Upper Yakima River
Suspended Sediment
Total Maximum Daily Load

Quality Assurance Project Plan

Betsy Dickes and Joe Joy

October 7, 1999

Washington State Department of Ecology
Environmental Assessment Program
Olympia, WA 98504

Publication No. 99-03-100

303(d) listings addressed in this study:

Cherry Creek (WA-39-1032) - DDT, 4,4'-DDE, Dieldrin
Wilson Creek (WA-39-1020) - Fecal Coliform bacteria
Cooke Creek (WA-39-1034) - Fecal Coliform bacteria

Approvals:

Signature Joe Joy, Project Manager Watershed Ecology Section	Signature Stuart Magoon, Lab Director Manchester Laboratory
Signature Betsy Dickes, Principle Investigator Watershed Ecology Section	Signature Cliff Kirchmer Quality Assurance Officer
Signature Karol Erickson, Unit Supervisor Watershed Ecology Section	Signature Chris Coffin, Client Staff Contact Central Regional Office
Signature Will Kendra, Section Supervisor Watershed Ecology Section	Signature Bob Barwin, Section Manager Central Regional Office

Signatures are not available on the Internet version.

Introduction

The Yakima River basin is located in south-central Washington State. It flows 214.5 miles from the outlet of Keechelus dam, southeasterly to its confluence with the Columbia River. The basin drains nearly half of Washington's eastern slope of the Cascade Mountains (6,155 square miles) and is one of the most intensively irrigated areas in the United States. This intense irrigation has resulted in a long history of water quality impairments due to suspended sediment. The Washington State Department of Ecology (Ecology), responsible for protecting water quality and aquatic communities, and for managing water resources, recognized the severity of the suspended sediment problem and in 1994-1995 initiated a total maximum daily load (TMDL) evaluation. The TMDL was designed to examine both the suspended sediment and associated pesticides in the lower Yakima River basin. Based on results from this evaluation, Ecology established TMDLs for sub-basins in the lower basin to attain State water quality standards for turbidity, aquatic life criteria for pesticides, and to protect fish health and habitat (Joy and Patterson 1997). As a result, coordinated activities in the lower basin have begun to improve sediment management strategies.

Ecology is now initiating work in the upper basin to continue its assessment of suspended sediment in the Yakima River (Figure 1). The primary purpose of this project is to evaluate the upper reaches of the Yakima River basin for total suspended solids (TSS) and turbidity, identify sediment sources, recommend reductions of sediment to support aquatic resources, and link the information obtained from the upper basin to that of the lower river. The evaluation will be carried out in two geographic areas. One area consists of the mainstem Yakima River and its major tributaries from river mile 121.7 (Harrison Road bridge, near the town of Selah) upstream to river mile 191 (4.5 miles northwest of Cle Elum on I-90) (Figure 2). The second area consists of tributaries in the Wilson-Cherry Creek basin, referred to in this study as the Kittitas Valley (Figure 3). In addition to TSS and turbidity, fecal coliform and pesticide samples will be taken in the Kittitas Valley. Fecal coliform bacteria will be sampled throughout the Valley to characterize bacteria and to evaluate the current 303(d) listings in Cooke and Wilson Creeks. Pesticide samples will also be taken to verify the existing 303(d) listing in Cherry Creek for DDT, DDE and dieldrin as well as to document presence/absence of DDD and other pesticides.

