analyzed for 24 chlorinated pesticides/breakdown products and eight PCB mixtures. The concentrations of 303(d) listed chemicals detected in the samples are summarized in Table 10. Pesticides other than those listed in Table 10 either met human health criteria or were not detected. The complete chemical data are in Appendix B.

Table 10. Mean Concentrations of 303(d) Listed Pesticides and PCBs in Palouse River Fish Fillets Analyzed by Ecology in 2005 Compared to Human Health Criteria (ug/kg, wet weight; parts per billion) (Highlighted values exceed human health criteria)

Reach	No. of Composite Samples	alpha-BHC	Heptachlor epoxide	4,4'-DDE	Dieldrin	Total PCBs
Lower Mainstem	10	0.40 U	0.40 U	13	1.1	4.4
Upper Mainstem	10	0.40 U	0.40 U	25	0.84	7.2
South Fork	12	0.40 U	0.40 U	27	1.6	18
North Fork	14	0.40 U	0.40 U	25	0.34	3.9
303(d) Human Health Criteria		1.7	1.2	32	0.65	5.3

U = not detected at or above reported value

None of the Palouse fish samples exceeded human health criteria for alpha-BHC or heptachlor epoxide. The average 4,4'-DDE concentration met the criterion in all areas. Dieldrin and PCBs were close to human health criteria levels in both upper and lower mainstem fish. There were moderate PCB and dieldrin exceedances in the South Fork. There were no exceedances in the North Fork for PCBs, dieldrin, or the other 303(d) listed pesticides.

These results are consistent with the reconnaissance sampling of river water Ecology conducted the previous year. The North Fork fish tissue samples show no evidence of the elevated pesticide/PCB concentrations reported by USGS in limited fish samples from the early 1990s, previously described.

The pesticide and PCB levels measured in lower Palouse River fish in 2005 were one-to-two orders of magnitude lower than those found by Ecology in 1984 and 1994 and on which the 303(d) listings are based (Table 5). Relative to human health criteria, the highest concentrations in 2005 were for dieldrin and PCBs in South Fork fish, 1.6 and 18 ug/Kg, respectively, on average.

Figure 5 compares the Palouse River PCB data to statewide fish tissue data Ecology and EPA have collected in recent years, as reported by Seiders and Kinney (2004). As shown in this figure, the mean total PCB concentrations in fish from the Palouse River rank among the lower 10% or lower 20% (South Fork) of fish samples statewide. Because of variable and often high detection limits in the statewide data, a similar comparison cannot be made for dieldrin.

Historically, lindane has exceeded human health criteria in Palouse River water samples. Low concentrations of 0.091–1.2 ug/Kg were detected in 60% of Ecology's 2005 fish samples (Appendix B). The human health fish tissue criterion for lindane is 8.2 ug/Kg.

Lindane is only slightly bioaccumulated by aquatic organisms. Lindane (gamma-BHC) isomerizes to alpha-, beta-, and delta-BHC by biological processes and to beta-BHC by photochemical reaction (Callahan et al., 1979). Lindane does not appear to be a human health concern for fish consumption in the Palouse River and is therefore not considered further in this TMDL.

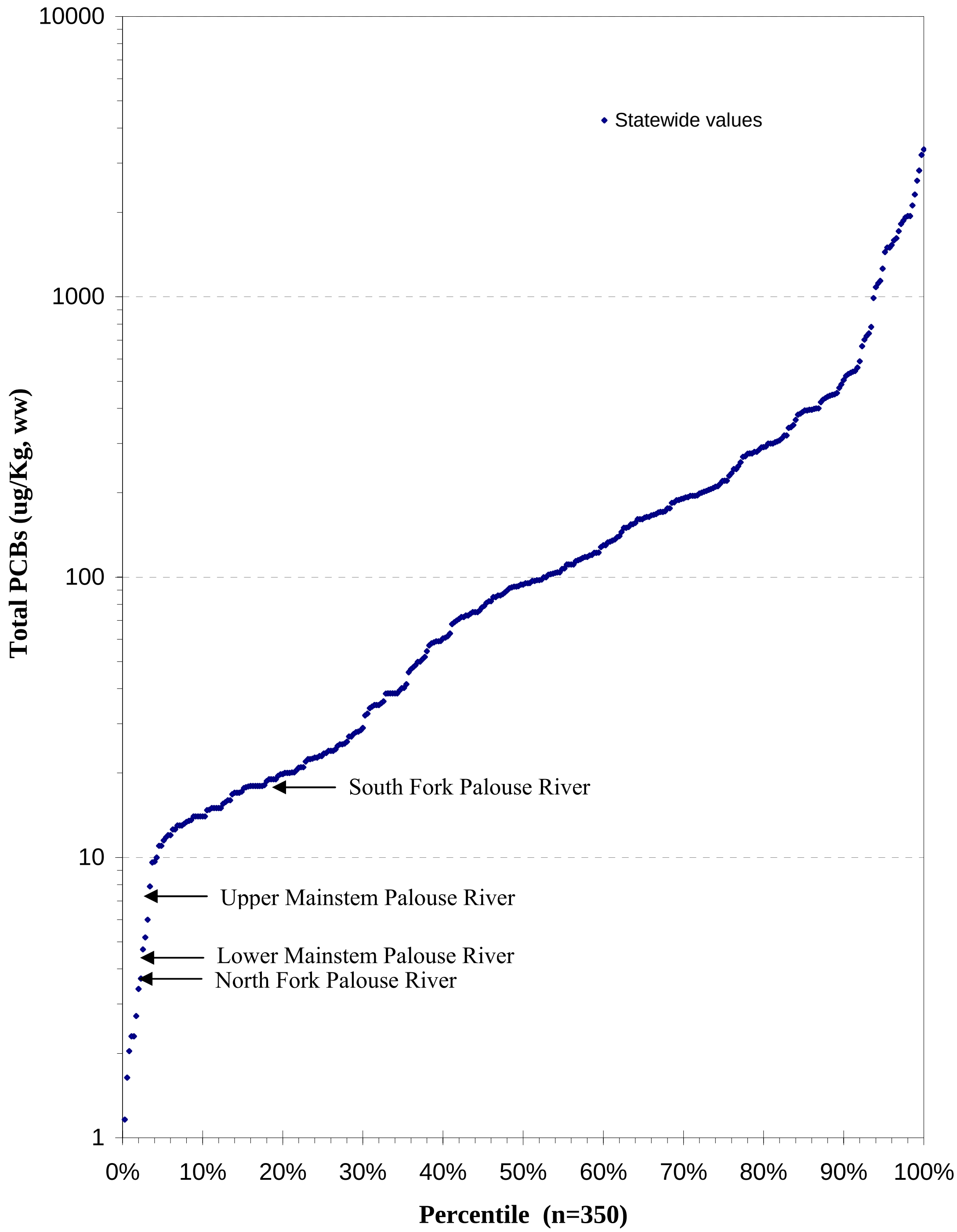

Figure 5. Mean Total PCB Concentrations in Palouse River Fish Compared to Freshwater Edible Fish Tissue Samples Collected Statewide (modified from Seiders and Kinney, 2004)

Stormwater Pilot Study

The Phase II Municipal Stormwater Permits for Eastern Washington became effective in February 2007, under the National Pollutant Discharge Elimination System (NPDES). Phase II communities are identified under the rule as jurisdictions that: (1) own and operate a stormwater system; (2) discharge to surface waters; (3) are located in urbanized areas; and (4) have a population of greater than 10,000. Pullman is the only Washington town in the Palouse River basin with a population over 10,000 and is thus likely to be regulated under Phase II. EPA has not made a final decision on Phase II permitting for Moscow, Idaho.

In November 2002, EPA issued a Policy Memorandum on Wasteload Allocations for Stormwater indicating that stormwater discharges from permitted entities must be addressed under wasteload allocations established for TMDLs. In 2005, Ecology received a grant from EPA to conduct a pilot project to estimate the municipal stormwater load of pollutants from Phase II cities. In view of the TMDLs scheduled for the Palouse basin – which, in addition to toxics, include temperature, fecal coliform bacteria, dissolved oxygen, nutrients, and pH – Ecology decided to conduct the study in Pullman. The technical studies being conducted for these other TMDL parameters are described in Mathieu and Carroll (2006) and Bilhimer et al. (2006).

The design of the Pullman stormwater study is detailed in Lubliner (2005). For purposes of this study, a storm event was defined as 0.2 inches of rainfall in a 24-hour period. Precipitation probabilities for Pullman are shown in Figure 6. As indicated in this figure, the probability of precipitation exceeding 0.2 inches is approximately 10% for November through March and less than 10% for April through September.

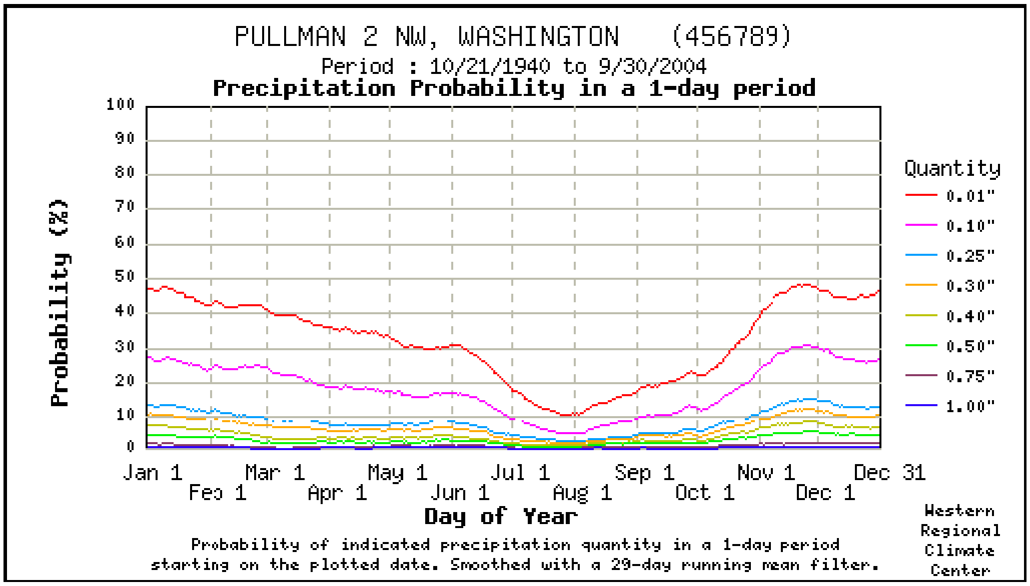

Figure 6. One-Day Precipitation Probabilities in Pullman, WA (Lubliner, 2005)

Stormwater runoff from Pullman drains to four creeks: Airport Creek, Paradise Creek, Missouri Flat Creek, and Dry Creek. Airport Creek empties into Paradise Creek at the Pullman city limits. The other three creeks are tributaries that converge with the South Fork Palouse River in Pullman.

Three storm drains were selected for sampling (Figure 7). The Stadium Way drain serves the largest stormshed in Pullman, and land use is characteristic of the city as a whole, including light commercial, residential, and portions of Washington State University (WSU). The second site, College Street, drains the southwestern side of WSU. Benewah Street drains the southern end of the WSU campus, including high density residential, and several commercial areas along Highway 270 and Latah Street.

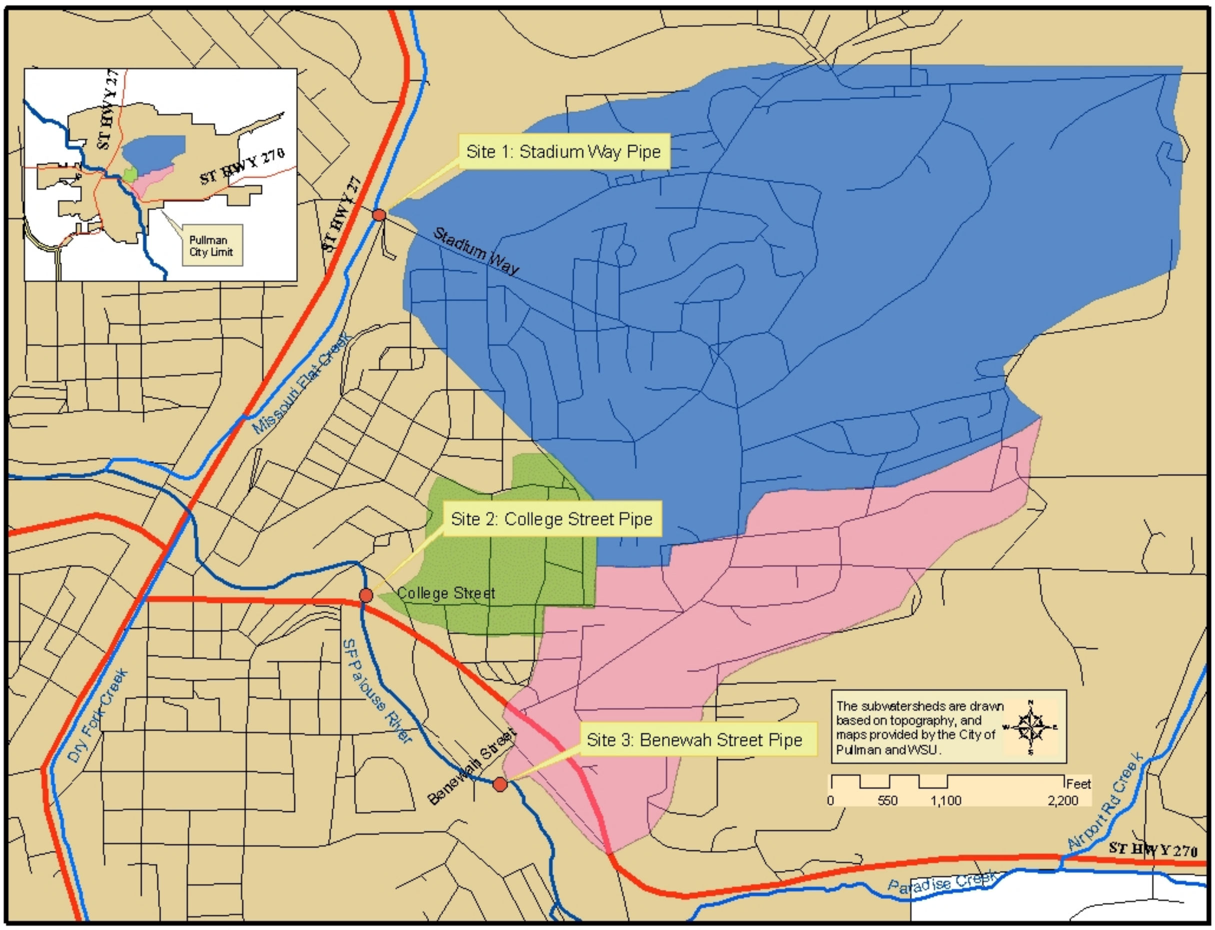

Figure 7. Pullman Area Showing Sampling Sites for 2005-06 Stormwater Pilot Study (Lubliner, 2006).

The storm drains were sampled over three storm events during the winter and early spring of 2005-2006 and analyzed for chlorinated pesticides, PCBs, fecal coliform bacteria, and ancillary water quality parameters. Each pesticide/PCB sample was a grab composite that covered the first three hours of the storm.

The results for 303(d) listed pesticides and PCBs are summarized in Table 11. Pesticides other than those listed in Table 11 either met human health water quality criteria or were not detected.

Table 11. Concentrations of 303(d) Listed Pesticides and PCBs in Pullman Stormwater Samples Collected in 2005-06 (ng/L, parts per trillion)

Storm drain	Date	alpha-BHC		Heptachlor epoxide		4,4'-DDE		Dieldrin		Total PCBs
Stadium Way	10/13/2005	0.49	J	0.39	J	2.0	J	3.1	UJ	4.1
	1/30/2006	0.10	J	0.16	J	2.0	J	0.50	J	1.5
	4/5/2006	0.20	J	0.18	J	4.8	J	0.36	J	11
College Street	10/13/2005	0.46	J	0.38	J	1.3	J	0.37	J	8.3
	1/30/2006	0.21	J	0.33	J	1.7	J	0.53	J	18
	4/5/2006	0.15	J	0.16	J	1.5	J	0.11	J	13
Benewah Street	10/13/2005	0.52	J	0.32	UJ	2.0	J	1.3	J	17
	1/30/2006	0.17	J	0.23	J	3.3	J	5.0	J	18
	4/5/2006	0.20	J	0.20	J	1.4	J	2.0	J	45
Human Health WQ Criteria*		13		0.11		0.59		0.14		0.17

UJ = The analyte was not detected at or above the reported estimated result.
J = The analyte was positively identified. The associated numerical result is an estimate.
*for fish consumption

303(d) pesticides and PCBs were detected in all of the Pullman storm drain samples. Dieldrin and PCBs were present at the highest concentrations, 0.11–5.0 and 1.5–45 ng/L, respectively. Human health criteria were substantially exceeded for dieldrin (0.14 ng/L) and PCBs (0.17 ng/L). The highest concentrations were recorded for the Benewah Street drain, followed by College Street and, lastly, Stadium Way.