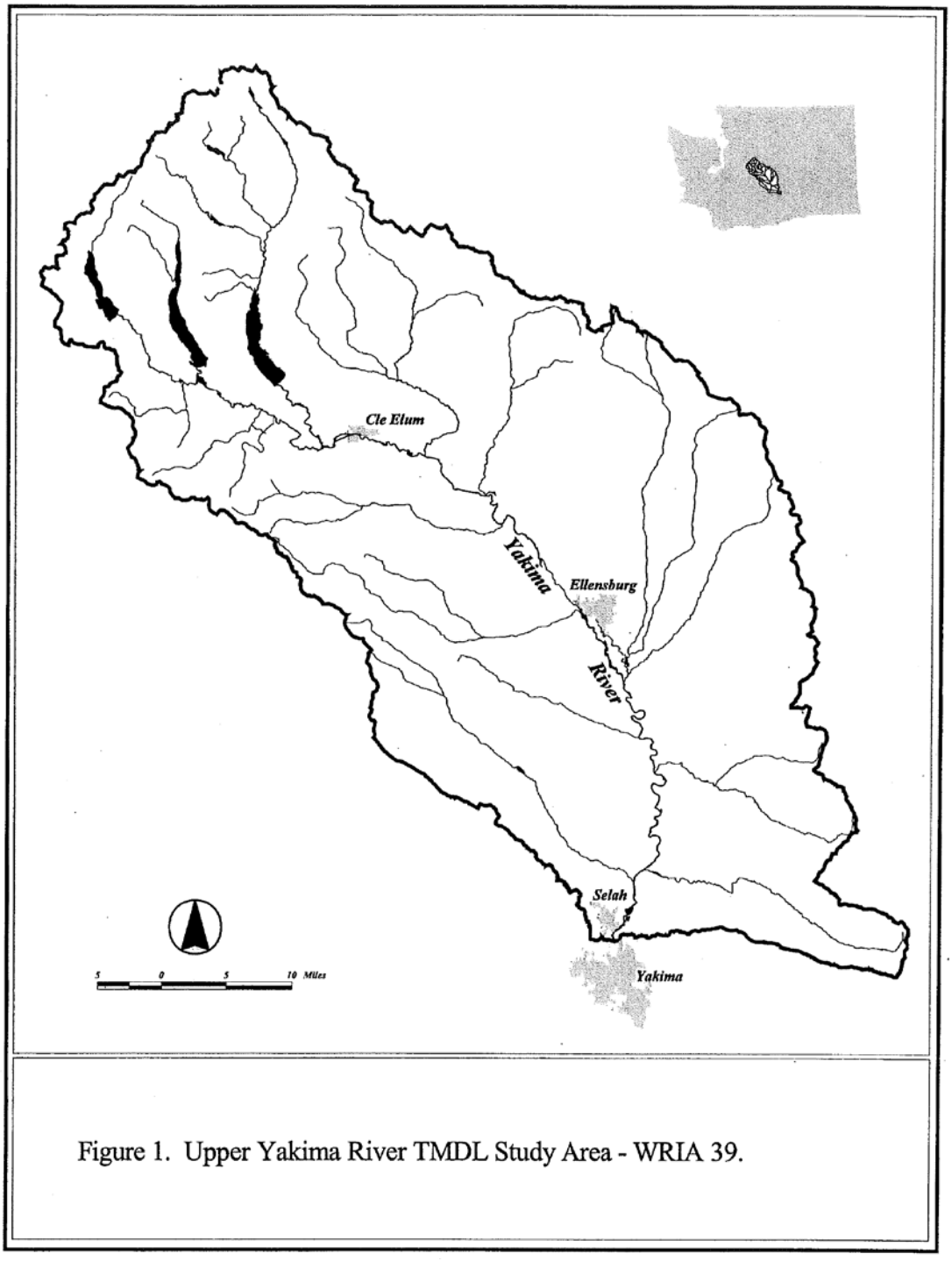
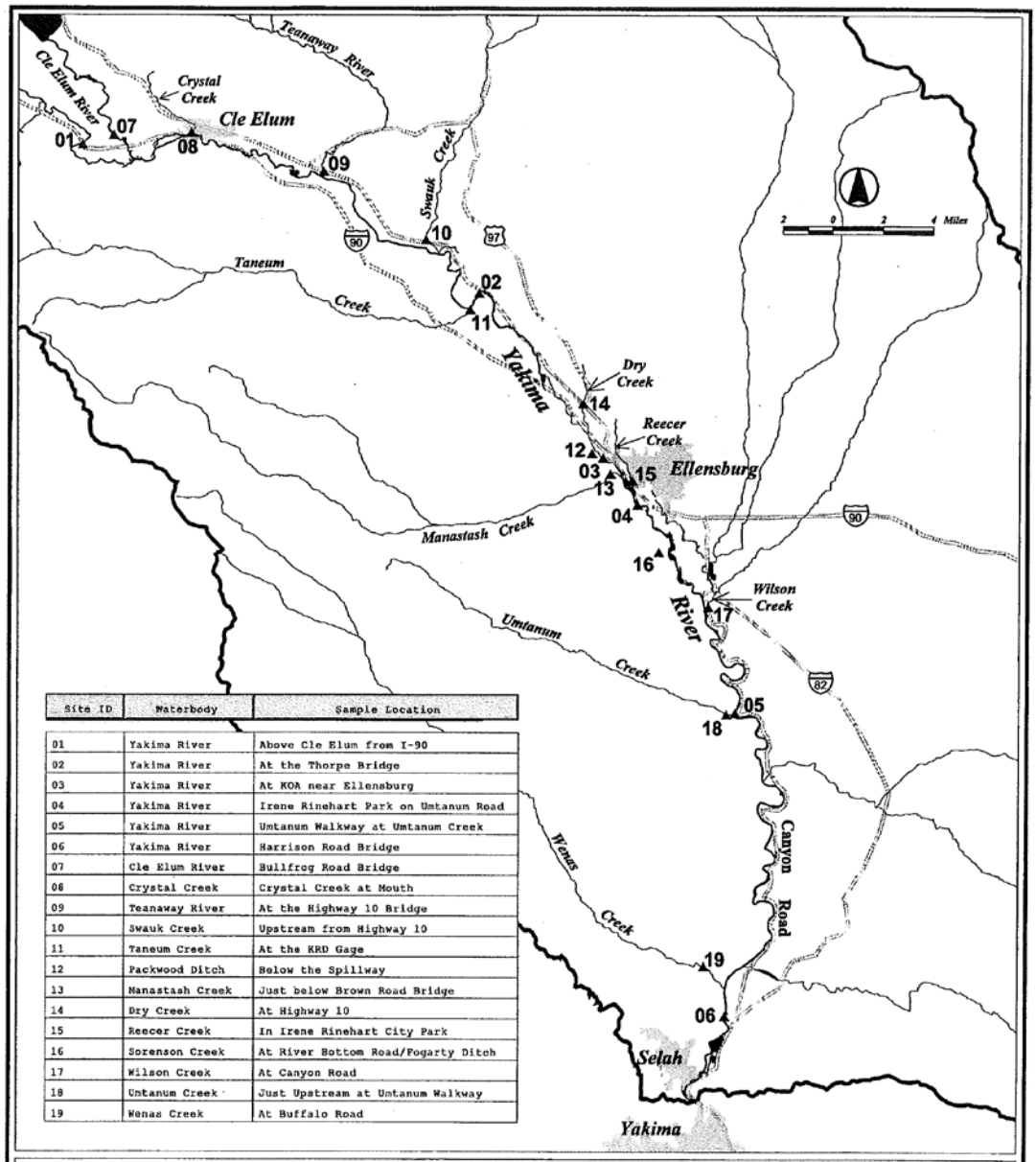


Figure 1. Upper Yakima River TMDL Study Area - WRIA 39.



Site ID	Waterbody	Sample Location
01	Yakima River	Above Cle Elum from I-90
02	Yakima River	At the Thorpe Bridge
03	Yakima River	At KOA near Ellensburg
04	Yakima River	Irene Rinehart Park on Umtanum Road
05	Yakima River	Umtanum Walkway at Umtanum Creek
06	Yakima River	Harrison Road Bridge
07	Cle Elum River	Bullfrog Road Bridge
08	Crystal Creek	Crystal Creek at Mouth
09	Teanaway River	At the Highway 10 Bridge
10	Swauk Creek	Upstream from Highway 10
11	Taneum Creek	At the KRD Gage
12	Packwood Ditch	Below the Spillway
13	Manastash Creek	Just below Brown Road Bridge
14	Dry Creek	At Highway 10
15	Reecer Creek	In Irene Rinehart City Park
16	Sorenson Creek	At River Bottom Road/Fogarty Ditch
17	Wilson Creek	At Canyon Road
18	Umtanum Creek	Just Upstream at Umtanum Walkway
19	Wenas Creek	At Buffalo Road

Figure 2. Upper Yakima TMDL Sampling Locations for the Mainstem Yakima River and Major Tributaries.

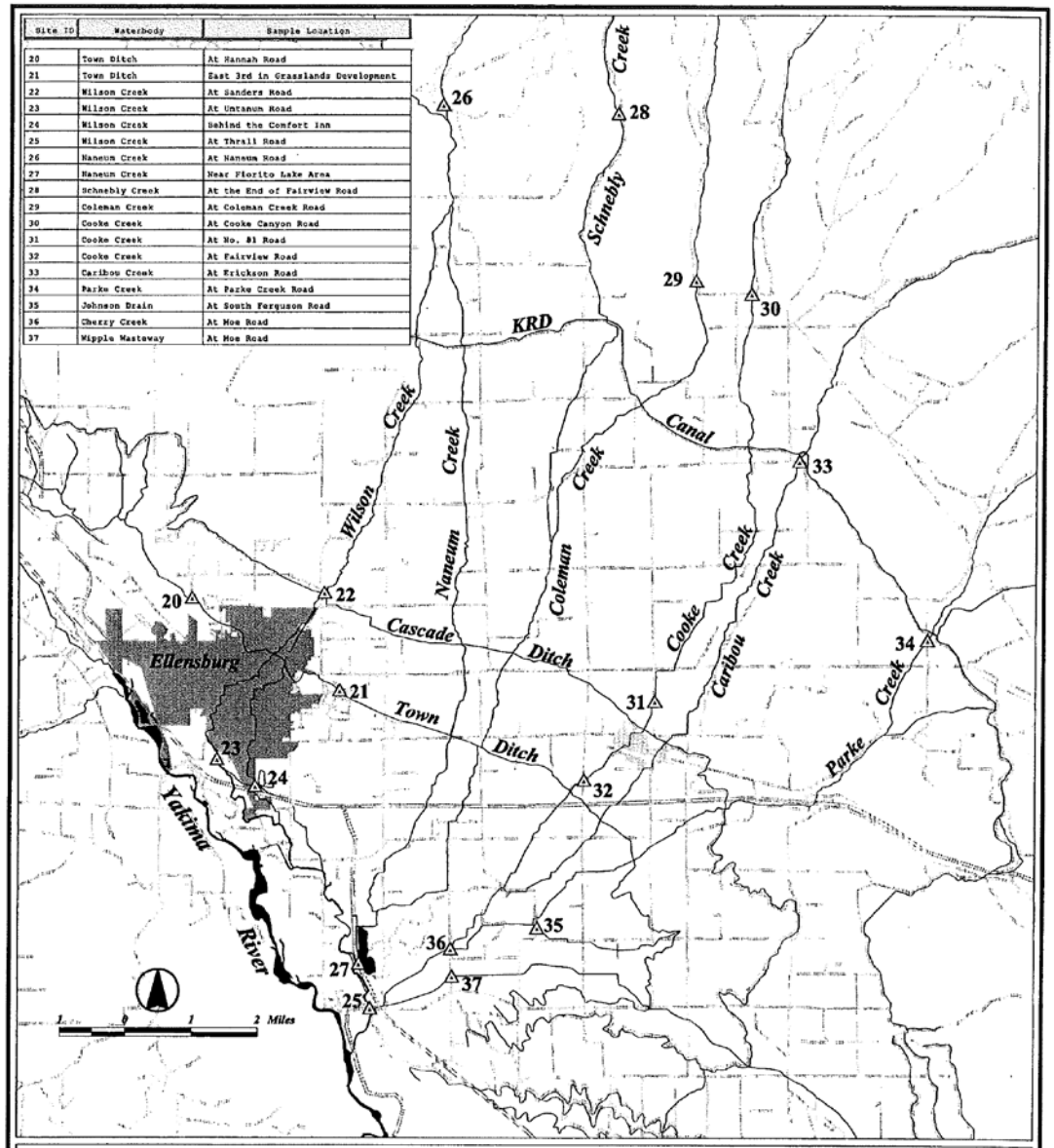


Figure 3. Upper Yakima TMDL Sampling Locations in Kittitas Valley.

Project Objectives

1. **Characterize the upper Yakima River basin for TSS and turbidity, primarily during the irrigation season, and set TMDL targets.**

    - Evaluate the suspended sediment load in the upper Yakima River during the irrigation season.
    - Evaluate contributions from major tributaries.
    - Set suspended sediment TMDL targets for the upper river basin during the irrigation season.
    - Evaluate the effect of the upper basin TMDL targets on the lower basin suspended sediment TMDL.

2. **Evaluate the major sources of suspended sediment loading from the Kittitas Valley entering the Yakima River via Wilson Creek.**

    - Coordinate with on-going data collection in the basin by the Kittitas Conservation District and the Kittitas Reclamation District.
    - Estimate suspended sediment transport from various land use types during the irrigation season.
    - Estimate suspended sediment transport from various land use types outside of the irrigation season through historic data analysis or, if resources allow, through continued field investigation.
    - Develop a suspended sediment TMDL for the major drainages and associated land uses in the Kittitas Valley.

3. **Evaluate fecal coliform (FC) bacteria in the Kittitas Valley.**

    - Evaluate FC 303(d) listings for Wilson Creek and Cooke Creek based on dominant land use.
    - Provide baseline FC data for other drainages in the Valley.

4. **Evaluate water column concentrations for pesticides in the Cherry Creek basin.**

    - Evaluate the 303(d) listing for DDT, DDE and dieldrin.
    - Evaluate the relationship between suspended sediment and pesticides, particularly DDT and metabolites (DDT+DDE+DDD) and dieldrin.
    - Screen for presence of previously identified pesticides.

Historical Data Assessment

Data collected by Ecology, United States Bureau of Reclamation (USBR), United States Geological Survey (USGS), Kittitas County Conservation District (KCCD), Kittitas Reclamation District (KRD), and others will be brought together, assessed for comparability, and collated. Seasonal TSS loading patterns in Kittitas Valley sub-basins and the upper Yakima River mainstem will be assessed, with emphasis on comparing irrigation season to winter storm and spring melt periods. The results of this assessment will determine whether or not subsequent data are collected during the non-irrigation season. The review will be completed by September 30, 1999 so that any necessary field work from December 1999 through March 2000 can be planned and budgeted.

The TSS and turbidity problems in the upper Yakima River basin may be distinctly different from the problems encountered in the lower basin in two primary ways:

1. The types of land uses and water routing operations in the upper basin may deliver the heaviest load of suspended sediment outside of the irrigation season.