A final report on the stormwater study has been completed: *Pullman Stormwater Pilot Study for Pesticides, PCBs, and Fecal Coliform Bacteria, 2005-2006* (Lubliner, 2006).

Evaluation of Other Potential Sources

NPDES Discharges

Washington facilities that currently have NPDES permits to discharge to surface water in the Palouse basin are listed in Table 12. All the surface water discharges are from wastewater treatment plants (WWTPs).

Table 12. Washington WWTPs that Discharge to Surface Water in the Palouse River Basin

Facility	Type	Size	Receiving Water
Albion	Municipal	Minor	South Fork Palouse River
Colfax	Municipal	Minor	Mainstem Palouse River
Colton	Municipal	Minor	Union Flat Creek
Endicott	Municipal	Minor	Rebel Creek
Garfield	Municipal	Minor	Silver Creek
Oakesdale	Municipal	Minor	Pine Creek
Palouse	Municipal	Minor	North Fork Palouse River
Pullman	Municipal	Major	South Fork Palouse River
Rosalia	Municipal	Minor	Pine Creek
St. John	Municipal	Minor	Pleasant Valley Creek

Pesticide and PCB data have been reported for the Pullman WWTP, the largest NPDES discharger in the Washington portion of the basin (City of Pullman, 1999**)**. Pullman discharges to the South Fork.

Composite samples of Pullman's final effluent were analyzed in 1997 and 1999. No chlorinated pesticides or PCBs were detected in either sample. The 1999 data are shown in Table 13. Pesticides and PCBs have not been analyzed in effluent from other Washington WWTPs or from the Moscow WWTP (Sonia Vidanage, EPA Region 10, 2/24/06 email).

Table 13. Results of a Chlorinated Pesticide and PCB Analysis on a Composite Effluent Sample Collected from the Pullman WWTP on October 9, 1999 (ug/L; parts per billion)

Chemical	Concentration	
4,4'-DDE	0.05	U
4,4'-DDT	0.05	U
4,4'-DDD	0.05	U
gamma-BHC (Lindane)	0.05	U
alpha-BHC	0.05	U
beta-BHC	0.05	U
delta-BHC	0.05	U
Dieldrin	0.05	U
Endrin	0.05	U
Endrin aldehyde	0.05	U
Aldrin	0.05	U
Heptachlor	0.05	U
Heptachlor epoxide	0.05	U
Endosulfan I	0.05	U
Endosulfan II	0.05	U
Endosulfan sulfate	0.05	U
Hexachlorobenzene	0.05	U
Chlordane	0.05	U
Methoxychlor	0.05	U
PCB-1016	0.50	U
PCB-1221	0.50	U
PCB-1232	0.50	U
PCB-1242	0.50	U
PCB-1248	0.50	U
PCB-1254	0.50	U
PCB-1260	0.50	U

U = The analyte was not detected at or above the reported result.

Although no chlorinated pesticides or PCBs were detected in Pullman effluent, the detection limits were not low enough to determine if human health criteria were exceeded. In many cases the criteria are two or more orders of magnitude lower.

Hazardous Waste/Toxics Cleanup Sites

The Ecology Eastern Regional Office (ERO) was consulted to determine if there are hazardous waste or toxics cleanup sites in the Palouse River basin that could be sources for the chemicals of concern in this TMDL. Table 14 provides a listing and assessment of sites of potential interest. Ten sites have been investigated. There is no evidence that any of these sites are sources of chlorinated pesticides or PCBs to the Palouse River.

Table 14. Hazardous Waste/Toxic Cleanup Sites Evaluated for the Palouse River Chlorinated Pesticides and PCB TMDL (prepared by Lisa Brown HWTR and Elaine Snouwaert WQP, Ecology Eastern Regional Office)

Site Name (Location)	Comment
Rogers Bros/NK Seed Sumner N & 3rd, Colfax	Site had soil and groundwater contamination that included dieldrin. All contaminated soils have been removed. Calculations indicated groundwater has low potential to affect dieldrin concentrations in the Palouse River
Colfax Grange Supply Walla Walla Highway	Inspected in 1995. Some areas of concern, but limited to currently used pesticides.
Passmore Aviation Route 1, Box 21, LaCrosse	Does not appear to be of concern for the TMDL.
Dale's Flying Service Route 1, Box 12, Palouse	Does not appear to be of concern for the TMDL.
Nu-Chem 2622 S. Grand, Pullman	Does not appear to be of concern for the TMDL.
McKiernan Bros Farm & Auto Palouse Highway, Pullman	Most recent concerns had to do with oil.
Dion Flying Service Rosalia Airport	Received complaint in 1997, followed with an inspection. The concern was limited to currently used chemicals draining to the ground.
Rosalia Producers Rosalia	Does not appear to be of concern for the TMDL.
Laramie Davis (crop duster) RR2, Box 3, St. John	Does not appear to be of concern for the TMDL.
Sprague Grange Supply Box 307, Sprague	Inspected in 1993, no mishandlings of chemicals.

Abandoned Landfills/Dumps

Old municipal landfills and dumps located on or near the Palouse River are potential sources of chlorinated pesticides and PCBs. The following relevant information was obtained through ERO files.

- The City of Pullman used to dump refuse directly into the South Fork just west of town. A closed landfill is located near this site. There is no sign of a direct discharge, but it is near the river. An incinerator used for burning municipal garbage and other waste material was also located on the north bank about ½ mile downstream. Ash, bricks, and other residues from this facility are still evident on the river bank.

- High water events in 1996-97 uncovered an old dump site about two miles downstream of Colfax on the mainstem. An oxbow was fortified at the upstream end with automobile bodies. The channel was then used as a disposal site until the early 1970s when it was covered. Refuse was visible for miles downstream after the flood waters receded. Whatever toxics were associated with this site appear to have been flushed out over the years. Refuse that did not wash away was covered in place.

- The Whitman County Health Department collected water samples at this site in May 1997. Two samples were analyzed: one from an eroded channel that cut through the fill and another from a seep of discolored water on the river side of the fill. No chlorinated pesticides or PCBs were detected at or above 1.0 ug/L (unpublished data collected by John Skyles, Whitman County Health Department, Colfax).

Marti and Chern (1991) assessed groundwater and surface water contamination at the Washington State University chemical waste landfill in Pullman. The landfill was located on 16 acres at the eastern edge of the campus on a south facing slope bordered by Airport Creek, a tributary to Paradise Creek. Marti and Chern concluded that "In general, contaminant concentrations were low, confirming previous groundwater sample results." Low concentrations (<1.0 ug/L) of chlorinated pesticides were detected in only 1 of the 16 wells sampled. The detections included DDT compounds and heptachlor epoxide, but not dieldrin or alpha-BHC. No chlorinated pesticides were detected in an Airport Creek water sample collected downstream of the site. PCBs were not detected in any groundwater or surface water samples.

TMDL Analysis

Loading Capacity

Loading capacity is the maximum amount of a pollutant that can be delivered to a waterbody and still achieve water quality standards. Loading capacity can be calculated by multiplying streamflow by the pollutant water quality criterion. EPA recommends using the long-term harmonic mean flow for carcinogens, since the adverse impacts 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 always less than the arithmetic mean and is expressed as $Q_h = n/\sum(1/Q_i)$ where n is the number of recorded flows Q_i. As previously described, flows in the South Fork Palouse River can be comprised primarily of WWTP effluent any month of the year. For effluent dominated streams such as the South Fork, EPA (1991) recommends using the arithmetic mean flow.

The loading capacity of the mainstem and South Fork was calculated for 303(d) listed chemicals (Table 15). The harmonic mean for the mainstem Palouse River was derived from USGS historical streamflow data for Hooper. The arithmetic mean for the South Fork is based on the combined flow of the South Fork Palouse River at Pullman and Missouri Flat Creek. (The period of record for the USGS gauging station on the South Fork at Colfax was limited to 1993-95, so the data were not sufficient to use in this analysis.) Pelletier (1993) observed a trend toward increasing flows in the South Fork during the period 1960-80, which was attributed to increasing flows out of the Moscow WWTP. The mean flow was therefore calculated using data from 1980–2003 (most recent verified data currently available). Loading capacities are substantially less than one gram per day for most chemicals.

Table 15. Loading Capacity of the Palouse River for 303(d) Listed Pesticides and PCBs

Reach/Chemical	Human Health Water Quality Criteria (ng/L)	Loading Capacity (grams/day)
Mainstem (harmonic mean flow = 76 cfs*)		
alpha-BHC	13	2.4
Heptachlor epoxide	0.11	0.020
4,4'-DDE	0.59	0.11
Dieldrin	0.14	0.026
Total PCBs	0.17	0.032
South Fork (arithmetic mean = 38 cfs†)		
alpha-BHC	13	1.2
Heptachlor epoxide	0.11	0.010
4,4'-DDE	0.59	0.055
Dieldrin	0.14	0.013
Total PCBs	0.17	0.016

*USGS site #13351000 Palouse River @ Hooper
†USGS site #13348000 S.F. Palouse River @ Pullman plus site #1332800 Missouri Flat Creek @ Pullman

Loading capacity can also be expressed in terms of the contaminant concentration in the water. The 2005 fish tissue data were used to back-calculate ambient water column concentrations and make a determination as to the current status of the river with respect to loading capacity for 303(d) listed pesticides and PCBs (Table 16). The mean fish tissue values were used in the calculation. This is appropriate since the human health water quality criteria apply to the average exposure (dose) over a lifetime of fish consumption.

Table 16. Loading Capacity Status of the Palouse River, Based on Fish Tissue Concentrations of 303(d) Listed Pesticides and PCBs

Reach/Chemical	Mean Fish Tissue Concentration (ug/Kg)	EPA Bioconcentration Factor (L/Kg)	Est. Ambient Water Concentration * (ng/L)	Human Health WQ Criteria (ng/L)	Exceedance Factor for Water†
Lower Mainstem					
alpha-BHC	<0.40	130	<3	13	<1
Heptachlor epoxide	<0.40	11,200	<0.04	0.11	<1
4,4'-DDE	13	53,600	0.24	0.59	<1
Dieldrin	1.1	4,670	0.24	0.14	1.7
Total PCBs	4.4	31,200	0.14	0.17	<1
Upper Mainstem					
alpha-BHC	<0.40	130	<3	13	<1
Heptachlor epoxide	<0.40	11,200	<0.04	0.11	<1
4,4'-DDE	25	53,600	0.47	0.59	<1
Dieldrin	0.84	4,670	0.18	0.14	1.3
Total PCBs	7.2	31,200	0.23	0.17	1.4
South Fork					
alpha-BHC	<0.40	130	<3	13	<1
Heptachlor epoxide	<0.40	11,200	<0.04	0.11	<1
4,4'-DDE	27	53,600	0.50	0.59	<1
Dieldrin	1.6	4,670	0.34	0.14	2.4
Total PCBs	18	31,200	0.58	0.17	3.4
North Fork					
alpha-BHC	<0.40	130	<3	13	<1
Heptachlor epoxide	<0.40	11,200	<0.04	0.11	<1
4,4'-DDE	25	53,600	0.47	0.59	<1
Dieldrin	0.34	4,670	0.07	0.14	<1
Total PCBs	3.9	31,200	0.13	0.17	<1

*fish tissue concentration / bioconcentration factor x 0.001 (unit conversion factor)
†estimated ambient water concentration / human health water quality criteria

Based on Table 16, the following conclusions appear warranted with respect to the Palouse River's loading capacity for the pesticides and PCBs of concern in this TMDL:

- The mainstem Palouse River (below Colfax) is below loading capacity for 4,4'-DDE, heptachlor epoxide, and alpha-BHC, but slightly exceeds loading capacity for dieldrin and for PCBs in the upper mainstem only.
- The South Fork Palouse River is below loading capacity for 4,4'-DDE, heptachlor epoxide, and alpha-BHC, but exceeds loading capacity for dieldrin and PCBs by factors of 2–3.

- The North Fork Palouse River is below loading capacity for 4,4'-DDE, heptachlor epoxide, alpha-BHC, dieldrin, and PCBs.

This analysis supports a change in the listing status for 4,4'-DDE, heptachlor epoxide, and alpha-BHC in the Palouse River. The current Category 5 listings (Polluted Waters that Require a TMDL) for these compounds should be moved to Category 1 (Meets Tested Standards for Clean Waters).

The remainder of Part 1 of this report is devoted to the development of a TMDL for dieldrin and PCBs in the mainstem and South Fork Palouse River.

Wasteload and Load Allocations

A TMDL must identify the total pollutant amount allowed and its components: appropriate wasteload allocations for point sources; load allocations for nonpoint sources; and natural background. The allocations proposed for dieldrin and PCBs in the Palouse River are shown in Table 17.

Table 17. Wasteload and Load Allocations for Dieldrin and PCBs in the Palouse River (grams per day)

Source	Total PCBs	Dieldrin
South Fork Palouse River		
Wasteload Allocations		
Pullman WWTP (interim WLA)	0.0022	0.0018
Albion WWTP (interim WLA)	0.0001	0.0001
Stormwater	BMPs	BMPs
Load Allocations		
Nonpoint	0.010	0.008
Natural Background	0	0
Margin of Safety	0.0032	0.0026
Total Allocations	0.016	0.013
TMDL	0.016	0.013
Mainstem Palouse River		
Wasteload Allocations		
Colfax WWTP (interim WLA)	0.0004	0.0003
Load Allocations		
Nonpoint	0.026	0.021
Natural Background	0	0
Margin of Safety	0.0064	0.0052
Total Allocations	0.032	0.026
TMDL	0.032	0.026

The data that were available to determine if WWTP discharges were causing or contributing to exceedances of human health water quality criteria for dieldrin or PCBs in the Palouse River were extremely limited and insufficient to determine compliance with the criteria. Effluent samples analyzed for TMDLs in other parts of Eastern Washington show that PCBs and dieldrin are discharged from WWTPs, with PCBs commonly exceeding criteria (Golding, 2001; Serdar, 2003; Johnson et al., 2004).

Although Ecology suspects that the main sources of PCB and dieldrin are from nonpoint sources, the widespread presence of PCB and dieldrin in the environment increases the likelihood they are present in the WWTP effluents. Therefore wasteload allocations (WLAs) were assigned for the Pullman, Albion, and Colfax WWTPs (Table 18). Because the receiving waters already exceed loading capacity for these compounds, the WLAs were set to meet the human health criteria at the end of pipe for each facility's design flow. These are interim WLAs that will be revised as more knowledge is gained about the levels being discharged.

Table 18. PCB and Dieldrin Interim Wasteload Allocations for Palouse River Wastewater Treatment Plants

WWTP	Chemical	Design Flow (mgd)	Human Health Criteria (ng/L)	Interim WLA* (grams/day)
Pullman	Total PCBs	3.4	0.17	0.0022
	Dieldrin	3.4	0.14	0.0018
Albion	Total PCBs	0.12	0.17	0.0001
	Dieldrin	0.12	0.14	0.0001
Colfax	Total PCBs	0.60	0.17	0.0004
	Dieldrin	0.60	0.14	0.0003

* = mgd x criteria/1000 x 3.79

As previously described, storm events in the Palouse are infrequent and of short duration. EPA recognizes that establishing numeric limits for municipal stormwater discharges is rarely feasible because of the variability of storm events (EPA, 2002). EPA therefore recommends that effluent limits for NPDES-regulated municipal stormwater discharges should be expressed as best management practices (BMPs) rather than as numeric limits (EPA, 2002). BMPs for Pullman stormwater are described in the implementation plan (Part 2 of this report).

For nonpoint sources, the load allocations for dieldrin and PCBs were set equal to the loading capacities (Table 15) minus the sum of the wasteload allocations and margin of safety. Because dieldrin and PCBs are man-made chemicals, there is no contribution from natural background. Therefore the load allocation for natural background is zero for both chemicals.

Margin of Safety

A margin of safety is required in a TMDL to account for uncertainty in understanding the relationship between pollutant discharges and water quality impacts. In recognition of the uncertainties associated with stormwater and WWTP loading of PCBs and dieldrin, including those from the Moscow area, this TMDL includes a safety margin of 20% of the loading capacities of the South Fork and mainstem Palouse River (Table 15).

Achieving Water Quality Standards

Dieldrin was widely used in the United States from 1950 to 1974 as a broad spectrum insecticide on termites and other soil-dwelling insects, and on corn, cotton, citrus, and other crops. As such, it is primarily associated with nonpoint sources. In an EPA (1992) national study of chemical residues in freshwater fish, dieldrin concentrations decreased according to the following land use categories: agricultural > urban/industrial > wastewater treatment plants. EPA banned the use of dieldrin on food products in 1974. All uses were voluntarily cancelled by industry in 1984. (EPA, 1992 and 2000).

PCBs are commercial products containing various mixtures of chlorinated biphenyls. In the United States, PCBs were produced commercially from 1929 until 1977. After 1974, PCBs were primarily used as dielectric (nonconductor) fluids in capacitors and transformers. Prior to 1974 other uses of PCBs included: plasticizers in plastic and rubber products; lubricants in hydraulic and vacuum fluids; ink carriers and solvents in making carbonless paper; and as a sealer for gaskets and furnaces. The EPA (1992) study found the highest PCB residues in fish from urban/industrial rivers and streams. Thus, like dieldrin, PCBs are primarily a nonpoint pollutant, but associated with urban areas more so than agriculture. In 1974, EPA banned the production-based discharge of PCBs. Their manufacture, processing, and distribution in commerce were banned in 1979; continued use was allowed in closed electrical systems. In 1982 and 1985, further restrictions were placed on PCBs in electrical equipment.

As with other chemicals banned by EPA, environmental concentrations of dieldrin and PCBs have decreased over time. The effects of the ban are evident in lower Palouse River fish, where the concentrations measured in 2005 are one to two orders of magnitude lower than those recorded in 1984 and 1995 (Table 19). The trend toward decreasing concentrations of PCBs, dieldrin, and other 303(d) listed chemicals in the lower Palouse River is illustrated in Figure 8. Reduced soil erosion in the Palouse watershed has probably also played a part in lowering contaminant concentrations in the fish.

Table 19. Comparison of Historical and Recent Data on 303(d) Listed Pesticides and PCBs in Lower Mainstream Palouse River Fish (ug/Kg, wet weight)

Chemical	1984/1994 (1-3 composite samples)	2005 (mean of 10 composites samples)
alpha-BHC	16 - 37	<0.40
Heptachlor epoxide	6.3	<0.40
4,4'-DDE	73 - 137	13
Dieldrin	7	1.1
Total PCBs	11	4.4

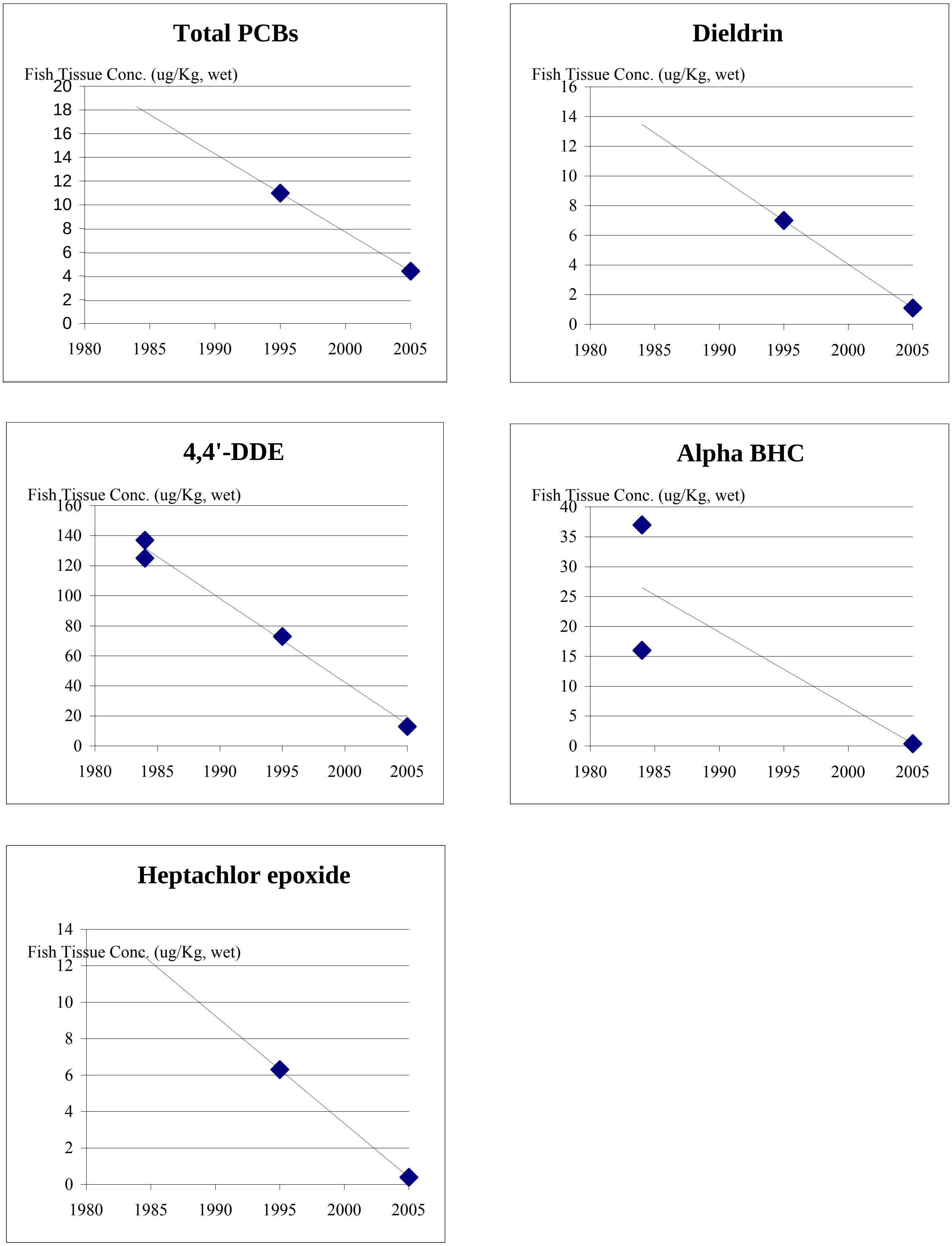

Figure 8. Time Trends in Levels of 303(d) Listed Pesticides and PCBs in Fillets from Lower Palouse River Fish (ug/Kg, wet weight; parts per billion)

The goal of a TMDL is to develop a plan to achieve water quality standards in a waterbody. For the Palouse River, the specific goal is to reduce the levels of dieldrin and PCBs in the mainstem and South Fork to the point where there is no significant human health risk from long-term fish consumption. The numeric targets for achieving this objective are the 303(d) fish tissue criteria, which are based directly on the water quality criteria.. Estimates of the further reductions required to meet the targets and bring the river into compliance with water quality standards are shown in Table 20. Concentrations need to be reduced from approximately 0–41% in the mainstem and 59–71% in the South Fork. No reductions are required in the North Fork.

Table 20. Estimates of Reductions Needed in Fish Tissue Concentrations of Dieldrin and PCBs to Meet Water Quality Standards in the Palouse River

Reach/Chemical	Mean Fish Tissue Concentration (ug/Kg)	Numeric Fish Tissue Target for TMDL (ug/Kg)	Reduction Required to Meet Standards (%)
Lower Mainstem			
Dieldrin	1.1	0.65	41
Total PCBs	4.4	5.3	0
Upper Mainstem			
Dieldrin	0.84	0.65	23
Total PCBs	7.2	5.3	26
South Fork			
Dieldrin	1.6	0.65	59
Total PCBs	18	5.3	71
North Fork			
Dieldrin	0.34	0.65	0
Total PCBs	3.9	5.3	0

It is proposed that natural attenuation, monitoring, and BMPs be relied on to bring the Palouse River into compliance with water quality standards for dieldrin and PCBs. A monitored natural attenuation approach is warranted for a number of reasons:

- The levels are low relative to human health criteria.
- The chemicals of concern are no longer used.
- Fish tissue concentrations have decreased over the past 10–20 years and will continue to decrease without further action being taken.
- A monitored natural attenuation approach is consistent with EPA-approved TMDLs in other states with similar 303(d) listings (e.g., www.epa.gov/owow/tmdl/examples/pesticides/pa_cheat.html).

The Washington State Department of Health (WDOH) does not consider this level of fish contamination to represent a significant human health risk. WDOH does not consider a fish consumption advisory to be warranted (Dave McBride, WDOH, personal communication).

It is not possible to predict with certainty how long it will take for water quality standards to be achieved in the Palouse River, thus the need for monitoring. The mainstem is close to meeting the TMDL targets for dieldrin and PCBs at the present time. By inspection, the rates of decrease in lower mainstem fish (Figure 8) imply a half-life of approximately 10 years for both dieldrin and PCBs (1995 and 2005 data). If these rates apply to the South Fork – which appears to be the major source of contamination – compliance would be achieved in the South Fork within 10–15 years for dieldrin and within 15–20 years for PCBs. Similarly, the mainstem would be expected to comply within about 5 years. These conclusions are based on limited historical data.

Seasonal Variation

Seasonal increases and decreases in concentration are less important than the long-term exposure to a carcinogen. Fish integrate water column concentrations over time. Therefore, using fish tissue data to assess loading capacity and set numeric TMDL targets adequately considers seasonal variations of water column concentrations for 303(d) listed pesticides and PCBs in the Palouse River.

Recommendations

1. The 303(d) Category 5 listings (Polluted Waters that Require a TMDL) for 4,4’-DDE, heptachlor epoxide, and alpha-BHC in the Palouse River should be moved to Category 1 (Meets Tested Standards for Clean Waters).
2. Ecology should periodically monitor fish tissue for dieldrin and PCBs in the mainstem Palouse River below Colfax and in the South Fork Palouse River to assure levels are continuing to decline at the expected rate.
3. PCBs and dieldrin in the influent and effluent of South Fork Palouse River WWTPs should be monitored to fill the data gap on sources to and loading from these facilities.
4. In light of elevated concentrations of dieldrin and PCBs in Pullman stormwater and the potential for adverse water quality impacts, Ecology, the City of Pullman, and Washington State University should work cooperatively to identify and clean up sources of these chemicals to the storm drain system.
5. An effort should be made to identify abandoned landfills and old dumps vulnerable to high water events or surface runoff during storms, determine if they are sources of dieldrin or PCBs to the Palouse River, and remediate as needed.
6. It is anticipated that most sources of dieldrin and PCB are from nonpoint sources. However, if levels do not continue to decline in Palouse River fish as anticipated, then the Moscow, Idaho WWTP should be re-evaluated as a possible contributor to the problem. Initially this could consist of sampling Paradise Creek to quantify dieldrin and PCB loading from the Moscow area.
7. Chemical analysis of the above samples should use detection limits low enough to compare to human health water quality criteria.

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Part 2

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Implementation Plan

Introduction

This *implementation plan* is intended to describe the framework for improving water quality. It expands on the recommendations made in Part 1 of this report. This plan describes the roles and authorities of cleanup partners (i.e., those organizations with jurisdiction, authority, or direct responsibility for cleanup) and the programs or other means through which they will address these water quality issues.

Typically, Ecology produces an i*mplementation strategy* which is submitted with the technical analysis to the U.S. Environmental Protection Agency (EPA) for approval of the TMDL. Then, following EPA approval, Ecology and interested and responsible parties develop a *Water Quality implementation plan*. However, this implementation plan will serve as both the *implementation strategy* and the i*mplementation plan*.

This implementation plan describes how water quality standards will be met for dieldrin and PCBs. TMDL reductions should be achieved by 2012 for dieldrin and PCBs in the mainstem Palouse River and by 2017 for dieldrin and 2022 for PCBs in the South Fork Palouse River.

What Needs to be Done?

Four chlorinated pesticides (heptachlor epoxide, 4,4’-DDE, dieldrin, and alpha-BHC) and PCBs were listed on the 2004 303(d) list as an impairment to the Palouse River. The TMDL analysis demonstrates that heptachlor epoxide, 4,4’-DDE, and alpha-BHC currently meet human health criteria and therefore water quality standards. Ecology recommends that these listings be moved from Category 5 (the 303(d) list) to Category 1 (Meets tested standards) during the next Water Quality Assessment.

According to the Water Quality Program’s Policy 1-11 (Ecology 2006), to move a Category 5-listed water body segment to Category 1, new data must meet the following requirements and be collected in a manner consistent with the policy:

> *A Category 5 determination will be changed if a more recent assessment qualifies a waterbody segment for placement in another category.*
>
> *A more recent toxic pollutant assessment that results in a Category 5 change must be based on data from the same medium (tissue or water column) as was assessed to determine initial impairment. The change of a Category 5 determination may also occur if information from a TMDL or verification study confirms that the impairment no longer exists.*
>
> *Fin fish fillet tissue samples, whole shellfish tissue samples, and edible shellfish muscle samples must have at least three single-fish samples or a single composite sample made up of at least five separate fish of the same species. Fin fish fillet tissue samples may be analyzed with skin on or skin off. All fish samples must be from resident fish to be considered for Categories 1 or 5.*

Due to local migration of species, toxic pollutant tissue studies that collect samples near Category 5 waterbody segments may be sufficient to represent more recent water quality conditions of the local area. In this case, tissue data and rationale that the samples collected from an adjacent or nearby waterbody segment are comparable may be considered for change in category determination.

The data from the current study meets these conditions. Table 21 lists the river segments which will be recommended for this change.

Table 21. 2004 303(d) Listings Recommended for a Category 1 (Meets tested standards) Classification.

Listing Identification number	Waterbody	Parameter	Township	Range	Section
14190	Palouse River	4,4'-DDE	15N	37E	26
8819	Palouse River	4,4'-DDE	17N	40E	20
14191	Palouse River	Alpha-BHC	15N	37E	26
8822	Palouse River	Heptachlor epoxide	17N	40E	20

Two remaining parameters (dieldrin and PCBs) currently violate water quality standards in the South Fork Palouse River and the mainstem Palouse River. Ecology will rely on natural attenuation and the implementation of stormwater and agricultural BMPs and effluent wasteload allocations to bring the Palouse River and the South Fork Palouse River into compliance with water quality standards. Monitoring will be conducted to track the progress in meeting water quality standards.

This TMDL implementation plan also addresses the additional river segments found to be impaired during the fish tissue survey (Table 2).

Natural Attenuation

Since dieldrin and PCBs are not being manufactured, distributed or used, concentrated sources of these chemicals should not exist. Instead, the technical analysis for this TMDL suggests that these chemicals are entering the Palouse River from nonpoint sources. In other words, historical use of these chemicals has deposited them in the environment including the Palouse River. Those deposited on land may wash into streams through stormwater runoff.

The technical analysis for this TMDL demonstrates that the levels of both dieldrin and PCBs have decreased over time. Without any apparent sources of these chemicals it is expected that they should continue to decrease in the future.

Stormwater

The highest levels of dieldrin and PCBs were found in the South Fork Palouse River. This sub-watershed is the most urbanized in the Palouse River watershed. In addition, high levels of these chemicals were also found in stormwater samples from the city of Pullman and

Washington State University storm drains. Therefore, Ecology recommends that the city of Pullman and Washington State University adopt stormwater BMPs that address dieldrin and PCBs. Since these pollutants adhere to soil particles, applying BMPs that address sediment will likely reduce current levels.

In addition, any construction activity required to obtain a construction stormwater permit should apply stormwater BMPs to prevent sediment from reaching surface water.

Effluent Wasteload Allocations

WLAs described in Part 1 of this report will be included in the NPDES permits for the three treatment plants discharging to waterbodies impaired by PCBs and dieldrin. If future data collection indicates the facilities are out of compliance with the wasteload allocations, future permits will outline a compliance schedule to assist the treatment plants in meeting these targets.

Agriculture

The agricultural community's efforts to reduce erosion in the watershed have likely played a role in the observed reduction of these toxins. Dieldrin and PCBs tend to adhere to soil particles and can be deposited into streams through erosion. BMPs such as direct seed technology should continue to be implemented and encouraged in the watershed. Conservation districts and Ecology will continue to support practices that reduce soil erosion in the watershed through technical assistance and funding.

Monitoring

To ensure the levels of dieldrin and PCBs continue their downward trend, Ecology will monitor fish in the Palouse River and the South Fork Palouse River and compare the results to data collected during the TMDL and past studies. If concentrations of dieldrin and PCBs have not continued to decline, Ecology will apply adaptive management to this TMDL (see Adaptive Management section later in this report). Ecology and the Whitman County Health Department may also conduct monitoring at abandoned landfills to determine if they are sources of dieldrin and PCBS.

Who Needs to Participate?

Several agencies and programs will work collaboratively to assure levels of dieldrin and PCBs in the South Fork Palouse River and Palouse River fish continue to decline and meet water quality standards. Entities that regulate or discharge stormwater, regulate landfills, monitor water quality or provide technical assistance and funding for methods that reduce erosion should participate in this TMDL.

The Department of Ecology – Environmental Assessment Program

Ecology's Environmental Assessment program will sample Palouse River fish every five years or as resources allow. At a minimum fish will be sampled 10 years after TMDL approval. The results will be compared to current levels to determine if dieldrin and PCBs are continuing to decline at the expected rates. More details about this sampling can be found in the *Measuring Progress Towards Goals* section later in this report.

The Department of Ecology – Water Quality Program

Ecology's Water Quality Program will regulate stormwater discharges through the Construction, Municipal and Industrial Stormwater Permits.