2. The reduced reliance on mainstem Yakima River water for irrigation in the Kittitas Valley relative to the nearly total dependence on the mainstem river as the lower basin water supply may require multiple water quality control points.

These basic differences could mean the final TMDL framework in the upper Yakima River basin may be significantly different from that in the lower basin. A detailed historical data review will be conducted to ensure data are available to adequately address these differences.

Study Design

Monitoring Schedule

Sampling will occur every other week from April through mid-November 1999 for a total of 17 events (Table 1). The sampling dates were selected to characterize the irrigation season as well as to coincide with the sampling being performed by the KCCD (Olsen, 1999) and the KRD. The sampling season may extend into the non-irrigation season as discussed in the Historical Data Assessment section. Sampling dates during this season would be targeted to collection during rain events and run-off conditions.

Each water quality field survey will occur over a three-day period. The mainstem Yakima River and its tributaries will be sampled one day, the Kittitas Valley sites will be sampled on another day, with a third day spent measuring instantaneous flows at the Kittitas Valley sites.

Sampling Sites

Sampling sites are listed in Table 2 as well as graphically displayed in Figures 2 and 3. There are 19 sites for the Yakima River mainstem study area; 6 mainstem sites, and 13 sites on tributaries. The Kittitas Valley sampling area has 18 sites.

Sampling sites for the upper mainstem Yakima River were selected to characterize the upper river from north of Cle Elum south to Yakima; sites were limited to bridge crossings. The upper-most Yakima River site on I-90 at RM 191 will represent the upper boundary of the study area. This site is also one of Ecology's ambient water quality stations. The lower-most mainstem site at RM 121.7 is at the Harrison Road bridge crossing; it corresponds with the Lower Yakima River TMDLs upper boundary (Joy and Patterson, 1997). Tributaries to the Yakima River are being sampled as close to their confluence with the mainstem as possible.

Sites in the Kittitas Valley were selected to identify sediment loading to the Yakima River as well as to bracket loading from land use types. Sampling sites were located as high as possible in the Kittitas Valley to capture forestry impacts. Sites were also located above and below the towns of Ellensburg and Kittitas to capture the urban influence. Additionally, two sampling locations were selected which correspond with KCCD; these sites will be sampled by both the KCCD and the KRD to provide quality control checks.

Field and Laboratory Analyses

Standard Environmental Assessments Program field methods will be followed for the collection of water samples and measurement of instantaneous flow (Watershed Assessments Section, 1993). Protocols for pesticide samples will follow those described in Davis (1993). The above methods are the same as those used by Joy and Patterson (1997) for the lower Yakima River TMDL.

Table 1. Water quality (WQ) sampling schedule (X) for the upper Yakima Suspended Sediment TMDL

The schedule also includes the dates for flow monitoring in the Kittitas Valley.
FC = fecal coliform sampling; PES = organochlorine pesticide sampling.

Sampling Date	Upper Yakima River & Tributaries WQ	Kittitas Valley Tributaries	Kittitas Valley Flows	Sampling Date	Upper Yakima River & Tributaries WQ	Kittitas Valley Tributaries	Kittitas Valley Flows
12-Apr-99	X			9-Aug-99		X PES*	
13-Apr-99		X FC		10-Aug-99	X		
14-Apr-99			X	11-Aug-99			X
19-Apr-99		X		23-Aug-99	X		
20-Apr-99	X			24-Aug-99		X FC	
21-Apr-99			X PES	25-Aug-99			X
3-May-99	X			7-Sep-99	X		
4-May-99		X FC		8-Sep-99		X PES	
5-May-99			X	9-Sep-99			X
18-May-99	X			21-Sep-99	X		
19-May-99		X PES		22-Sep-99		X FC	
20-May-99			X	23-Sep-99			X
1-Jun-99	X			4-Oct-99		X PES*	
2-Jun-99		X FC		5-Oct-99	X		
3-Jun-99			X	6-Oct-99			X
14-Jun-99		X PES*		18-Oct-99	X		
15-Jun-99	X			19-Oct-99		X FC	
16-Jun-99			X	20-Oct-99			X
28-Jun-99		X FC		1-Nov-99			X
29-Jun-99	X			2-Nov-99	X		
30-Jun-99			X	3-Nov-99		X PES	
12-Jul-99	X			16-Nov-99	X		
13-Jul-99			X	17-Nov-99		X FC	
14-Jul-99		X PES		18-Nov-99			X
26-Jul-99	X						
27-Jul-99			X				
28-Jul-99		X FC					

* scheduled for the additional pesticide/herbicide screening

Standard protocols for the on-site continuous data loggers will follow those currently established by Ecology's Hydrology Unit. Standard Ecology protocols will be used for sample collection, preservation, and shipping to the Manchester Environmental Laboratory (MEL, 1994).

Parameters to be measured are listed in Tables 2 and 3. Measurements to be taken in the field consist of air and water temperature, conductivity, and stream discharge. Total suspended solids (TSS) and turbidity will be taken at all sites. Fecal coliform bacteria and chloride will be collected once a month at all Kittitas Valley sampling locations; chloride will be used as a conservative tracer. Select pesticides will be collected in the Cherry Creek basin particularly at Cherry Creek and Wipple Wasteway at their intersection with Moe Road. Additionally, total organic carbon (TOC) and dissolved organic carbon (DOC) will be sampled at the sites where pesticide samples are collected; DOC samples will be filtered in the field. Water samples will be placed on ice and stored in closed coolers immediately after sampling. Samples will be transported at the end of each day to arrive at the lab by the following morning.

Table 2. Proposed sampling locations for the Upper Yakima Suspended Sediment TMDL, April-99 through Nov-99.

Numbered notation in boxes represents number of sampling events per month. "1" represents sampling 1/month, "2" represents sampling every other week, "T3" means a total of three times over the study period.