A ***Construction Stormwater Permit*** is required for all soil disturbing activities (including clearing, grading, and/or excavation) where one or more acre will be disturbed, and stormwater will be directly discharged to a receiving water (e.g., wetlands, creeks, unnamed creeks, rivers, marine waters, ditches, estuaries), or to storm drains that discharge to a receiving water. A permit is also required for construction projects smaller than one acre if the project is part of a "common plan of development or sale" in which the total land disturbance exceeds one acre. Any size construction activity may be required to obtain a permit if Ecology determines it to be a significant source of pollutants to waters of the state. If all stormwater is retained on-site and cannot enter surface waters of the state under any condition, permit coverage is not needed. Construction site operators must apply for a permit 60 days prior to discharging stormwater.

A ***Municipal Stormwater Permit*** is required for public entities in urbanized areas (as defined by the 2000 Census) that operate municipal separate storm sewer systems (MS4). A special purpose district such as a sewer district, flood control district, port, public university or college, prison complex, drainage district, or parks and recreation district is regulated as a secondary permittee under the municipal permit. Storm sewer systems in very discrete areas such as individual buildings do not require permit coverage. The City of Pullman and Washington State University will be included under the Phase II Municipal Stormwater Permit for Eastern Washington.

Coverage under the ***Industrial Stormwater General Permit*** is required for industrial facilities that discharge stormwater from their industrial areas to waters of the state, or to storm drains that discharge to waters of the state. No permit is required if the facility treats and retains all the stormwater on site.

Ecology's Water Quality Program will also monitor the progress of this implementation plan, review monitoring data, and apply adaptive management if the trend towards meeting water quality goals does not continue.

Ecology will include WLAs in the NPDES permits for the cities of Pullman, Colfax and Albion's WWTPs. The purpose of these WLAs is to ensure point sources are not contributing to the elevated levels of PCBs and dieldrin in the South Fork Palouse River and the Palouse River. The NPDES permits will include monitoring requirements and if necessary future permits will include a compliance schedule.

Ecology will also pursue resources to obtain water quality data for the treatment plants' influents and effluents. This data will be used to revise the interim WLAs if necessary. If PCB and dieldrin levels are elevated in the influent, it will indicate a need to locate potential sources to the sewer system.

If levels of PCBs and dieldrin do not decline as anticipated and no sources are located within Washington, Ecology will seek opportunities to measure loading coming from Moscow, Idaho.

Whitman County Regional Health Department

The Whitman County Regional Health Department will investigate an abandoned landfill and incinerator along the South Fork Palouse River as funding allows. It is anticipated that the Department will be able to use a current solid waste enforcement grant to partially fund this investigate.

City of Pullman

The city of Pullman will be regulated under the Eastern Washington Phase II Municipal Stormwater General Permit. The Phase II Municipal Permit is scheduled to be issued and take effect in winter 2006-2007. At a minimum, the permit will require permit holders to address the following federal requirements:

1. Develop and implement a Stormwater Management Program (SWMP) which shall include:
    a. Public education and outreach
    b. Public participation and involvement
    c. Illicit discharge detection and elimination
    d. Construction site runoff control
    e. Post-construction runoff control
    f. Pollution prevention and good housekeeping
2. Compliance with TMDL requirements
3. Program evaluation and reporting

The terms and conditions of Ecology's Phase II Municipal Stormwater Permit are currently drafted and were published for public review from February 15 through May 19, 2006. More information on the stormwater permits can be found on Ecology's website at www.ecy.wa.gov/programs/wq/stormwater/index.html.

Ecology's municipal stormwater permits establish the primary activities needed to control pollution from urban stormwater. This TMDL assumes that compliance with the Phase II stormwater permit is the only requirement the city of Pullman needs to fulfill to accomplish the objectives of this TMDL. In the event Pullman is determined to not require coverage under the Phase II Municipal Stormwater Permit, Pullman can comply with this TMDL by implementing the recommendations in the Eastern Washington Stormwater Manual, paying particular attention to developing and carrying out the eight core elements outlined in Chapter 2 of the manual. Since the *Pullman Stormwater Pilot Study for Pesticides, PCBs, and Fecal Coliform Bacteria* (Lubliner, 2006) indicated stormwater was a significant source of PCBs and dieldrin, BMPs and maintenance and operation practices must be conducted to ensure sediment, which may carry PCBs and dieldrin, does not enter local streams.

Since dieldrin and PCBs attach to sediment particles, Ecology believes that the best stormwater BMPs to reduce these pollutants are measures that reduce the amount of sediment discharged to streams. The city of Pullman's schedule to address stormwater, especially suspended sediment is outlined below.

Immediate and Ongoing

1. Control of suspended sediment in stormwater:
    a. Per City of Pullman Design Standards (2001 Edition) require Erosion and Sediment Control plans for land altering activities. The degree of sediment and erosion control is somewhat dependent on the project scope.
    b. During the Site Plan and Subdivision Review process advise developers and contractors on the need to comply with Ecology's Construction Stormwater General Permit when disturbing more than 1 acre.
    c. Require erosion control plans as part of the building permit review process.
    d. Continue to train engineering and building division personnel as Certified Erosion and Sediment Control Leads (CESCL). Currently two engineering staff members and all four of our building inspectors are CESCLs .
    e. Increase annual storm drain pipe maintenance (jetting and cleaning) to eventually complete cleaning of entire sub-basins over time as budgeting allows. Prioritize sub-basin cleaning by past land use activity.

By December 2008

2. Revise City's Design Standards to reference the *Stormwater Management Manual for Eastern Washington* as the technical reference for best available practice. [Current reference is Manual for Puget Sound basin]
3. Complete storm drain computer mapping project.

In addition the city of Pullman installed a stormwater treatment device (Vortechnics 5000) at the city's Maintenance and Operations (M&O) yard. The M&O yard consists of the maintenance and operations facilities, transit storage area, and equipment rental division (automotive shop). All the stormwater from the M&O yard is piped to this treatment device. This treatment device will be inspected and cleaned at regular intervals. It is designed to remove sediment and oil.

Washington State University

Washington State University (WSU) will be regulated as a secondary permittee under the Phase II Municipal Stormwater General Permit. As a secondary permittee WSU will also be required to address the following federal requirements:

1. Develop and implement a Stormwater Management Program (SWMP) which shall include:

  a. Public education and outreach
  b. Public participation and involvement
  c. Illicit discharge detection and elimination
  d. Construction site runoff control
  e. Post-construction runoff control
  f. Pollution prevention and good housekeeping

2. Compliance with TMDL requirements
3. Program evaluation and reporting

Ecology's municipal stormwater permits establish the primary activities needed to control pollution from urban stormwater. This TMDL assumes that compliance with the Phase II stormwater permit is the only requirement WSU needs to fulfill to accomplish the objectives of this TMDL. In the event WSU is determined to not require coverage under the Phase II Municipal Stormwater NPDES permit, WSU can comply with this TMDL by implementing the recommendations in the Eastern Washington Stormwater Manual, paying particular attention to developing and carrying out the eight core elements outlined in Chapter 2 of the manual. Since the *Pullman Stormwater Pilot Study for Pesticides, PCBs, and Fecal Coliform Bacteria* (Lubliner, 2006) indicated stormwater was a significant source of PCBs and dieldrin, BMPs and maintenance and operation practices must be conducted to ensure sediment, which may carry PCBs and dieldrin, does not enter local streams.

WSU currently has an active stormwater program with plans to expand it in the future. Activities in this program that should help reduce dieldrin and PCBs include:

1. Proactively removing all PCB sources on campus to a level below Federal and Washington State regulations.
2. Continuing illicit discharge detection program (which includes connecting floor drains to sanitary sewer).
3. Developing a computerized mapping system of existing stormwater lines, catch basin locations, and drainage areas.
4. Overseeing construction projects one acre or greater that require Construction Stormwater NPDES permits.
5. Using video inspection and repairing all storm sewer lines as budgeting allows.
6. Sweeping streets and parking lots with new waterless street sweeper.
7. Applying washed gravel without fines to roads for winter traction.

Cities of Pullman, Colfax, and Albion's WWTPs

NPDES permits for the cities of Pullman, Colfax, and Albion's WWTPs will include WLAs for PCBs and dieldrin. Because the current level of PCBs and dieldrin in their wastewater is not known, these municipalities should work closely with Ecology to analyze wastewater influent and effluent. Ecology is seeking resources to initiate a study of the wastewater influents and effluents. This study will help determine the need for additional implementation activities, revisions to the interim WLAs and a schedule for WWTP monitoring. The NPDES permit will include requirements for monitoring PCBs and dieldrin following Ecology's initial study.

If the wastewater influent has elevated concentrations of PCBs and dieldrin the city will:

- Work with Ecology to develop a compliance schedule to meet the WLAs.
- Develop a strategy for determining sources to the system and identifying possible corrective actions.

If elevated levels of PCBs and dieldrin are found in Pullman's wastewater influent, the city should work closely with Washington State University to ensure a source is not located on campus.

Palouse River Watershed Conservation Districts (Palouse, Whitman, Palouse-Rock Lake, Adams, Pine Creek and Spokane)

The Spokane County Conservation District currently has a State Revolving Fund loan to assist landowners who wish to make the transition from conventional farming techniques to conservation tillage and direct seeding operations. This program is designed to reduce nonpoint source pollution from eroding agricultural lands. Chlorinated pesticides and PCBs are known to attach to sediment particles, therefore converting to conservation tillage and direct seeding operations will aid in the reduction of these pollutants. The Spokane County Conservation District has a memorandum of understanding (MOU) with Palouse, Whitman, Palouse-Rock Lake, Pine Creek, and Adams conservation districts to offer this loan program to landowners throughout the entire Palouse River Watershed.

In addition, all of these conservation districts provide funding and technical assistance to help landowners implement BMPs to reduce or stop erosion. These practices often include riparian restoration, grassed waterways, fencing, and other BMPs approved by the Natural Resources Conservation Service.

These conservation districts will continue to promote and implement best management practices through their current programs and will seek other funding opportunities for future efforts. Each conservation district will report an estimate of acres transitioned to conservation tillage or direct seed technology and number of BMP projects that will substantially reduce erosion to the TMDL coordinator annually.

The actions described above should accelerate the natural attenuation rate of both dieldrin and PCBs in the watershed. Table 22 provides a summary of the actions, organizational responsibilities, and timeline for this implementation plan.

Table 22. Activities and Resources to Reduce Dieldrin and PCBs

Source	Action Item	Organization	Performance Measures	
			What	When
Stormwater	Issue and monitor compliance with municipal, construction and industrial stormwater permits	Ecology's Water Quality Program	Issue municipal stormwater permit to the city of Pullman and WSU	2007
			Provide technical assistance	On-going
			Monitor permit implementation by reviewing annual reports	Annually
	Reduce pollutants in urban stormwater	City of Pullman	Implement requirements of Phase II municipal stormwater permit	On-going
			Require Erosion and Sediment Control plans for land altering activities and building permits	On-going
			Continue to train engineering and building division personnel as Certified Erosion and Sediment Control Leads (CESCL)	On-going
			Increase annual storm drain pipe maintenance	On-going; report progress annually
			Revise City's Design Standards to reference the *Stormwater Management Manual for Eastern Washington*	2008
			Complete storm drain computer mapping project	2008
		Washington State University	Implement requirements of Phase II municipal stormwater permit	On-going
			Proactively removing all PCB sources on campus to a level below Federal and Washington State regulations	Report progress annually
			Continue illicit discharge detection program	On-going; report progress annually
			Complete computerized mapping system of existing stormwater lines, catch basin locations and drainage areas	On-going
			Oversee construction projects one acre or greater that require Construction Stormwater NPDES permits	On-going

Source	Action Item	Organization	Performance Measures	
			What	When
			Inspect and repair all storm sewer lines	On-going; report progress annually
			Maintain streets and parking lots	On-going
Abandoned and old landfills	Determine if abandoned and old landfills could be sources of dieldrin and PCBs	Whitman County Regional Health Department	Investigate an abandoned landfill and incinerator along the South Fork Palouse River to determine if they are sources	As funding allows; goal is to complete investigation by 2009
Agricultural sediment	Promote and implement direct seed technology and other BMPs to reduce erosion	Palouse Watershed Conservation Districts (Spokane County, Palouse, Whitman, Palouse-Rock Lake, Pine Creek, Adams)	Report number of acres converted to conservation tillage or BMP projects that significantly reduce erosion	Annually
			Seek additional funding opportunities to support this action	As needed
Wastewater	Meet WLAs at end of pipe for Pullman, Colfax and Albion WWTPs	Ecology	Incorporate WLAs into NPDES Permits	2008
		Pullman, Colfax, Albion WWTPs	Meet conditions of NPDES permit	2008
	Revise WLAs or seek sources to treatment systems if necessary	Ecology and/or WWTPs	Assess levels of PCBs and dieldrin in influent and effluent of WWTPs	2008
			Develop source identification plan for WWTPs if necessary	If necessary
All	Monitor fish tissue concentrations of dieldrin and PCBs	Ecology's Environmental Assessment Program	Sample Palouse River and South Fork Palouse River fish to determine tissue concentrations	Every 5 years (2012, 2017, 2022)
	Monitor implementation of this plan	Ecology's Water Quality Program	Track progress of activities outlined in this plan with partner organizations	Annually
	Apply adaptive management if targets are not being met	Ecology's Water Quality Program	Investigate further monitoring to locate sources of dieldrin and PCBs	2017
	Determine if Moscow Idaho could be a source	Ecology's Water Quality Program	Seek opportunities to monitor Paradise Creek to assess loading	If necessary

What is the Schedule for Achieving Water Quality Standards?

Fish tissue concentrations of dieldrin and PCBs have decreased by 2 to 3 orders of magnitude over the past 10 to 20 years and will continue to decrease without further action being taken. However the actions outlined in the previous section will assure that the levels of these pollutants continue to decline and may even accelerate the timeframe when the Palouse River will reach water quality standards for dieldrin and PCBs.

Although it is not possible to predict exactly how long it will take for water quality standards to be achieved in the Palouse River, it is possible to estimate a timeframe and monitor progress. The mainstem is close to meeting the TMDL targets for dieldrin and PCBs at the present time. The rates of decrease in lower mainstem fish imply a half-life of approximately 10 years for both dieldrin and PCBs (1995 and 2005 data). If these rates apply to the South Fork (which appears to be the major source of contamination) compliance would be achieved in the South Fork within 10 to 15 years for dieldrin and within 15 to 20 years for PCBs. Similarly, the mainstem would be expected to comply within about 5 years.

Reasonable Assurances

When establishing a TMDL, reductions of a particular pollutant are allocated among the pollutant sources (both point and nonpoint sources) in the waterbody. TMDLs (and related Action Plans) must show “reasonable assurance” that these sources will be reduced to their allocated amount. Education, outreach, technical and financial assistance, permit administration, and enforcement will all be used to ensure that the goals of this water clean up plan are met.

Ecology believes that natural attenuation and the implementation of stormwater and agricultural BMPs that reduce sediment contributions to surface water are already supporting this TMDL and add to the assurance that dieldrin and PCBs in the Palouse River will meet Washington State water quality standards within a reasonable timeframe. This assumes that both dieldrin and PCB will continue to decline at the rate observed over the past 10 to 20 years.

Ecology’s issuance of the Phase II Eastern Washington Stormwater Permit in 2007 will add to the assurance that dieldrin and PCBs will be reduced in the South Fork Palouse River. The city of Pullman and WSU will be covered under this permit.

WLAs incorporated into NPDES permits for Pullman, Colfax and Albion will assure that the treatment facilities are not elevating the levels of PCBs and dieldrin in the Palouse and South Fork Palouse rivers.

While Ecology is authorized under Chapter 90.48 RCW to impose strict requirements or issue enforcement actions to achieve compliance with state water quality standards, it is the goal of all participants in the Palouse River TMDL process to achieve clean water through voluntary control actions.

Measuring Progress Toward Goals (Monitoring Plan)

Additional monitoring, inspections, and investigations are planned or recommended in four areas for this TMDL:

- Conduct periodic fish tissue monitoring for dieldrin and PCBs.
- Evaluate wastewater treatment facilities (including the collection systems) as potential dieldrin and PCB sources.
- Identify and clean up sources of dieldrin and PCBs to the Pullman storm drain system.
- Identify and clean up abandoned landfills and old dumps vulnerable to high water events or surface runoff during storms.

The success of this implementation plan will be measured by tracking the progress of implementation actions and reassessing pollutant levels in Palouse River and South Fork Palouse River fish tissue.

Performance measures and targets

Ecology's TMDL coordinator will work with the organizations outlined in this document to track the progress of this implementation plan. Each organization should track the progress they have made on their performance measures. The TMDL coordinator will contact each organization annually and record the implementation progress in the tracking tables in Appendix C.

The TMDL coordinator will review implementation activities and water quality data collected by the Environmental Assessment Program to determine whether progress is being made or if adaptive management is needed.

Effectiveness monitoring plan

Effectiveness monitoring determines if the TMDL targets and water quality standards have been met. Ecology's Environmental Assessment Program will periodically monitor fish tissue for dieldrin and PCBs in the mainstem Palouse River below Colfax and in the South Fork Palouse River. Sampling sites and timing will be similar to those of the 2005 survey. To the extent possible, the species and size ranges analyzed will be appropriate for comparing to the 2005 data. Fish tissue samples from the 2005 collection have been archived to aide in comparing the data.

Fish tissue monitoring will be done on a 5-year cycle. Five years is the monitoring period typically employed in effectiveness monitoring for TMDLs. This timeline also fits within the estimated time frame when the mainstem is projected to achieve compliance with standards. All fish tissue data will be provided to the Washington State Department of Health and shared with stakeholders.

Adaptive Management

TMDL reductions should be achieved by 2012 for dieldrin and PCBs in the mainstem Palouse River and by 2017 for dieldrin and 2022 for PCBs in the South Fork Palouse River. Partners will work together to monitor progress towards these goals, evaluate successes, obstacles, and changing needs, and make adjustments to the implementation plan as needed.

Ecology will use any additional data collection to update the WLAs. If necessary Ecology will update NPDES permits to include new WLAs, a compliance schedule and monitoring requirements. If future monitoring suggests that Washington State University is a source of PCBs and dieldrin their permit to discharge to Pullman's collection system will be updated to include WLAs.

It is ultimately Ecology's responsibility to assure that cleanup is being actively pursued and water standards are achieved. If the effectiveness monitoring indicates that progress is not being made at the rate predicted, the TMDL Coordinator and the partner organizations will evaluate other methods and activities that could help the water meet water quality standards. Such activities may include sampling Paradise Creek at the Idaho border to determine if loading may be coming from the Moscow area. Chemical analysis of samples should use detection limits low enough to compare to human health water quality criteria.

Potential Funding Sources

Ecology's Centennial Clean Water Fund, Section 319, and State Revolving Fund loans can provide financial assistance to help implementation of the TMDL (water quality improvement plan). In addition to Ecology's funding programs, there are many other funding sources available for watershed planning and implementation, point and nonpoint source pollution management, fish and wildlife habitat enhancement, stream restoration, and education. Public sources of funding include federal and state government programs, which can offer financial as well as technical assistance. Private sources of funding include private foundations, which most often fund nonprofit organizations with tax-exempt status.

Forming partnerships with other government agencies, nonprofit organizations, and private businesses can often be the most effective approach to maximize funding opportunities. Some of the most commonly accessed funding sources for TMDL implementation are shown in Table 23 and are described below.

Table 23. Potential Funding Sources for Implementation Projects

Fund Source	Type of Project Funded	Maximum Amounts
Centennial Clean Water Fund	Watershed planning, stream restoration, & water pollution control projects.	$500,000
Section 319 Nonpoint Source Fund	Nonpoint source control; i.e., pet waste, stormwater runoff, & agriculture, etc.	$500,000
State Water Pollution Control Revolving Fund	Low-interest loans to upgrade pollution control facilities.	10% of total SRF annually
Coastal Zone Protection Fund (also referred to as Terry Husseman grants)	Stream restoration projects to improve water quality.	~$50,000
Conservation Reserve Program (CRP)	Establishes long-term conservation cover of grasses, trees and shrubs on eligible land.	Rental payments based on the value of the land; plus 50% - 90% cost share dependant on practices implemented
Environmental Quality Incentives Program (EQIP)	Natural resource protection.	Dependent on practices implemented
Wildlife Habitat Incentive Program (WHIP)	Provide funds to enhance and protect wildlife habitat including water.	$25,000 dependent on practices implemented
Conservation Security Program (CSP)	Provides financial assistance for conservation on private working lands.	Dependent on practices implemented

Centennial Clean Water Fund (CCWF)

A 1986 state statute created the Water Quality Account, which includes the Centennial Clean Water Fund (CCWF). Ecology offers CCWF grants and loans to local governments, tribes, and other public entities for water pollution control projects. The application process is the same for CCWF, 319 Nonpoint Source Fund, and the state Water Pollution Control Revolving Fund.

Section 319 Nonpoint Source Fund

The 319 Fund provides grants to local governments, tribes, state agencies, and nonprofit organizations to address nonpoint source pollution to improve and protect water quality. Nonpoint source pollution includes many diffuse sources of pollution, such as stormwater runoff from urban and residential development, agricultural and timber practices, and other activities. Non-governmental organizations can apply to Ecology for funding through a 319 grant to provide additional implementation assistance.

State Water Pollution Control Revolving Fund

Ecology also administers the Washington State Water Pollution Control Revolving Fund. This program uses federal funding from U.S. Environmental Protection Agency and monies appropriated from the state's Water Quality Account to provide low-interest loans to local governments, tribes, and other public entities. The loans are primarily for upgrading or expanding water pollution control facilities, such as public sewage and stormwater plants, and for activities to address nonpoint source water quality problems.

Coastal Zone Protection Fund

Since July 1998, water quality penalties issued under Chapter 90.48 RCW have been deposited into a sub-account of the Coastal Protection Fund (also referred to as Terry Husseman grants). A portion of this fund is made available to regional Ecology offices to support on-the-ground projects to perform environmental restoration and enhancement. Local governments, tribes, and state agencies must propose projects through Ecology staff. Stakeholders with projects that will reduce erosion are encouraged to contact their local TMDL coordinator to determine if their project proposal is a good candidate for Coastal Zone Protection funding.

Conservation Reserve Program (CRP)

The Conservation Reserve Program (CRP) is a voluntary program for agricultural landowners. Through CRP, landowners can receive annual rental payments and cost-share assistance to establish long-term, resource conserving covers on eligible farmland. Included under CRP is the Continuous Conservation Reserve Program (CCRP), which provides funds for special practices for both upland and riparian land. Landowners can enroll in CCRP at anytime. There are designated sign up periods for CRP.

The Commodity Credit Corporation (CCC) makes annual rental payments based on the agriculture rental value of the land, and it provides cost-share assistance for 50 to 90% of the participant's costs in establishing approved conservation practices. Participants enroll in CRP contracts for 10 to 15 years.

The program is administered by the CCC through the Farm Service Agency (FSA), and program support is provided by Natural Resources Conservation Service, Cooperative State Research and Education Extension Service, state forestry agencies, and local Soil and Water Conservation Districts. (Farm Service Agency, 2006)

Environmental Quality Incentives Program (EQIP)

The federally funded Environmental Quality Incentives Program (EQIP) is administered by NRCS. EQIP is the combination of several conservation programs that address soil, water, and related natural resource concerns. EQIP encourages environmental enhancements on land in an environmentally beneficial and cost-effective manner. The EQIP program:

- Provides technical assistance, cost share, and incentive payments to assist crop and livestock producers with environmental and conservation improvements on the farm.
- Has 75% cost sharing but allows 90% if producer has limited resources or beginning farmer.
- Divides program funding 60% for livestock-related practices, 40% for cropland.
- Has contracts lasting five to ten years.
- Has no annual payment limitation; sum not to exceed $450,000 per farm.

Wildlife Habitat Incentive Program

The Wildlife Habitat Incentive Program (WHIP) is administered by NRCS. WHIP is a voluntary program for people who want to develop and improve wildlife habitat primarily on private land. Through WHIP, NRCS provides both technical assistance and up to 75% cost-share assistance to establish and improve fish and wildlife habitat. WHIP agreements between NRCS and the participant generally last from five to ten years from the date the agreement is signed.

Conservation Security Program

The Conservation Security Program (CSP) is a voluntary program that provides financial and technical assistance to promote the conservation and improvement of soil, water, air, energy, plant and animal life, and other conservation purposes on tribal and private working lands. Working lands include cropland, grassland, prairie land, improved pasture, and range land, as well as forested land that is an incidental part of an agriculture operation. The program provides equitable access to benefits to all producers, regardless of size of operation, crops produced, or geographic location. CSP is administered by NRCS (NRCS, 2006).

Each year different watersheds are selected for CSP enrollment. It is not known when this program will come to the Palouse watershed. However, since the program rewards producers who already have conservation practices in place, producers are encouraged to use other federal, state, and local funding sources to prepare their land for enrollment (R. Riehle, NRCS 2006, personal communication. March 17).

Summary of Public Involvement Methods

In April 2005, a press release was issued to announce the start of this TMDL effort. Several newspapers published articles about this project. On April 27, 2005 a public meeting was held in Colfax, Washington to present information about the fish tissue study and TMDLs.

Ecology maintains a mailing list of people interested in water quality in the Palouse River watershed. Several updates about this project have been sent to this mailing list.

Information about this project has been available on Ecology's website at: www.ecy.wa.gov/programs/wq/tmdl/palouse/index.html.

A Quality Assurance Project Plan (QAPP) for the fish tissue study was developed. Members of the Palouse Watershed Planning Unit were invited to review and comment on the QAPP.

A press release was issued on May 21, 2007 inviting the public to view and comment on this report. Advertisements announcing the comment period were placed in several of the local newspapers. The 30-day public comment period ran from May 24, 2007 to June 22, 2007. Comments received are responded to in Appendix D.

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Appendices

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Appendix A. Biological Information on Fish Samples

Table A-1. Biological Information on Ecology's 2005 Palouse River Fish Samples.

Sample ID	Sample No.	Collection Date	Species	Total Length (mm)	Weight (g)	Sex	Age (yrs)
NF CHM-1	05288366	6/8/05	CHM	214	93	M	2
		6/8/05	CHM	226	101	M	4
		6/8/05	CHM	210	83	M	2
		6/9/05	CHM	229	109	M	3
		6/9/05	CHM	208	85	F	2
			Mean	**217**	**94**	**n/a**	**2.6**
NF CHM-2	05288367	6/8/05	CHM	218	91	M	2
		6/8/05	CHM	224	101	M	3
		6/8/05	CHM	206	81	F	2
		6/8/05	CHM	208	86	M	2
		6/9/05	CHM	215	88	F	2
			Mean	**214**	**89**	**n/a**	**2.2**
NF CHM-3	05288368	6/8/05	CHM	206	76	M	2
		6/8/05	CHM	208	86	F	2
		6/8/05	CHM	226	104	M	4
		6/8/05	CHM	227	103	M	3
		6/8/05	CHM	211	97	M	2
			Mean	**216**	**93**	**n/a**	**2.6**
NF CHM-4	05288369	6/8/05	CHM	224	100	M	3
		6/8/05	CHM	216	87	M	3
		6/8/05	CHM	213	91	M	2
		6/8/05	CHM	204	78	M	2
		6/9/05	CHM	220	93	M	3
			Mean	**215**	**90**	**n/a**	**2.6**
NF CHM-5	05288370	6/8/05	CHM	206	72	F	2
		6/8/05	CHM	216	95	M	2
		6/8/05	CHM	221	93	M	3
		6/9/05	CHM	203	90	F	2
		6/8/05	CHM	215	90	M	2
			Mean	**212**	**88**	**n/a**	**2.2**
NF LSS-1	05288371	6/8/05	LSS	200	102	M	2
		6/8/05	LSS	199	82	F	2
		6/8/05	LSS	201	84	F	2
		6/9/05	LSS	195	84	F	2
		6/8/05	LSS	219	129	F	2
			Mean	**203**	**96**	**n/a**	**2**

Sample ID	Sample No.	Collection Date	Species	Total Length (mm)	Weight (g)	Sex	Age (yrs)
NF LSS-2	05288372	6/9/05	LSS	390	626	M	5
		6/9/05	LSS	410	757	F	7
		6/9/05	LSS	409	815	M	8
		6/9/05	LSS	397	772	M	7
		6/8/05	LSS	415	735	F	7
			Mean	**404**	**741**	**n/a**	**6.8**
NF LSS-3	05288373	6/9/05	LSS	393	643	M	7
		6/9/05	LSS	445	920	F	9
		6/9/05	LSS	387	445	M	5
		6/9/05	LSS	368	518	M	5
		6/7/05	LSS	380	571	M	5
			Mean	**395**	**619**	**n/a**	**6.2**
NF LSS-4	05288374	6/9/05	LSS	417	875	M	7
		6/9/05	LSS	398	712	M	7
		6/9/05	LSS	390	591	M	8
		6/9/05	LSS	390	597	M	6
		6/9/05	LSS	400	648	M	8
			Mean	**399**	**685**	**n/a**	**7.2**
NF LSS-5	05288375	6/9/05	LSS	385	593	M	6
		6/9/05	LSS	385	589	M	7
		6/9/05	LSS	387	558	M	7
		6/9/05	LSS	390	568	M	7
		6/9/05	LSS	421	770	F	7
			Mean	**394**	**616**	**n/a**	**6.8**
NF NPM-1	05288376	6/7/05	NPM	224	115	M	3
		6/8/05	NPM	266	175	M	4
		6/8/05	NPM	249	145	M	5
		6/8/05	NPM	224	97	M	5
		6/9/05	NPM	258	154	F	4
			Mean	**244**	**137**	**n/a**	**4.2**
NF NPM-2	05288377	6/8/05	NPM	272	182	M	6
		6/8/05	NPM	246	147	M	5
		6/8/05	NPM	237	130	M	5
		6/8/05	NPM	246	136	F	5
		6/8/05	NPM	243	122	M	5
			Mean	**249**	**143**	**n/a**	**5.2**
NF NPM-3	05288378	6/8/05	NPM	243	126	M	3
		6/9/05	NPM	256	136	F	4
		6/9/05	NPM	275	174	M	6
		6/9/05	NPM	225	118	F	3
		6/9/05	NPM	234	137	M	4
			Mean	**247**	**138**	**n/a**	**4**

Sample ID	Sample No.	Collection Date	Species	Total Length (mm)	Weight (g)	Sex	Age (yrs)
NF NPM-4	05288379	6/8/05	NPM	307	264	M	6
		6/8/05	NPM	361	458	M	8
		6/8/05	NPM	310	301	M	6
			Mean	**326**	**341**	**n/a**	**6.7**
NF NPM-5	05288380	6/8/05	NPM	313	296	M	6
		6/9/05	NPM	399	621	F	9
		6/9/05	NPM	399	570	F	8
		6/9/05	NPM	368	420	F	7
			Mean	**370**	**477**	**n/a**	**7.5**
SF CHM-1	05288381	5/24/05	CHM	259	177	M	4
		5/24/05	CHM	211	100	F	3
		5/24/05	CHM	200	76	M	2
		5/25/05	CHM	192	72	F	2
			Mean	**216**	**106**	**n/a**	**2.75**
SF CHM-2	05288382	5/24/05	CHM	240	123	F	3
		5/24/05	CHM	194	70	M	2
		5/25/05	CHM	234	123	F	3
		5/25/05	CHM	232	122	F	3
			Mean	**225**	**110**	**n/a**	**2.75**
SF LSS-1	05288383	5/24/05	LSS	300	262	F	5
		5/24/05	LSS	225	161	F	3
		5/24/05	LSS	224	126	nd	3
		5/24/05	LSS	204	127	M	2
		5/25/05	LSS	215	120	F	2
			Mean	**234**	**159**	**n/a**	**3**
SF LSS-2	05288384	5/24/05	LSS	205	93	M	2
		5/25/05	LSS	220	144	F	3
		5/25/05	LSS	203	101	M	2
		5/23/05	LSS	264	223	M	4
		5/23/05	LSS	231	152	F	3
			Mean	**225**	**143**	**n/a**	**2.8**
SF LSS-3	05288385	5/24/05	LSS	286	266	M	3
		5/25/05	LSS	251	182	M	4
		5/25/05	LSS	233	151	F	3
		5/25/05	LSS	205	92	M	2
		5/24/05	LSS	227	145	M?	3
			Mean	**240**	**167**	**n/a**	**3**
SF LSS-4	05288386	5/23/05	LSS	420	718	F	9
		5/23/05	LSS	435	932	F	10
		5/24/05	LSS	465	1115	F	11
		5/24/05	LSS	365	589	M	4
			Mean	**421**	**839**	**n/a**	**8.5**