Station name	Station location	Field ID	Lab #	USBR Gaging Station	Continuous flow gage	Staff gage	Tape down	Instantaneous flow **	Air temp (field)	Water temp (field)	Conductivity (field)	TSS	Turbidity	Fecal coliform (MF)	Chloride	DDT, DDE DDD, Dieldrin	TOC	DOC	Pesticide screen
UPPER YAKIMA TMDL																			
Yakima River above Cle Elum	from I-90 bridge	01-YKI	4001	calc*					2	2	2	2	2						
Yakima River at Thorpe bridge	bridge north of Thorpe	02-YKTH	4002	calc*					2	2	2	2	2						
Yakima River at KOA	bridge near Ellensburg KOA	03-YKKO	4003	X					2	2	2	2	2						
Yakima River at Irene Rinehart Park	bridge just below Irene Rinehart Park	04-YKIR	4004	calc*					2	2	2	2	2						
Yakima River at Umtanum Walkway	below mouth of Umtanum Creek	05-YKUM	4005	X					2	2	2	2	2						
Yakima River at Harrison Road Bridge	at Harrison Road Bridge	06-YKHA	4006	calc*					2	2	2	2	2						
Cle Elum River from I-90	Bullfrog Rd bridge	07-CLE	4007	X					2	2	2	2	2						
Crystal Creek at mouth	just upstream of road bridge	08-CRY	4008		X	X		X	2	2	2	2	2						
Teanaway River at Hwy 10	at Hwy 10 bridge	09-TEA	4009	X					2	2	2	2	2						
Swauk Creek above Hwy 10	upstream near old gaging station	10-SWA	4010		X	X		X	2	2	2	2	2						
Taneum Creek at KRD gage	below bridge	11-TAN	4011	X					2	2	2	2	2						
Packwood Ditch at Thorpe Hwy	culvert at mouth below spillway	12-PAC	4012		X	X		X	2	2	2	2	2						
Manastash Creek at Brown Rd	just downstream of bridge	13-MAN	4013		X	X		X	2	2	2	2	2						
Dry creek at Hwy 10	at Hwy 10 bridge	14-DRY	4014			X		X	2	2	2	2	2						
Reecer Creek in Irene Rinehart Park	below road bridge in Park	15-REE	4015				X	X	2	2	2	2	2						
Fogarty Ditch below River Bottom Rd	below confluence with creek	16-FOG	4016		X	X		X	2	2	2	2	2						
Wilson Creek at Canyon Road	at Canyon Road bridge	17-WIL	4017	X					2	2	2	2	2						
Umtanum Creek at walkway	upstream of the RR bridge	18-UMT	4018			X		X	2	2	2	2	2						
Wenas Creek via Buffalo Rd	near the old concrete dam	19-WEN	4019		X	X		X	2	2	2	2	2						
KITTITAS VALLEY TMDL																			
Town Ditch at Hannah Rd	at end of Hannah Rd	20-TWHN	4020				X	X	2	2	2	2	2	1	1				
Town Ditch at East 3rd	bridge in Grasslands development	21-TWE3	4021				X	X	2	2	2	2	2	1	1				
Wilson Creek at Sanders Rd	at Sanders Rd bridge	22-WLSN	4022				X	X	2	2	2	2	2	1	1				
Wilson Creek at Umtanum Rd	at Umtanum Rd bridge	23-WLUM	4023				X	X	2	2	2	2	2	1	1				
Wilson Creek behind the Comfort Inn	just off the freeway exit	24-WLCM	4024				X	X	2	2	2	2	2	1	1				
Wilson Creek at Thrall Rd	at Thrall Rd bridge	25-WLTH	4025	X					2	2	2	2	2	1	1				
Naneum Creek upper basin	Naneum Rd bridge	26-NN	4026				X	X	2	2	2	2	2	1	1				
Naneum Creek near Fiorito Ponds area	at the end of the access road	27-NNFR	4027		X	X		X	2	2	2	2	2	1	1				
Schnebly upper basin	above gate at end of Fairview Rd	28-SCH	4028				X	X	2	2	2	2	2	1	1				
Coleman Creek upper basin	first bridge on Coleman Canyon Rd	29-CL	4029				X	X	2	2	2	2	2	1	1				
Cooke Creek upper basin	first bridge at Cooke Creek Rd "T"	30-CK	4030				X	X	2	2	2	2	2	1	1				
Cooke Creek at No 81 Rd	at No 81 Rd bridge	31-CK81	4031				X	X	2	2	2	2	2	1	1				
Cooke Creek at Fairview Rd	at Fairview Rd bridge	32-CKFA	4032				X	X	2	2	2	2	2	1	1				
Caribou Creek upper basin	at Erickson Rd bridge	33-CR	4033				X	X	2	2	2	2	2	1	1				
Parke Creek upper basin	Parke Creek Rd at culvert	34-PR	4034				X	X	2	2	2	2	2	1	1				
Johnson Drain at So Ferguson Rd	at culvert on So Ferguson Rd	35-JNFR	4035				X	X	2	2	2	2	2	1	1				
Cherry Creek at Moe Rd	at Moe Rd bridge	36-CHMO	4036				X	X	2	2	2	2	2	1	1	1	1	1	T3
Wipple Wasteway at Moe Rd	at Moe Rd bridge	37-WPMO	4037				X	X	2	2	2	2	2	1	1	1	1	1	T3

* calculated from other gages or flow balance

** flows taken periodically to develop rating curve

Stream discharge information will be obtained at each sampling location to provide loading (concentration multiplied by flow) information for the irrigation season (Table 2). Data obtained from USBR gages will be used where available. Mainstem Yakima River tributaries considered to provide primary loading will have continuous data loggers and staff gages for measuring stage height. One site in the Kittitas Valley, at the mouth of Naneum Creek, was not easily accessible; therefore, it will also have a data logger. These data loggers will be installed and maintained by Ecology's Environmental Assessments Program's Stream Hydrology Unit. The remaining sites in the Kittitas Valley study area will have creek height reference points. Instantaneous flow measurements will be taken at intervals to cover the full range of seasonal flows. A combination of instantaneous flow and creek height reference point measurements will be used to develop flow rating curves.

Data Quality Objectives

Bias introduced in the field will be minimized and precision maintained through pre- and post-calibration of meters and adherence to sampling protocols. Precision limits for field replicate measurements and laboratory sample results are provided in Table 3. Based on data from previous data collection, it is expected that RPDs will fall below the 20% limit. At levels close to the detection limit the relative percent difference (RPD) becomes artificially high (e.g. replicate values of 1 and 2 mg/L yield a RPD of 67%) rendering RPDs greater than 50% acceptable; this may be particularly evident with the low level pesticide analyses. Additionally, due to the natural variability of bacteria in the environment it is difficult to quantify targets for precision, however, it is expected that the RPD will fall within 30% for samples greater than 100 colonies per 100 mL.