Sample ID	Sample No.	Collection Date	Species	Total Length (mm)	Weight (g)	Sex	Age (yrs)
SF LSS-5	05288387	5/25/05	LSS	399	745	M	6
		5/25/05	LSS	460	1007	M	12
		5/23/05	LSS	408	766	M	6
		5/24/05	LSS	451	1020	F	7
			Mean	**430**	**885**	**n/a**	**7.8**
SF NPM-1	05288388	5/25/05	NPM	255	158	F	4
		5/25/05	NPM	261	155	F	4
		5/25/05	NPM	232	108	M	3
		5/25/05	NPM	240	120	M	3
		5/24/05	NPM	206	72	M	2
			Mean	**239**	**123**	**n/a**	**3.2**
SF NPM-2	05288389	5/24/05	NPM	257	165	M	5
		5/24/05	NPM	252	148	F	5
		5/24/05	NPM	225	116	M	4
		5/25/05	NPM	210	71	F	3
		5/25/05	NPM	206	69	M?	3
			Mean	**230**	**114**	**n/a**	**4**
SF NPM-3	05288390	5/23/05	NPM	228	115	M	3
		5/24/05	NPM	236	150	F	3
		5/25/05	NPM	208	86	M	3
		5/25/05	NPM	206	78	M	3
		5/24/05	NPM	212	85	F	4
			Mean	**218**	**103**	**n/a**	**3.2**
SF NPM-4	05288391	5/24/05	NPM	235	128	F	3
		5/24/05	NPM	225	98	F	4
		5/24/05	NPM	213	92	M	4
		5/24/05	NPM	207	81	F	4
		5/24/05	NPM	244	107	F	5
			Mean	**225**	**101**	**n/a**	**4**
SF NPM-5	05288392	5/24/05	NPM	350	383	F	7
		5/24/05	NPM	397	644	F	8
		5/24/05	NPM	307	260	F	6
		5/24/05	NPM	363	481	F	7
			Mean	**354**	**442**	**n/a**	**7**
LWR LSS-1	05288393	6/22/05	LSS	420	788	M?	7
		6/22/05	LSS	400	667	M	6
		6/23/05	LSS	413	970	F?	6
		6/22/05	LSS	423	903	M	7
		6/22/05	LSS	402	713	M	5
			Mean	**412**	**808**	**n/a**	**6.2**

Sample ID	Sample No.	Collection Date	Species	Total Length (mm)	Weight (g)	Sex	Age (yrs)
LWR LSS-2	05288394	6/22/05	LSS	440	931	F	7
		6/22/05	LSS	433	978	M	6
		6/22/05	LSS	346	511	M	4
		6/22/05	LSS	445	1053	M	7
		6/22/05	LSS	376	614	M	4
			Mean	**408**	**817**	**n/a**	**5.6**
LWR LSS-3	05288395	6/23/05	LSS	445	1035	F	7
		6/23/05	LSS	424	924	M	6
		6/22/05	LSS	425	924	M	6
		6/22/05	LSS	409	710	F?	4
		6/22/05	LSS	431	942	F	6
			Mean	**427**	**907**	**n/a**	**5.8**
LWR LSS-4	05288396	6/22/05	LSS	350	496	M	3
		6/22/05	LSS	424	951	F	6
		6/23/05	LSS	431	891	M	6
		6/22/05	LSS	410	748	M	5
		6/23/05	LSS	422	863	M	5
			Mean	**407**	**790**	**n/a**	**5**
LWR LSS-5	05288397	6/22/05	LSS	390	730	F	4
		6/23/05	LSS	441	942	M	9
		6/22/05	LSS	424	820	F	7
		6/22/05	LSS	422	906	M	6
		6/23/05	LSS	410	731	M	5
			Mean	**417**	**826**	**n/a**	**6.2**
LWR NPM-1	05328474	6/23/05	NPM	192	65	U	2
		6/23/05	NPM	210	83	M?	3
		6/23/05	NPM	285	253	F?	5
			Mean	**229**	**134**	**n/a**	**3.3**
LWR NPM-2	05328475	8/3/05	NPM	420	792	F?	7
		6/22/05	NPM	443	844	F	8
		6/23/05	NPM	462	980	F	9
		6/23/05	NPM	481	1145	F?	10
		6/23/05	NPM	484	937	F	15
			Mean	**458**	**940**	**n/a**	**9.8**
LWR CHM-1	05328476	6/23/05	CHM	211	108	F	3
		6/23/05	CHM	183	65	M	2
		6/23/05	CHM	183	71	F	2
		6/23/05	CHM	220	114	F	3
			Mean	**199**	**90**	**n/a**	**2.5**
LWR SMB-1	05328477	6/23/05	SMB	208	115	F	2
		6/23/05	SMB	172	64	F	2
			Mean	**190**	**90**	**n/a**	**2**

Sample ID	Sample No.	Collection Date	Species	Total Length (mm)	Weight (g)	Sex	Age (yrs)
LWR CARP-1	05328478	8/3/05	CARP	**280**	**394**	M?	**3**
MID LSS-1	05328479	6/6/05	LSS	421	863	M	6
		6/6/05	LSS	456	1013	M	10
		6/6/05	LSS	460	995	M	11
		6/6/05	LSS	452	951	M	11
			Mean	**447**	**956**	**n/a**	**9.5**
MID LSS-2	05328480	6/6/05	LSS	423	731	F	6
		6/6/05	LSS	461	1006	F	9
		6/6/05	LSS	435	871	F	7
		6/6/05	LSS	452	850	F	9
			Mean	**443**	**865**	**n/a**	**7.8**
MID LSS-3	05328481	6/6/05	LSS	426	878	M	6
		6/6/05	LSS	432	920	M	7
		6/6/05	LSS	426	839	M	7
		6/6/05	LSS	423	835	M	6
			Mean	**427**	**868**	**n/a**	**6.5**
MID LSS-4	05328482	6/6/05	LSS	461	1060	M	10
		6/6/05	LSS	446	998	F	7
		6/6/05	LSS	430	944	M	5
		6/6/05	LSS	429	873	M	6
			Mean	**442**	**969**	**n/a**	**7**
MID NPM-1	05328483	6/6/05	NPM	260	149	M	5
		6/6/05	NPM	215	82	M	3
		6/6/05	NPM	191	66	F	3
			Mean	**222**	**99**	**n/a**	**3.7**
MID NPM-2	05328484	6/6/05	NPM	190	59	U	3
		6/6/05	NPM	251	139	F	4
		6/6/05	NPM	195	72	F	4
		6/6/05	NPM	240	121	M	4
			Mean	**219**	**98**	**n/a**	**3.8**
MID CHM-1	05328485	6/6/05	CHM	198	72	F	3
		6/6/05	CHM	217	110	M	2
		6/6/05	CHM	225	102	M	3
		6/6/05	CHM	225	83	M	3
		6/6/05	CHM	253	137	F	4
			Mean	**224**	**101**	**n/a**	**3**
MID SMB-1	05328486	6/6/05	SMB	181	79	F	2
		6/6/05	SMB	184	73	M	2
		6/6/05	SMB	184	76	M	2
			Mean	**183**	**76**	**n/a**	**2**

Sample ID	Sample No.	Collection Date	Species	Total Length (mm)	Weight (g)	Sex	Age (yrs)
MID SMB-2	05328487	6/6/05	SMB	164	60	F	2
		6/6/05	SMB	176	74	U	2
		6/6/05	SMB	184	83	U	2
		6/6/05	SMB	171	62	M	2
			Mean	**174**	**70**	**n/a**	**2**
MID SMB-3	05328488	6/6/05	SMB	230	142	M	3
		6/6/05	SMB	260	192	M	3
			Mean	**245**	**167**	**n/a**	**3**

n/a = not applicable
? = Unsure of sex of fish
U = Sex not determined
NF = North Fork Palouse River
SF = South Fork Palouse River
MID = Middle Palouse River
LWR = Lower Palouse River

CARP = Carp, *Cyprinus carpio*
CHM = Chiselmouth, *Acrocheilus alutaceus*
LSS = Largescale sucker, *Catostomus macrocheilus*
NPM = Northern pike minnow, *Ptychocheilus oregonensis*
SMB = Smallmouth bass, *Micropterus dolomieui*

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Appendix B. Contaminant Data on Fish Samples

Table B-1. Contaminant Data for Palouse River Fish Fillet Samples Collected in 2005 (ug/Kg wet weight)

Location	LWR_FISH	LWR_FISH	LWR_FISH	LWR_FISH	LWR_FISH	LWR_FISH
Date	6/22/05	6/22/05	6/22/05	6/22/05	6/22/05	6/23/05
Sample ID	LWR LSS-1	LWR LSS-2	LWR LSS-3	LWR LSS-4	LWR LSS-5	LWR NPM-1
Sample No.	05288393	05288394	05288395	05288396	05288397	05328474
Species	Largescale Sucker	Largescale Sucker	Largescale Sucker	Largescale Sucker	Largescale Sucker	Northern Pike Minnow
Alpha-BHC	0.38 U	0.39 U	0.38 U	0.39 U	0.39 U	0.39 U
Beta-BHC	0.95 U	0.98 U	0.96 U	0.99 U	0.97 U	0.98 U
Delta-BHC	0.38 U	0.39 U	0.38 U	0.39 U	0.39 U	0.39 U
Lindane	0.38 U	0.39 U	0.15 J	0.39 U	0.39 U	0.39 U
Heptachlor	0.38 U	0.39 U	1.3	0.39 U	0.39 U	0.39 U
Heptachlor Epoxide	0.38 U	0.39 U	0.89	0.39 U	0.51 J	0.39 U
4,4'-DDT	1.4	0.98	0.79	1.1	1.3	0.39 U
4,4'-DDE	23	16	16	11	24	9.3
4,4'-DDD	1.3	0.91	0.87	0.72	1.2	0.29 J
Aldrin	0.38 U	0.39 U	0.38 U	0.39 U	0.39 U	0.39 U
Dieldrin	0.34 J	0.99 J	1 J	1.2 J	0.7 J	0.73 J
Endrin	0.38 UJ	0.39 UJ	0.38 UJ	0.39 UJ	0.39 UJ	0.39 UJ
Endrin Aldehyde	0.38 UJ	0.39 UJ	0.38 UJ	0.39 UJ	0.39 UJ	0.39 UJ
Endrin Ketone	0.38 UJ	0.39 UJ	0.38 UJ	0.39 UJ	0.39 UJ	0.39 UJ
cis-Chlordane	0.38 U	0.39 U	0.38 U	0.39 U	0.39 U	0.39 U
trans-Chlordane	0.38 U	0.39 U	0.38 U	0.39 U	0.39 U	0.39 U
cis-Nonachlor	0.38	0.31 J	0.38 U	0.36 J	0.37 J	0.18 J
trans-Nonachlor	0.38 U	0.39 U	0.38 U	0.39 U	0.39 U	0.19 J
Oxychlordane	0.38 U	0.39 U	0.49 NJ	0.39 U	0.27 NJ	0.19 J
Hexachlorobenzene	1.1	0.67	1	0.56	0.84	0.92
Endosulfan I	0.38 UJ	0.39 UJ	0.38 UJ	0.39 UJ	0.39 UJ	0.29 J
Endosulfan II	0.38 UJ	0.39 UJ	0.38 UJ	0.39 UJ	0.39 UJ	0.39 UJ
Endosulfan Sulfate	0.38 UJ	0.39 UJ	0.38 UJ	0.39 UJ	0.39 UJ	0.55 J
Methoxychlor	1.9 U	2 U	1.9 U	2 U	1.9 U	2 U
PCB-aroclor 1016	3.8 U	3.9 U	3.8 U	3.9 U	3.9 U	3.9 U
PCB-aroclor 1221	3.8 U	3.9 U	3.8 U	3.9 U	3.9 U	3.9 U
PCB-aroclor 1232	3.8 U	3.9 U	3.8 U	3.9 U	3.9 U	3.9 U
PCB-aroclor 1242	3.8 U	3.9 U	3.8 U	3.9 U	3.9 U	3.9 U
PCB-aroclor 1248	3.8 U	3.9 U	3.8 U	3.9 U	3.9 U	3.9 U
PCB-aroclor 1254	6.1	5.1	11	10	6.2	4.7 NJ
PCB-aroclor 1260	3.8 U	3.9 U	3.8 U	3.9 U	3.9 U	3.9 U
PCB-aroclor 1268	3.8 U	3.9 U	3.8 U	3.9 U	3.9 U	3.9 U
Mercury (mg/Kg ww)			0.16			0.14 J
Lipids (%)	2.77	1.96	2.64	2.36	1.91	1.55

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.

Table B-1 (cont.). Contaminant Data for Palouse River Fish Fillet Samples Collected in 2005 (ug/Kg wet weight)

Location	LWR_FISH	LWR_FISH	LWR_FISH	LWR_FISH	MID_FISH	MID_FISH
Date	6/22/05	6/23/05	6/23/05	8/3/05	6/6/05	6/6/05
Sample ID	LWR NPM-2	LWR CHM-1	LWR SMB-1	LWR CARP-1	MID LSS-1	MID LSS-2
Sample No.	05328475	05328476	05328477	05328478	05328479	05328480
Species	Northern Pike Minnow	Chiselmouth	Smallmouth Bass	Common Carp	Largescale Sucker	Largescale Sucker
Alpha-BHC	0.39 U	0.37 UJ	0.39 UJ	0.4 U	0.4 U	0.38 U
Beta-BHC	0.96 U	0.74 U	0.79 U	1 U	1 U	0.96 U
Delta-BHC	0.39 U	0.37 UJ	0.39 UJ	0.4 U	0.4 U	0.38 U
Lindane	0.39 U	0.37 U	0.39 U	0.4 U	0.22 J	0.34 J
Heptachlor	0.39 U	0.37 U	0.39 U	0.4 U	0.4 U	0.38 U
Heptachlor Epoxide	0.39 U	1.5	0.79	0.4 U	0.4 U	0.38 U
4,4'-DDT	0.81	0.37 U	0.34 J	0.26 J	2.6	1.7
4,4'-DDE	51	6.5	5.1	8.3	43	21
4,4'-DDD	1.7	0.44	0.2 J	0.61	1.1	0.98
Aldrin	0.39 U	0.37 UJ	0.39 UJ	0.4 U	0.4 U	0.38 U
Dieldrin	1.1 J	0.81 J	2.4 J	0.59 J	0.8 J	0.5 J
Endrin	0.39 UJ	0.37 UJ	0.39 UJ	0.4 UJ	0.4 UJ	0.38 UJ
Endrin Aldehyde	0.39 UJ	0.37 UJ	0.39 UJ	0.32 J	0.4 UJ	0.4 J
Endrin Ketone	0	0.37 UJ	0.39 UJ	0.4 UJ	0.4 UJ	0.38 UJ
cis-Chlordane	0.29 J	0.22 J	0.39 U	0.22 J	0.17 J	0.12 J
trans-Chlordane	0.25 J	0.37 U	0.87	0.26 J	0.3 J	0.25 J
cis-Nonachlor	1	0.28 J	0.39 U	0.18 J	0.7	0.38 U
trans-Nonachlor	0.89	0.2 J	0.39 U	0.21 J	0.22 J	0.17 J
Oxychlordane	0.52	0.37 U	0.39 U	0.15 J	0.2 J	0.17 J
Hexachlorobenzene	1.7	0.81	0.97	1.2	1.7	1.9
Endosulfan I	0.7 J	0.37 UJ	0.39 UJ	0.4 UJ	0.4 UJ	0.38 UJ
Endosulfan II	0.39 UJ	0.18 J	0.39 UJ	0.4 UJ	0.4 UJ	0.38 UJ
Endosulfan Sulfate	0.39 UJ	0.37 UJ	0.39 UJ	0.48 J	0.4 UJ	0.38 UJ
Methoxychlor	1.9 U	3.7 U	3.9 U	2 U	2 U	1.9 U
PCB-aroclor 1016	3.9 U	3.7 U	3.9 U	4 U	4 U	3.8 U
PCB-aroclor 1221	3.9 U	3.7 U	3.9 U	4 U	4 U	3.8 U
PCB-aroclor 1232	3.9 U	3.7 U	3.9 U	4 U	4 U	3.8 U
PCB-aroclor 1242	3.9 U	3.7 U	3.9 U	4 U	4 U	3.8 U
PCB-aroclor 1248	3.9 U	3.7 U	3.9 U	4 U	4 U	3.8 U
PCB-aroclor 1254	12	2.4 J	3.9 U	4 U	9.6	6.1 NJ
PCB-aroclor 1260	3.9 U	3.7 U	3.9 U	4 U	4 U	3.8 U
PCB-aroclor 1268	3.9 U	3.7 U	3.9 U	4 U	4 U	3.8 U
Mercury (mg/Kg ww)	0.749					
Lipids (%)	1.94	2.46	0.46	2.03	2.11	1.53

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.