The sampling schedule and monitoring site locations are designed to optimize the representativeness of the data. Samples will be collected every other week during the irrigation season. Samples are also taken to characterize conditions a few weeks before and after the irrigation season. Samples on larger waterbodies will be collected using an integrated sampler to represent width and depth variations. Samples on smaller waterbodies will be taken in consistent well mixed locations.

As a result of detailed planning and personnel training, all sampling surveys are expected to be completed with usable high quality data. All sites are easily accessible. Alternate transportation arrangements are available to transport the samples to the lab if situations occur that prevent meeting the routine travel schedule.

Sampling protocols, quality assurance, and analytical methods are consistent with other work performed by Ecology's Environmental Assessment Program in the lower Yakima River basin.

Quality assurance checks between Ecology, the Kittitas County Conservation District and the Kittitas Reclamation District will occur throughout the sampling period. The quality assurance check samples are important to ensure data comparability between the entities. Data will be considered compatible if the quality assurance sample pair results are within the precision limits set for the Ecology replicate results.

Table 3. Summary of field and laboratory methods with precision and reporting limits.

Parameter	Method and Reference (1)	Precision Limit (RPD) (2)	Reporting Limit
Field Measurements			
Velocity	WAS, 1993 - Swoffer current meter	within 20%	0.05 feet/second
Conductivity	WAS, 1993 - Beckman bridge	+/- 20 umhos/cm @ 25 C	1 umhos/cm @ 25 C
Water Temperature	WAS, 1993 - Red liquid thermometer	+/- 0.2 C	0.1 C
Air Temperature	WAS, 1993 (mod.) - Red liquid thermometer	na*	0.1 C
Lab Measurements		**Lab and Field RPD** (2)	
Total Suspended Solids	EPA 160.2	20%	1 mg/L
Turbidity**	SM 2130	20%	1 NTU
Fecal Coliform bacteria	SM 16-909C - MF***	30%	1 cfu/100 mL ****
Chloride	EPA 300.0	20%	0.1 mg/L
Total Organic Carbon	EPA 415.1	20%	1 mg/L
Dissolved Organic Carbon	EPA 415.1 (field filtered)	20%	1 mg/L
DDT, DDE, DDD	EPA 8081 - low level	50%	0.00066 ug/L
Dieldrin	EPA 8081 - low level	50%	0.00066 ug/L
Organophosphorous Pesticides	EPA 8085 - screen	na	0.01 - 1.0 ug/L
Nitrogen Pesticides	EPA 8085 - screen	na	0.01 - 1.0 ug/L
Herbicides (Chlorophenoxy)	EPA 8085 - screen	na	0.01 - 1.0 ug/L

(1) Watershed Assessments Section, 1993
EPA: USEPA, 1983
SM: APHA, 1992

(2) RPD: relative percent difference from lab and field combined

* not applicable - no replicate samples taken

** ratio turbidimeter

*** MF: membrane filter

**** cfu: colony forming units

This page is purposely left blank

Quality Control Procedures

The basins will be sampled from upstream to downstream whenever possible. TSS and turbidity samples will be taken with Liquinox-cleaned and distilled-water-rinsed glass sampling equipment. The sample bottles will be rinsed between sites and cleaned between sampling weeks. TSS and turbidity samples will be depth and width integrated at three points on the cross-section of wider streams using a DH76 sampler; each aliquot will be completely mixed before splitting into the sample bottles. On smaller creeks, a single depth integrated grab will be taken directly with the laboratory cleaned sample bottles. Fecal coliform samples will be collected as a single grab directly into a sterile bottle. An independent sample will not be collected for chloride; an aliquot will be taken in the lab from the turbidity sample.

Pesticides will be collected in Type A laboratory cleaned 1-L glassware; the glassware will be cleaned by Eagle-Picher Environmental Services in Miami Oklahoma following the procedures described in Davis (1993). The samples will be collected using a wading rod and a priority pollutant–cleaned Teflon nozzle attached to the glass bottle. Samples are collected so that the sample water contacts only Teflon and glass. Samples will be depth and width integrated at three or more points on the cross-section. New sample bottles and decontaminated Teflon nozzles will be used at each site and for each sampling week. The Teflon nozzles will be decontaminated each sampling trip in the Ecology laboratory in Olympia using the following procedure:

1. Wash with laboratory detergent (Alconox).
2. Rinse several times with tap water.
3. Rinse with 10% HNO3 solution.
4. Rinse thoroughly with distilled-deionized.
5. Rinse with high purity acetone, then high purity hexane, followed by acetone.
6. Allow to dry and seal with aluminum foil.

Total variation for field sampling and analytical variation will be assessed by collecting replicate samples at 10 percent of the sites. Replicate sites will rotate throughout the season. Additionally, samples for a matrix spike and matrix spike duplicate will be collected whenever pesticide samples are collected. The conductivity meter will be pre- and post-calibrated in the field using a 100 umhos/cm calibration standard. Quality control procedures by the lab will follow standard operating procedures described in MEL (1994).

Standard laboratory procedures for analytical data reduction, review and reporting will be followed (MEL, 1994). Microbiologists and chemists will immediately inform the project manager of any problems with sample shipment conditions, holding times, or analyses. Data will be sent from MEL to the project manager by paper or electronic mail in standard file format. Lab and field analytical data will be matched with sample times and locations, and transferred to an Excel spreadsheet and into the Ecology's Environmental Information Management system database. Data will be screened for questionable values and problems.

Data Assessment Procedures

Variability of field replicates and lab duplicates will be quantified using relative percent difference (RPD). The relative magnitude of analytical and total field variability will be compared to describe relative contributions of variability from analytical methods and natural conditions.

A sediment mass balance for the upper Yakima River basin will be performed to evaluate the cumulative effects of existing tributary loads during the irrigation season. TMDL targets will be set for the primary loading sources and for compliance points in the mainstem of the Yakima River to protect beneficial uses. Data will also be assessed with regard to the TMDL now being implemented in the lower Yakima River basin.

Protection of water quality, fish habitat, and beneficial uses will be investigated through the use of water quality criteria and research literature. Turbidity values will be compared to State water quality criteria (Table 4). There are no U.S. Environmental Protection Agency (USEPA) or Washington State numeric water quality criteria for TSS. However, suspended sediment can be addressed through the State narrative criteria. Guidance documents and research literature will also be consulted that have classified aquatic habitat and organism impairment by TSS concentrations. Regression analysis will be performed to determine if there is a close association between TSS and turbidity as identified in the lower basin (Joy and Patterson, 1997).