Table B-1 (cont.). Contaminant Data for Palouse River Fish Fillet Samples Collected in 2005 (ug/Kg wet weight)

Location	MID_FISH	MID_FISH	MID_FISH	MID_FISH	MID_FISH	MID_FISH
Date	6/6/05	6/6/05	6/6/05	6/6/05	6/6/05	6/6/05
Sample ID	MID LSS-3	MID LSS-4	MID NPM-1	MID NPM-2	MID CHM-1	MID SMB-1
Sample No.	05328481	05328482	05328483	05328484	05328485	05328486
Species	Largescale Sucker	Largescale Sucker	Northern Pike Minnow	Northern Pike Minnow	Chiselmouth	Smallmouth Bass
Alpha-BHC	0.37 U	0.39 U	0.36 U	0.38 U	0.36 U	0.38 U
Beta-BHC	0.93 U	0.96 U	0.89 U	0.95 U	0.91 U	0.94 U
Delta-BHC	0.37 U	0.39 U	0.36 U	0.38 U	0.36 U	0.38 U
Lindane	0.37 J	0.27 J	0.14 J	0.23 J	0.24 J	0.38 U
Heptachlor	0.37 U	0.39 U	0.36 U	0.38 U	0.36 U	0.38 U
Heptachlor Epoxide	0.37 U	0.39 U	0.36 U	0.38 U	0.36 U	0.38 U
4,4'-DDT	3.2	2.9	0.21 J	0.23 J	0.14 J	0.36 J
4,4'-DDE	43	40	32	18	15	6
4,4'-DDD	1.4	1.3	0.95	0.65	0.69	0.13 J
Aldrin	0.37 U	0.39 U	0.36 U	0.38 U	0.36 U	0.38 U
Dieldrin	1.1 J	1.4 J	1 J	1.2 J	0.85 J	0.49 J
Endrin	0.37 UJ	0.39 UJ	0.36 UJ	0.38 UJ	0.36 UJ	0.38 UJ
Endrin Aldehyde	0.37 UJ	0.39 UJ	0.34 J	0.46 NJ	0.35 J	0.38 UJ
Endrin Ketone	0.37 UJ	0.39 UJ	0.25 NJ	0.38 UJ	0.36 UJ	0.38 UJ
cis-Chlordane	0.18 J	0.18 J	0.2 J	0.19 J	0.2 J	0.38 U
trans-Chlordane	0.58	0.37 J	0.25 J	0.27 J	0.25 J	0.11 J
cis-Nonachlor	0.63	0.69	0.57	0.55	0.27 J	0.38 U
trans-Nonachlor	0.48 J	0.23 J	0.3 J	0.18 J	0.25 J	0.38 U
Oxychlordane	0.41	0.21 J	0.23 J	0.21 J	0.16 J	0.38 U
Hexachlorobenzene	2.8	2.3	1.3	1.2	1.1	0.38 J
Endosulfan I	0.37 UJ	0.39 UJ	0.36 UJ	0.46 NJ	0.27 J	0.4 J
Endosulfan II	0.37 UJ	0.39 UJ	0.45 J	0.38 UJ	0.36 UJ	0.38 UJ
Endosulfan Sulfate	0.37 UJ	0.39 UJ	0.38 J	0.38 UJ	0.36 UJ	0.38 UJ
Methoxychlor	1.9 U	1.9 U	1.8 U	1.9 U	1.8 U	1.9 U
PCB-aroclor 1016	3.7 U	3.9 U	3.6 U	3.8 U	3.6 U	3.8 U
PCB-aroclor 1221	3.7 U	3.9 U	3.6 U	3.8 U	3.6 U	3.8 U
PCB-aroclor 1232	3.7 U	3.9 U	3.6 U	3.8 U	3.6 U	3.8 U
PCB-aroclor 1242	3.7 U	3.9 U	3.6 U	3.8 U	3.6 U	3.8 U
PCB-aroclor 1248	3.7 U	3.9 U	3.6 U	3.8 U	3.6 U	3.8 U
PCB-aroclor 1254	10	9.1	8.8	8	5.8	3.8 U
PCB-aroclor 1260	3.7 U	3.9 U	3.6 U	3.8 U	3.6 U	3.8 U
PCB-aroclor 1268	3.7 U	3.9 U	3.6 U	3.8 U	3.6 U	3.8 U
Mercury (mg/Kg ww)						
Lipids (%)	2.19	2.7	0.9	0.88	1.13	0.44

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.

Table B-1 (cont.). Contaminant Data for Palouse River Fish Fillet Samples Collected in 2005 (ug/Kg wet weight)

Location	MID_FISH	MID_FISH	NF_FISH	NF_FISH	NF_FISH	NF_FISH
Date	6/6/05	6/6/05	6/8/05	6/8/05	6/8/05	6/8/05
Sample ID	MID SMB-2	MID SMB-3	NF CHM-1	NF CHM-2	NF CHM-3	NF CHM-4
Sample No.	05328487	05328488	05288366	05288367	05288368	05288369
Species	Smallmouth Bass	Smallmouth Bass	Chiselmouth	Chiselmouth	Chiselmouth	Chiselmouth
Alpha-BHC	0.4 U	0.38 U	0.4 UJ	0.39 UJ	0.4 UJ	0.4 UJ
Beta-BHC	1 U	0.94 U	1 U	0.98 U	0.79 U	0.8 U
Delta-BHC	0.4 U	0.38 U	0.4 U	0.39 U	0.4 UJ	0.4 UJ
Lindane	0.4 U	0.38 U	0.14 J	0.39 U	0.4 U	0.4 U
Heptachlor	0.4 U	0.38 U	0.4 U	0.39 U	0.4 U	0.4 U
Heptachlor Epoxide	0.4 U	0.38 U	0.4 U	0.39 U	0.4 U	0.4 U
4,4'-DDT	0.48	1.6	0.4 U	0.17 J	0.4 U	0.4 U
4,4'-DDE	9.3	51	9.2	10	13	10
4,4'-DDD	0.28 J	1.1	0.59	0.53	0.67	0.58
Aldrin	0.4 U	0.38 U	0.4 UJ	0.39 UJ	0.4 UJ	0.4 UJ
Dieldrin	0.56 J	0.43 J	0.23 J	0.18 J	0.34 J	0.44 J
Endrin	0.4 UJ	0.38 UJ	0.4 UJ	0.39 UJ	0.4 UJ	0.4 UJ
Endrin Aldehyde	0.4 UJ	0.38 UJ	0.4 UJ	0.39 UJ	0.46 UJ	0.26 UJ
Endrin Ketone	0.4 UJ	0.38 UJ	0.4 UJ	0.39 UJ	0.4 UJ	0.4 UJ
cis-Chlordane	0.4 U	0.15 J	0.13 J	0.39 U	0.4 U	0.4 U
trans-Chlordane	0.4 U	0.34 J	0.4 U	0.39 U	0.4 U	0.4 U
cis-Nonachlor	0.11 J	0.74 J	0.4 U	0.39 U	0.26 J	0.4 U
trans-Nonachlor	0.085 J	0.36 J	0.15 J	0.22 J	0.26 J	0.4 U
Oxychlordane	0.13 J	0.23 J	0.18 J	0.39 U	0.4 U	0.4 U
Hexachlorobenzene	0.71	0.68	1	0.94	0.71	0.62
Endosulfan I	0.4 UJ	0.68 J	0.4 UJ	0.39 UJ	0.4 UJ	0.4 UJ
Endosulfan II	0.4 UJ	0.38 UJ	0.4 UJ	0.39 UJ	0.4 UJ	0.4 UJ
Endosulfan Sulfate	0.4 UJ	0.38 UJ	0.4 UJ	0.25 J	1 UJ	1.2 UJ
Methoxychlor	2 U	1.9 U	2 U	2 U	4 U	4 U
PCB-aroclor 1016	4 U	3.8 U	4 U	3.9 U	4 U	4 U
PCB-aroclor 1221	4 U	3.8 U	4 U	3.9 U	4 U	4 U
PCB-aroclor 1232	4 U	3.8 U	4 U	3.9 U	4 U	4 U
PCB-aroclor 1242	4 U	3.8 U	4 U	3.9 U	4 U	4 U
PCB-aroclor 1248	4 U	3.8 U	4 U	3.9 U	4 U	4 U
PCB-aroclor 1254	4 U	9.4	5.1 NJ	5.5 NJ	3.6 J	2.4 J
PCB-aroclor 1260	4 U	3.8 U	4 U	3.9 U	4 U	4 U
PCB-aroclor 1268	4 U	3.8 U	4 U	3.9 U	4 U	4 U
Mercury (mg/Kg ww)	0.12	0.318				
Lipids (%)	0.47	0.26	1.4	1.59	1.28	1.36

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.

Table B-1 (cont.). Contaminant Data for Palouse River Fish Fillet Samples Collected in 2005 (ug/Kg wet weight)

Location	NF_FISH	NF_FISH	NF_FISH	NF_FISH	NF_FISH	NF_FISH
Date	6/8/05	6/8/05	6/8/05	6/7/05	6/9/05	6/9/05
Sample ID	NF CHM-5	NF LSS-1	NF LSS-2	NF LSS-3	NF LSS-4	NF LSS-5
Sample No.	05288370	05288371	05288372	05288373	05288374	05288375
Species	Chiselmouth	Largescale Sucker	Largescale Sucker	Largescale Sucker	Largescale Sucker	Largescale Sucker
Alpha-BHC	0.4 UJ	0.39 UJ	0.38 UJ	0.39 UJ	0.39 UJ	0.4 UJ
Beta-BHC	0.79 U	0.96 U	0.94 U	0.98 U	0.98 U	0.8 U
Delta-BHC	0.4 UJ	0.39 U	0.38 U	0.39 U	0.39 U	0.4 UJ
Lindane	0.4 U	0.39 U	0.38 U	0.088 J	0.19 J	0.4 U
Heptachlor	0.4 U	0.39 U	0.38 U	0.39 U	0.39 U	0.4 U
Heptachlor Epoxide	0.4 U	0.39 U	0.38 U	0.39 U	0.39 U	0.4 U
4,4'-DDT	0.4 U	0.75	1.9	2	3.2	2
4,4'-DDE	11	5.5	18	25	40	27
4,4'-DDD	0.69	0.39 J	0.75	1.1	1.4	1
Aldrin	0.4 UJ	0.39 UJ	0.38 UJ	0.39 UJ	0.39 UJ	0.4 UJ
Dieldrin	0.43 J	0.11 J	0.26 J	0.33 J	0.55 J	0.2 J
Endrin	0.4 UJ	0.39 UJ	0.38 UJ	0.39 UJ	0.39 UJ	0.4 UJ
Endrin Aldehyde	0.63 J	0.39 UJ	0.38 UJ	0.39 UJ	0.39 UJ	0.4 UJ
Endrin Ketone	0.4 UJ	0.39 UJ	0.38 UJ	0.39 UJ	0.39 UJ	0.4 UJ
cis-Chlordane	0.4 U	0.087 J	0.11 J	0.14 J	0.21 J	0.4 U
trans-Chlordane	0.4 U	0.39 U	0.38 U	0.39 U	0.39 U	0.4 U
cis-Nonachlor	0.4 U	0.39 U	0.38 U	0.39 U	0.39 U	0.2 J
trans-Nonachlor	0.4 U	0.087 J	0.17 J	0.16 J	0.26 J	0.4 U
Oxychlordane	0.4 U	0.11 J	0.13 J	0.12 J	0.22 J	0.28 J
Hexachlorobenzene	0.75	0.54	0.79	0.86	1.9	0.9
Endosulfan I	0.4 UJ	0.39 UJ	0.38 UJ	0.39 UJ	0.39 UJ	0.4 UJ
Endosulfan II	0.4 UJ	0.39 UJ	0.38 UJ	0.39 UJ	0.39 UJ	0.4 UJ
Endosulfan Sulfate	0.4 UJ	0.39 UJ	0.38 UJ	0.17 J	0.39 UJ	1.1 UJ
Methoxychlor	4 U	1.9 U	1.9 U	2 U	2 U	4 U
PCB-aroclor 1016	4 U	3.9 U	3.8 U	3.9 U	3.9 U	4 U
PCB-aroclor 1221	4 U	3.9 U	3.8 U	3.9 U	3.9 U	4 U
PCB-aroclor 1232	4 U	3.9 U	3.8 U	3.9 U	3.9 U	4 U
PCB-aroclor 1242	4 U	3.9 U	3.8 U	3.9 U	3.9 U	4 U
PCB-aroclor 1248	4 U	3.9 U	3.8 U	3.9 U	3.9 U	4 U
PCB-aroclor 1254	4.1	4 NJ	3.8 U	3.9 U	5.1 NJ	3.2 J
PCB-aroclor 1260	4 U	3.9 U	3.8 U	3.9 U	3.9 U	4 U
PCB-aroclor 1268	4 U	3.9 U	3.8 U	3.9 U	3.9 U	4 U
Mercury (mg/Kg ww)		0.056	0.266			
Lipids (%)	1.65	2.09	2.86	1.7	3.12	2.28

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.

Table B-1 (cont.). Contaminant Data for Palouse River Fish Fillet Samples Collected in 2005 (ug/Kg wet weight)

Location	NF_FISH	NF_FISH	NF_FISH	NF_FISH	NF_FISH	SF_FISH
Date	6/7/05	6/8/05	6/8/05	6/8/05	6/8/05	5/24/05
Sample ID	NF NPM-1	NF NPM-2	NF NPM-3	NF NPM-4	NF NPM-5	SF CHM-1
Sample No.	05288376	05288377	05288378	05288379	05288380	05288381
Species	Northern Pike Minnow	Northern Pike Minnow	Northern Pike Minnow	Northern Pike Minnow	Northern Pike Minnow	Chiselmouth
Alpha-BHC	0.39 UJ	0.4 UJ	0.39 UJ	0.4 UJ	0.37 UJ	0.4 UJ
Beta-BHC	0.99 U	1 U	0.98 U	1 U	0.74 U	1 U
Delta-BHC	0.39 U	0.4 U	0.39 U	0.4 U	0.37 UJ	0.4 U
Lindane	0.1 J	0.4 U	0.21 J	0.4 U	0.37 U	1
Heptachlor	0.39 U	0.4 U	0.39 U	0.4 U	0.37 U	0.4 U
Heptachlor Epoxide	0.39 U	0.4 U	0.39 U	0.4 U	0.37 U	0.4 U
4,4'-DDT	0.39 J	0.4 U	0.29 J	0.26 J	0.32 J	0.58
4,4'-DDE	33	28	54	54	53	25
4,4'-DDD	0.99	0.96	1.7	1.5	1.6	2.1
Aldrin	0.39 UJ	0.4 UJ	0.39 UJ	0.4 UJ	0.37 UJ	0.4 UJ
Dieldrin	0.32 J	0.34 J	0.42 J	0.6 J	0.37 UJ	0.66 J
Endrin	0.39 UJ	0.4 UJ	0.39 UJ	0.4 UJ	0.37 UJ	0.4 UJ
Endrin Aldehyde	0.39 UJ	0.4 UJ	0.21 J	0.4 UJ	0.37 UJ	0.4 UJ
Endrin Ketone	0.39 UJ	0.4 UJ	0.39 UJ	0.4 UJ	0.37 UJ	0.4 UJ
cis-Chlordane	0.39 U	0.19 J	0.23 J	0.22 J	0.37 U	0.36 J
trans-Chlordane	0.39 U	0.4 U	0.39 U	0.4 U	0.37 U	0.14 J
cis-Nonachlor	0.39 U	0.4 U	0.39 U	0.4 U	0.37 U	0.4 U
trans-Nonachlor	0.44 J	0.24 J	0.37 J	0.42	0.37 J	0.71 U
Oxychlordane	0.24 J	0.13 J	0.35 J	0.28 J	0.28 J	0.21 J
Hexachlorobenzene	1.1	0.83	1.7	1.1	1.2	2.3
Endosulfan I	0.39 UJ	0.4 UJ	0.39 UJ	0.4 UJ	0.37 UJ	0.4 UJ
Endosulfan II	0.39 UJ	0.4 UJ	0.39 UJ	0.4 UJ	0.35 J	0.4 UJ
Endosulfan Sulfate	0.39 UJ	0.4 UJ	0.25 J	0.34 J	0.37 UJ	0.15 NJ
Methoxychlor	2 U	2 U	2 U	2 U	3.7 U	2 U
PCB-aroclor 1016	3.9 U	4 U	3.9 U	4 U	3.7 U	4 U
PCB-aroclor 1221	3.9 U	4 U	3.9 U	4 U	3.7 U	4 U
PCB-aroclor 1232	3.9 U	4 U	3.9 U	4 U	3.7 U	4 U
PCB-aroclor 1242	3.9 U	4 U	3.9 U	4 U	3.7 U	4 U
PCB-aroclor 1248	3.9 U	4 U	3.9 U	4 U	3.7 U	4 U
PCB-aroclor 1254	3.9 U	4.6 NJ	8.4	4 U	8.2	18
PCB-aroclor 1260	3.9 U	4 U	3.9 U	4 U	3.7 U	4 U
PCB-aroclor 1268	3.9 U	4 U	3.9 U	4 U	3.7 U	4 U
Mercury (mg/Kg ww)		0.422				
Lipids (%)	2.43	2.34	3.15	3.47	2.77	1.66

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.

Table B-1 (cont.). Contaminant Data for Palouse River Fish Fillet Samples Collected in 2005 (ug/Kg wet weight)

Location	SF_FISH	SF_FISH	SF_FISH	SF_FISH	SF_FISH	SF_FISH
Date	5/24/05	5/24/05	5/23/05	5/24/05	5/23/05	5/23/05
Sample ID	SF CHM-2	SF LSS-1	SF LSS-2	SF LSS-3	SF LSS-4	SF LSS-5
Sample No.	05288382	05288383	05288384	05288385	05288386	05288387
Species	Chiselmouth	Largescale Sucker	Largescale Sucker	Largescale Sucker	Largescale Sucker	Largescale Sucker
Alpha-BHC	0.39 UJ	0.39 UJ	0.38 UJ	0.39 UJ	0.39 U	0.39 U
Beta-BHC	0.98 U	0.97 U	0.95 U	0.99 U	0.97 U	0.98 U
Delta-BHC	0.39 U	0.39 U	0.38 U	0.39 U	0.39 U	0.39 U
Lindane	0.8	1.2	1.1	1.2	0.59	0.46
Heptachlor	0.39 U	0.39 U	0.38 U	0.39 U	0.39 U	0.39 U
Heptachlor Epoxide	0.39 U	0.39 U	0.38 U	0.39 U	0.39 U	0.39 U
4,4'-DDT	0.37 J	3.4	3.6	3.3	6.4	3.4
4,4'-DDE	21	19	18	19	35	25
4,4'-DDD	1.7	1.6	1.6	1.8	2	1.1
Aldrin	0.39 UJ	0.39 UJ	0.38 UJ	0.39 UJ	0.39 U	0.39 U
Dieldrin	0.55 J	0.5 J	0.78 J	0.56 J	3.8 J	2.7 J
Endrin	0.39 UJ	0.39 UJ	0.38 UJ	0.39 UJ	0.39 UJ	0.39 UJ
Endrin Aldehyde	0.16 J	0.39 UJ	0.21 J	0.39 UJ	0.39 UJ	0.39 UJ
Endrin Ketone	0.39 UJ	0.39 J	0.47 J	0.39 U	0.39 UJ	0.39 UJ
cis-Chlordane	0.31 J	0.25 J	0.26 J	0.22 J	0.39 U	0.39 U
trans-Chlordane	0.39 U	0.39 U	0.38 U	0.39 U	0.39 U	0.39 U
cis-Nonachlor	0.39 U	0.39 U	0.38 U	0.93	2.8	1.3
trans-Nonachlor	0.35 J	0.21 J	0.3 J	0.42	0.39 U	0.39 U
Oxychlordane	0.27 J	0.18 J	0.38 U	0.28 J	0.39 U	0.39 U
Hexachlorobenzene	1.5	1.6	1.9	2.1	1.4	0.81
Endosulfan I	0.1 J	0.16 J	0.45 J	0.39 UJ	0.39 UJ	0.39 UJ
Endosulfan II	0.39 UJ	0.39 UJ	0.38 UJ	0.39 UJ	0.39 UJ	0.39 UJ
Endosulfan Sulfate	0.14 J	0.41 J	0.62 J	0.089 J	0.39 UJ	0.39 UJ
Methoxychlor	2 U	1.9 U	1.9 U	2 U	1.9 U	2 U
PCB-aroclor 1016	3.9 U	3.9 U	3.8 U	3.9 U	3.9 U	3.9 U
PCB-aroclor 1221	3.9 U	3.9 U	3.8 U	3.9 U	3.9 U	3.9 U
PCB-aroclor 1232	3.9 U	3.9 U	3.8 U	3.9 U	3.9 U	3.9 U
PCB-aroclor 1242	3.9 U	3.9 U	3.8 U	3.9 U	3.9 U	3.9 U
PCB-aroclor 1248	3.9 U	3.9 U	3.8 U	3.9 U	3.9 U	3.9 U
PCB-aroclor 1254	14	12	16	13	33	13
PCB-aroclor 1260	3.9 U	3.9 U	3.8 U	3.9 U	3.9 U	3.9 U
PCB-aroclor 1268	3.9 U	3.9 U	3.8 U	3.9 U	3.9 U	3.9 U
Mercury (mg/Kg ww)			0.049			0.304
Lipids (%)	1.1	2.32	1.83	1.75	1.37	1.4

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.

Table B-1 (cont.). Contaminant Data for Palouse River Fish Fillet Samples Collected in 2005 (ug/Kg wet weight)

Location	SF_FISH		SF_FISH		SF_FISH		SF_FISH		SF_FISH	
Date	5/24/05		5/24/05		5/23/05		5/24/05		5/24/05	
Sample ID	SF NPM-1		SF NPM-2		SF NPM-3		SF NPM-4		SF NPM-5	
Sample No.	05288388		05288389		05288390		05288391		05288392	
Species	Northern Pike Minnow		Northern Pike Minnow		Northern Pike Minnow		Northern Pike Minnow		Northern Pike Minnow	
Alpha-BHC	0.38	U	0.4	U	0.39	U	0.4	U	0.39	U
Beta-BHC	0.95	U	1	U	0.98	U	1	U	0.97	U
Delta-BHC	0.38	U	0.4	U	0.39	U	0.4	U	0.39	U
Lindane	0.54		0.4		0.87		0.47		0.71	
Heptachlor	0.38	U	0.4	U	0.39	U	0.4	U	0.39	U
Heptachlor Epoxide	0.38	U	0.4	U	0.39	U	0.4	U	0.39	U
4,4'-DDT	0.49	NJ	0.61	NJ	0.56	NJ	0.45	NJ	0.62	NJ
4,4'-DDE	28		48		30		22		53	
4,4'-DDD	1.4		1.1		1.8		1		1.6	
Aldrin	0.38	U	0.4	U	0.39	U	0.4	U	0.39	U
Dieldrin	2.4	J	2.6	J	3.6	J	2.7	J	2	J
Endrin	0.38	UJ	0.4	UJ	0.39	UJ	0.4	UJ	0.39	UJ
Endrin Aldehyde	0.38	UJ	0.4	UJ	0.39	UJ	0.4	UJ	0.39	UJ
Endrin Ketone	0.38	UJ	0.4	UJ	0.39	UJ	0.4	UJ	0.39	UJ
cis-Chlordane	0.38	U	0.4	U	0.39	U	0.4	U	0.39	U
trans-Chlordane	0.38	U	0.4	U	0.39	U	0.4	U	0.39	U
cis-Nonachlor	1.3		1.8		0.39	U	1.2		2.8	
trans-Nonachlor	0.38	U	0.4	U	0.39	U	0.4	U	0.26	J
Oxychlordane	0.38	U	0.4	U	0.39	U	0.4	U	0.39	U
Hexachlorobenzene	1.2		2.7		1.5		1		1.5	
Endosulfan I	0.38	UJ	0.4	UJ	0.39	UJ	0.4	UJ	0.39	UJ
Endosulfan II	0.38	UJ	0.4	UJ	0.39	UJ	0.4	UJ	0.39	UJ
Endosulfan Sulfate	0.38	UJ	0.4	UJ	0.39	UJ	0.4	UJ	0.39	UJ
Methoxychlor	1.9	U	2	U	2	U	2	U	1.9	U
PCB-aroclor 1016	3.8	U	4	U	3.9	U	4	U	3.9	U
PCB-aroclor 1221	3.8	U	4	U	3.9	U	4	U	3.9	U
PCB-aroclor 1232	3.8	U	4	U	3.9	U	4	U	3.9	U
PCB-aroclor 1242	3.8	U	4	U	3.9	U	4	U	3.9	U
PCB-aroclor 1248	3.8	U	4	U	3.9	U	4	U	3.9	U
PCB-aroclor 1254	16		25		17		12		26	
PCB-aroclor 1260	3.8	U	4	U	3.9	U	4	U	3.9	U
PCB-aroclor 1268	3.8	U	4	U	3.9	U	4	U	3.9	U
Mercury (mg/Kg ww)							0.16		0.465	
Lipids (%)	1.18		1.78		1.88		1.24		0.92	

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.

Appendix C. Tracking Tables

Department of Ecology – Water Quality Program		Timeline									
		2007	2008	2009	2010	2011	2012	2013	2014	2015	Future
Performance Measures	Issue municipal stormwater permit to city of Pullman and WSU										
	Provide stormwater technical assistance										
	Monitor permit implementation by reviewing annual reports										
	Track progress of activities outlined in plan										
	Investigate further monitoring to locate sources of dieldrin and PCBs (if adaptive management is needed)										
	Incorporate WLAs into NPDES Permits										

Department of Ecology – Environmental Assessment Program		Timeline			
		2007 - 2012	2013 - 2017	2018 - 2022	Future
Performance Measures	Sample Palouse River and South Fork Palouse River Fish to determine tissue concentrations				
	Assess levels of PCBs and dieldrin in influent and effluent of WWTPs				

City of Pullman		Timeline									
		2007	2008	2009	2010	2011	2012	2013	2014	2015	Future
Performance Measures	Implement requirements of Phase II municipal stormwater permit										
	Require Erosion and Sediment Control plans for land altering activities and building permits										
	Continue to train engineering and building division personnel as Certified Erosion and Sediment Control Leads (CESCL)										
	Increase annual storm drain pipe maintenance										
	Revise City's Design Standards to reference the *Stormwater Management Manual for Eastern Washington*										

City of Pullman		Timeline									
		2007	2008	2009	2010	2011	2012	2013	2014	2015	Future
	Complete storm drain computer mapping project										
	Meet conditions of NPDES wastewater permit										

Cities of Colfax and Albion		Timeline									
		2007	2008	2009	2010	2011	2012	2013	2014	2015	Future
Performance Measures	Meet conditions of NPDES wastewater permit										

Washington State University		Timeline									
		2007	2008	2009	2010	2011	2012	2013	2014	2015	Future
Performance Measures	Implement requirements of Phase II municipal stormwater permit										
	Proactively removing all PCB sources on campus to a level below Federal and Washington State regulations										
	Illicit discharge detection program										
	Computerized mapping system of existing stormwater lines, catch basin locations and drainage areas										
	Overseeing construction project one acre or greater than require Construction Stormwater NPDES permits										

Washington State University		**Timeline**									
		2007	2008	2009	2010	2011	2012	2013	2014	2015	Future
	Increase video inspection and repair all storm sewer lines										
	Street and parking lot maintenance										

Whitman County Regional Health Department		**Timeline**									
		2007	2008	2009	2010	2011	2012	2013	2014	2015	Future
Performance Measures	Investigate an abandoned landfill and incinerator along the South Fork Palouse River to determine if they are sources										

Palouse Watershed Conservation Districts		Timeline									
		2007	2008	2009	2010	2011	2012	2013	2014	2015	Future
Performance Measures	Report number of acres converted to conservation tillage or BMP projects that significantly reduce erosion										
	Seek additional funding opportunities to support this action										

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Appendix D. Response to Comments

A 30-day public comment period ran from May 24 to June 22, 2007. Ecology received the following comments:

Comments from Mark Solomon, Moscow, ID:

Has the WRIA group been informed of the levels of PCBs in the N. Fk? While below human health levels they are above Safe Drinking Water standards which could and should effect plans to recharge groundwater aquifers with N. Fk water between Potlatch and Palouse. While not mentioned in the TMDL, the former Potlatch mill site on the N. Fk floodplain just upstream from the WA line is highly contaminated with PCBs from leaking transformers (I worked there as a salvage contractor during the teardown in 1982).

Response:

In 2006 Ecology made an announcement to the Palouse Watershed Planning Group about the results of the fish tissue study. In addition, an email announcement about the public comment period was distributed by the Palouse Conservation to the Planning Unit. The fish tissue data from this study is available in Appendix B of this report and on Ecology's Environmental Information Management System website (www.ecy.wa.gov/eim/). This TMDL study only evaluated the level of PCBs and chlorinated pesticides in fish tissue. It did not measure the levels in the water column. However, the fish tissue data can be used to estimate the levels in the water column.

The Environmental Protection Agency's (EPA) Maximum Contaminant Level Goal (MCLG) for PCBs is 0 mg/l. EPA's Maximum Contaminant Level (MCL) (allowed level in drinking water) for PCBs is 0.0005 mg/l. Ecology's estimate of the PCB level in the North Fork Palouse (based on the levels in the fish tissue) is 0.13 ng/l which is equivalent to 0.00000013 mg/l. These estimates can be found in Table 16 of this report. Therefore, our estimate of the PCB levels in the North Fork Palouse River is below the Maximum Contaminant Level allowed in drinking water. It is important to note though, that this is only an estimate based on the levels in fish tissue and not an actual sample taken from the river. The Watershed Planning Unit will use available data to determine the feasibility of any activities they implement.

Thank you for the information about the Potlatch Mill Site.

Comments from Alex McGregor, The McGregor Company:

I have read the PCB chlorinated hydrocarbon plan. I think the trend lines are encouraging and the recommendation of moving from category five to category one to be appropriate. I found one very minor typo on page 65—referencing 'natural attention' instead of 'natural attenuation'. But that extremely minor suggestion I found while wearing my proofreader hat aside, it looks very solid.

Response:

Thank you for your review and comment. The typographical error has been corrected.

Comments from Kevin Gardes, Deputy Public Works Director, City of Pullman:

I am submitting comments below, on the behalf of the City of Pullman, on the draft Palouse River Chlorinated Pesticide and PCB Water Quality Improvement Report and Implementation Plan.

1. In Table ES-3, with respect to interim wasteload allocations we request that Ecology recognize that the wasteloads on the point source wastewater treatment plants may need to be revised upward (increasing the wasteload allocation) as more data becomes available. Ecology acknowledges in the draft document that available information is extremely limited. Ecology has also stated to us on numerous occasions that they feel that natural attenuation and the implementation of stormwater BMPs is the best approach for addressing toxics, since these pollutants are no longer being used. It is our understanding that there really isn't a good method for removing these pollutants at the wastewater treatment plant other than the amount normally removed through a typical biological treatment plant. Coupled with that fact that these pollutants are being measured in the parts per trillion range, it seems unlikely that the city would be able to implement a cost-effective removal strategy at the wastewater treatment plant should subsequent testing show concentrations in our effluent above the interim limits in Table ES-3.

Thank you for considering our comments and we appreciate Ecology's willingness to continue working with us to find the best solution to addressing toxics in the South Fork of the Palouse River.

Response:

Thank you for your review and comment. Because the South Fork Palouse River exceeds the loading capacity for dieldrin by 59% and PCBs by 71%, Ecology is not able to include mixing zone dilution in the wasteload allocations. Therefore, the interim wasteload allocations can not be revised upward until the river can provide the necessary dilution. However, Ecology acknowledges that the most likely sources of PCBs and dieldrin to the treatment plant are infiltration/inflow (I/I), illicit connections or industrial users. Therefore, if monitoring determines the treatment plant's effluent exceeds the wasteload allocation, Ecology will work with the city to develop a compliance schedule for determining sources to the collection system. In managing the treatment plant's NPDES permit, Ecology will focus on implementing the compliance schedule over meeting the wasteload allocations. The city and Ecology's efforts should be dedicated to finding and eliminating sources to the collection system rather than treating for removal at the treatment plant.

Comments from Gene Patterson, Public Health/Air & Water Quality Manager, Washington State University:

The following are WSU comments to the draft Palouse River Chlorinated Pesticide and PCB TMDL Report:

> Page 7, 1st sentence in paragraph after Table ES-4: Delete "attention" and insert "attenuation".
>
> Page 38, 2nd paragraph, last sentence: Delete "the hospital" since it has moved.
>
> Page 44, 4th paragraph, last sentence: Replace "John Sykes" with "John Skyles".
>
> Page 44, 5th paragraph, first and second sentences: Change "chemical dump" and "dump" to "chemical waste landfill".
>
> Page 63, add the following sentence to end of the first full paragraph: "If WSU is determined not to be subject to an individual NPDES permit, this TMDL assumes that compliance with the Eastern Washington Stormwater Manual BMPs is the only requirement that WSU needs to fulfill to accomplish the objectives of this TMDL."
>
> Page 63, second paragraph, item #5: Change "over the next five years" to "as budgeting allows" to be consistent with the City of Pullman section.
>
> Page 66, Table 22, WSU section, first row: Change "2011" to "on-going, report progress annually" to be consistent with the City of Pullman section.
>
> Page 103, WSU timeline, first row: Change "Video inspection and repair of all storm sewer lines" to "Increase video inspection and repair of storm sewer lines" to be consistent with the City of Pullman timeline.

Thank you for the opportunity to review and comment to the draft report.

Response:

Thank you for your review and comment. All WSU comments except the 5th comment have been incorporated into the text of this report. The 5th comment was addressed by adding the following text on page 63:

> In the event WSU is determined to not require coverage under the Phase II Municipal Stormwater NPDES permit, WSU can comply with this TMDL by implementing the recommendations in the Eastern Washington Stormwater Manual, paying particular attention to developing and carrying out the eight core elements outlined in Chapter 2 of the manual. Since the *Pullman Stormwater Pilot Study for Pesticides, PCBs, and Fecal Coliform Bacteria* (Lubliner, 2006) indicated stormwater was a significant source of PCBs and dieldrin, BMPs and maintenance and operation practices must be conducted to ensure sediment, which may carry PCBs and dieldrin, does not enter local streams.

Similar language was added for the city of Pullman for consistency.

Comments from William C. Stewart, Environmental Protection Agency:

Thank you for the opportunity to comment on the draft Palouse River Toxics Total Maximum Daily Load. The document is well written and well organized.

After a thorough review of this document, I have no comments at this time.

Again, thank you for the opportunity to review this TMDL and I look forward to seeing the final version of this document. I would be happy to discuss this project with you at your convenience.

Response:

Thank you for your review and comment.