The TSS, turbidity, and FC assessment in the Kittitas Valley will compare concentrations and loads between monitoring sites on streams and drains using data collected by Ecology, KCCD, and KRD. Attempts will be made to define loads by land use for TMDL target recommendations. Turbidity and FC concentrations will also be compared to State water quality criteria (Table 4). Regression analysis will be performed to determine if there is an association between TSS and turbidity in this basin.

Concentrations for t-DDT (DDT+DDE+DDD) and dieldrin will be compared with the aquatic life chronic criteria: 0.001 ug/L and 0.0019 ug/L respectively (Chapter 173-201A WAC). Concentrations will also be compared to the National Toxics Rule (40 CFR 131.36) human health criteria (Table 5). However, the detection limits for human health criteria are not presently attainable; therefore, compliance with the human health criteria cannot be determined for samples with no detected DDT or dieldrin concentrations. Regression analysis will be performed to determine if there is an association between TSS and pesticides.

Data from the pesticide screening in Cherry Creek and Wipple Wasteway will be compared to available criteria as well as to the data collected by Ecology in 1995. Davis et. al. (1998) detected the following 10 pesticides at the mouth of Cherry Creek: diazinon, disulfoton sulfone, 2,4-D, atrazine, bromacil, bromoxynil, Dacthal, dicamba, MCPA, MCPP. Results from this screening could lead to follow-up sampling by Ecology or local governments.

Table 4. Class AA (extraordinary) and Class A (excellent) fresh water quality standards and characteristic uses (Chapter 173-201A WAC).

All sample sites for this project are located in Class A waterbody segments except for the Cle Elum River and the upper most Yakima River site, river mile 191, which are Class AA.

	Class AA	Class A
General Characteristic:	Shall markedly and uniformly exceed the requirements for all, or substantially all uses.	Shall meet or exceed the requirements for all, or substantially all uses.
Characteristic Uses:	Shall include, but not be limited to, the following: domestic, industrial, and agricultural water supply; stock watering; salmonid and other fish migration, rearing, spawning, and harvesting; wildlife habitat; primary contact recreation, sport fishing, boating, and aesthetic enjoyment; and commerce and navigation.	Same as AA.
Water Quality Criteria:		
Fecal Coliform:	Shall not exceed a geometric mean value of 50 organisms/100 mL, with not more than 10% of samples exceeding 100 organisms/100 mL.	Shall not exceed a geometric mean value of 100 organisms/100 mL, with not more than 10% of samples exceeding 200 organisms/100 mL.
Dissolved Oxygen:	Shall exceed 9.5 mg/L.	Shall exceed 8.0 mg/L.
Total Dissolved Gas:	Shall not exceed 110% saturation.	Same as AA.
Temperature:	Shall not exceed 16.0°C due to human activities. When conditions exceed 16.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C. Increases from non-point sources shall not exceed 2.8°C.	Shall not exceed 18.0°C due to human activities. When conditions exceed 18.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C. Increases from non-point sources shall not exceed 2.8°C.
pH:	Shall be within the range of 6.5 to 8.5 with a man-caused variation with a range of less than 0.2 units	Shall be within the range of 6.5 to 8.5 with a man-caused variation with a range of less than 0.5 units.
Turbidity:	Shall not exceed 5 NTU over background turbidity when the background turbidity is 50 NTU or less, or have more than a 10% increase in turbidity when the background is more than 50 NTU.	Same as AA.
Toxic, Radioactive, or Deleterious Material:	Shall be below concentrations which have the potential singularly or cumulatively to adversely affect characteristic uses, cause acute or chronic conditions to the most sensitive aquatic biota, or adversely affect public health.	Same as AA.
Aesthetic Values:	Shall not be impaired by the presence of materials or their effects, excluding those of natural origin, which offend the senses of sight, smell, touch, or taste.	Same as AA.

Table 5. Human health criteria for pesticides.

Criteria are based on fish consumption.

Pesticide	Human Health Criteria (1)
4,4'-DDT	0.00059 ug/L
4,4'-DDE	0.00059 ug/L
4,4'-DDD	0.00083 ug/L
dieldrin	0.00014 ug/L

(1) National Toxics Rule (40 CFR 131.36).

Schedule, Laboratory Budget, and Project Organization

Schedule

The schedule is based on the following milestones (dates in parentheses are appropriate if historical data analyses initiate the need for storm event sampling):

Water Quality Surveys	April-Nov 1999	(Dec 1999-Mar 2000)
Historical Data Assessment	September 30, 1999	
Laboratory Analyses Complete	January 31, 2000	(May 31, 2000)
Data Analysis & Stakeholder		
Advisory Consultation	July 31, 2000	(Dec 31, 2000)
Draft Final Report	January 31, 2001	(June 30, 2001)
Final Report	April 28, 2001	(Sept 30, 2001)

Laboratory Budget

The estimated lab budgets for FY99 (through June 1999) and FY00 (July 1, 1999 through June 30, 2000) are $14,173 and $20,883, respectively. The break-out figures are presented in Tables 6 and 7. A budget will be estimated for non-irrigation storm-event sampling if the historical data analyses conclude additional sampling is necessary.

Table 6. Estimated laboratory budget for FY99 (through June 30, 1999) for the Upper Yakima TMDL Evaluations.

FY99 Field Samples	Lab Analysis	Samples	QA	# of Events	Total Samples	Cost per Sample	Cost Sub-totals
QA Check with KCD							
	TSS	2	2	1	4	10	40
	Turbidity	2	2	1	4	7	28
	FC	2	2	1	4	20	80
Yakima River Mainstem and Tributaries							
	TSS	24	2	7	182	10	1820
	Turbidity	24	2	7	182	7	1274
Kittitas Valley Complex							
	TSS	24	2	7	182	10	1820
	Turbidity	24	2	7	182	7	1274
	FC	24	2	4	104	20	2080
	Chloride	24	2	4	104	12	1248
							9664
Pesticide Component in the Kittitas Valley							
	DDT, DDD, DDE, Dieldrin	2	3	3	15	159	2385
	Organophosphorous	2		1	2	184	368
	Nitrogen	2		1	2	184	368
	Chlorophenoxy	2		1	2	184	368
Assoc. chem	TSS	2	3	3	15	29	435
	TOC	2	3	3	15	10	150
	DOC	2	3	3	15	29	435
							4509
						TOTAL FY99	**14173**

Table 7. Estimated laboratory budget for FY00 (July 1, 1999 to June 30, 2000) for the Upper Yakima TMDL Evaluations.

FY00 Field Samples	Lab Analysis	Samples	QA	# of Events	Total Samples	Cost per Sample	Cost Sub-totals
Yakima River Mainstem and Tributaries							
	TSS	24	2	10	260	10	2600
	Turbidity	24	2	10	260	7	1820
Kittitas Valley Complex							
	TSS	24	2	10	260	10	2600
	Turbidity	24	2	10	260	7	1820
	FC	24	2	5	130	20	2600
	Chloride	24	2	5	130	12	1560
							13000
Pesticide/Herbicide Component in the Kittitas Valley							
	DDT, DDE, DDE, Dieldrin	2	3	5	25	159	3975
	Organophosphorous	2		2	4	184	736
	Nitrogen	2		2	4	184	736
	Chlorophenoxy	2		2	4	184	736
	TSS	2	3	5	25	29	725
	TOC	2	3	5	25	10	250
	DOC	2	3	5	25	29	725
							7883
						TOTAL FY00	**20883**

Project Organization

The roles and responsibilities of staff involved in this project are provided below:

Joe Joy: Project manager, Environmental Assessment Program, Watershed Ecology Section. Responsible for overall project management. Defines project objectives, scope, and study design. Responsible for review of the project QAPP and final report. Provides initial quality control review for field techniques with the KCCD and KRD. Reviews historical data and determines whether continued monitoring is warranted beyond the irrigation season to characterize the wet season. Responsible for primary contact with the client and stakeholders.

Betsy Dickes: Principle Investigator, Environmental Assessment Program, Watershed Ecology Section. Assists in defining project objectives, scope, and study design. Responsible for writing the quality assurance project plan (QAPP), data collection, data quality review and analysis, and report writing. Responsible for technical coordination with the KCCD and KRD.

Chris Coffin: Client Staff Contact, Water Quality Program, Central Regional Office (CRO). Reviews and comments on QAPP and reports. Coordinates local outreach and information exchange about the TMDL. Acts as local contact for technical information exchange with project team. Acts as coordinator and contact for local monitoring efforts and subsequent data to be used for a TMDL.

Art Larson and Chris Evans: Environmental Assessment Program, Environmental Monitoring and Trends Section, Stream Hydrology Unit. Responsible for the deployment and maintenance of continuous flow loggers and staff gages on mainstem tributaries and Naneum Creek. Responsible for producing records of hourly flow data at select sites for the study period.

Stephanie Brock: Environmental Assessment Program, Watershed Ecology Section. Provides field assistance as well as filling in as field lead when necessary. Provides data management and analytical support.

John Summers: Environmental Assessment Program, Watershed Ecology Section. Provides field assistance as well as filling in as field lead when necessary.

Ryan Anderson: CRO, Water Quality Program. Provides field assistance as needed.

Bob Barwin: Water Quality Program Section Supervisor, CRO. Reviews and comments on QAPP and reports.

Max Linden: CRO Water Quality Program Nonpoint Issues Staff. Technical advisor: reviews the QAPP and reports, provides technical information on local agriculture and enforcement issues.

Will Kendra: Environmental Assessment Program. Section supervisor of the Watershed Ecology Section. Responsible for approval of the project QAPP and final report.

Karol Erickson: Environmental Assessment Program**.** Unit supervisor of the Watershed Studies Unit. Responsible for review of the project QAPP and final report.
Cliff Kirchmer: Environmental Assessment Program, Quality Assurance Unit. Responsible for review of QAPP.

Stewart Magoon: Ecology Manchester Laboratory Director. Environmental Assessment Program. Provides laboratory staff and resources, sample processing, analytical results, laboratory contract services, and QA/QC data. Reviews sections of the QAPP relating to laboratory analysis.

Anna Olsen: Kittitas County Conservation District (KCCD). Coordinates with Ecology for data quality and sample collection. Ecology and KCCD will coordinate efforts for data sharing.

Roger Satnik: Kittitas Reclamation District (KRD). Provides critical link for local information exchange and site selection. Coordinates with Ecology for data quality and sample collection. Ecology and KRD will coordinate efforts for data sharing.

References

APHA, 1992. Standard Methods for the Examination of Water and Wastewater. American Public Health Association. 18th ed., Washington, DC.

Davis, D., 1993. Washington State Pesticide Monitoring Program – Reconnaissance sampling of Surface Waters (1992). Washington State Department of Ecology, Environmental Investigations and Laboratory Services Program, Olympia, Washington.

Davis, D., A. Johnson, and D. Serdar, 1998. Washington State Pesticide Monitoring Program; 1995 Surface Water Sampling Report. Washington State Department of Ecology, Environmental Investigations and Laboratory Services Program, Olympia, Washington. Publication No. 98-300.

Joy, Joe and Barbara Patterson, 1997. A Suspended Sediment and DDT Total Maximum Daily Load Evaluation Report for the Yakima River. Washington State Department of Ecology, Environmental Investigations and Laboratory Services Program, Olympia, Washington. Publication No. 97-321.

Manchester Environmental Laboratory (MEL), 1994. Manchester Environmental Laboratory, Lab Users Manual. Washington State Department of Ecology, Environmental Investigations and Laboratory Services, Manchester Environmental Laboratory, Port Orchard, Washington.

Olsen, Anna, 1999. Kittitas Valley Water Quality and Water Conservation Project, Monitoring Plan. Department of Ecology Grant #9700126. Kittitas County Conservation District, Ellensburg, Washington.

U.S. EPA, 1983. Methods for Chemical Analysis of Water and Wastes. U.S. Environmental Protection Agency, EPA-600/4-79-020. United States Environmental Protection Agency Laboratory, Cincinnati, Ohio.

Watershed Assessments Section (WAS), 1993. Field Sampling and Measurement Protocols for the Watershed Assessments Section. Washington State Department of Ecology, Olympia, Washington.