The Hangman (Latah) Creek Water Sampling Data Summary

March 2005

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The Hangman (Latah) Creek Watershed Planning Unit
WRIA 56

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DEDICATION

The Spokane County Conservation District would like to dedicate this report to a longtime friend from Ecology who recently passed away, Nancy Weller. Nancy always maintained a close working relationship with not only the conservation district, but with anyone who had an interest in improving water quality. Her dedication to the waters of the State of Washington will be missed.

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EXECUTIVE SUMMARY

The Department of Ecology (DOE) has identified the Hangman Creek watershed (also known as the Latah Creek watershed) as a water body with quality and quantity issues. Past and current land uses within the watershed are varied, and contribute to the problem. Issues such as, stormwater runoff, sedimentation, stream bank erosion, water rights, instream flows, spawning habitat (cold water fisheries), urban development, wetland destruction, and agricultural and forestry practices are all major concerns for the area.

The Planning Unit has chosen to address water quality in the Hangman Creek watershed. The basin's growth and land uses have led to environmental stresses that have reduced water quality over the years. The Department of Ecology (Ecology) has identified the Hangman Creek watershed as a water body with quality and quantity issues. Past water quality studies have shown that state standards for fecal coliform, temperature, pH, and dissolved oxygen are often exceeded (SCCD 1994, 1999, 2000; WDOE, 1998). Past and current land uses within the watershed are varied, and contribute to the problem. Issues such as, stormwater runoff, sedimentation, stream bank erosion, water rights, instream flows, spawning habitat (cold water fisheries), urban development, wetland destruction, and agricultural and forestry practices are all major concerns for the area. Hangman Creek was identified on the 2002/2004 303(d) list for not achieving State water quality standards for fecal coliform, dissolved oxygen, turbidity, ammonia, pH, and temperature. Recent monitoring has identified several other water quality problems not acknowledged by the 303(d) list (sediment load, low flows, and total phosphorus). This project was to further characterize the extent and severity of these water quality problems within the basin for the development of a TMDL clean-up plan.

For the water quality sampling plan, 19 sites were selected. There were 11 sites on the mainstem of Hangman Creek and eight sites located on five tributaries. The sites were sampled for eight routine monthly samples and for three event samples. Two of the event samples were high flow events, 4,000 cubic feet per second (cfs), and the third event was a summer rainfall event. The summer rainfall event was only sampled for fecal coliform bacteria. Along with the stream sampling, total phosphorus samples were taken from the outfall of the Tekoa, Fairfield, and Rockford wastewater treatment facilities.

As would be expected, the high flow events generally had the highest turbidity, total suspended sediment, fecal coliform, and total phosphorus levels. Nitrates were also generally elevated during the high flow events.

For the August event sampling, the results suggest that summer events are significant inputs for fecal bacteria. Of the 17 sites sampled for fecal in August, 14 had fecal counts greater that 200 colonies per 100 ml. Ten of the 17 sites had the highest fecal count for the study. Although the total loading was lower (stream flows generally remain low compared to the average annual flow), the state limits were exceeded at most sites during the summer event sampling.
For the 19 sites sampled:

- Thirteen sites had more than 10 percent of the samples with fecal coliform counts greater than 200 colonies per 100 ml.
- Two had nitrate levels that exceeded the EPA recommended guideline of 10 mg/l.
- Eleven had total phosphorus greater than the EPA recommended guideline of 0.10 mg/l.
- Nine had pH values that either exceeded 8.5 units or were less than 6.5 units.
- Five had dissolved oxygen values less than the state limit of 8 mg/l.
- Seven had water temperatures greater than the state limit of 18 °C.

1.0 INTRODUCTION AND BACKGROUND

Hangman Creek (also known as Latah Creek) is a trans-boundary watershed that begins in the foothills of the rocky mountains of northern Idaho and spans across the southeastern portion of Spokane County, Washington (Figure 1). It encompasses over 689 square miles (approximately 430,000 acres). The watershed is dominated by dryland farming, but, like other eastern Washington watersheds, is experiencing increases in urbanization and changes in land use practices. The land use changes have caused increasing pressure for water development and have prompted the need for the protection and management of stream flows, water quality, and related aquatic and riparian habitat.

Agriculture has been the dominant land use in the Hangman Creek watershed since the early 1900s. By the early 1920s, a significant portion of the farmable land had been cleared and cultivated for the production of wheat, barley, peas, and lentils. Thousands of acres of forest and riparian areas were cut and cleared. Miles of stream channel were straightened and new ditches were dug to quickly move water off the farm fields. These modifications, along with stream meander cutoff by roads, changed the watershed's hydrological response. The system became stressed with heavy sediment loading, poor water quality, and accelerated stream bank erosion. The altered hydrology produces flashy, and sometimes damaging stream flows during the winter and spring months (peak flows greater than 20,000 cfs). During the summer months, the base flow decreases significantly throughout a majority of the watershed (daily average flows of less than one cfs have been recorded on numerous days). As a result of the streamside modifications and upland land uses, Washington State water quality standards for temperature, dissolved oxygen, pH, and fecal coliform are routinely violated.

Beginning in the early 1970s, efforts were made to manage and improve land use and water quality in the basin. The Soil Conservation Service (currently the Natural Resources Conservation Service), the local conservation districts, private landowners, and producers have implemented Best Management Practices (BMPs), conservation tillage operations, and rehabilitated riparian areas. A management plan was developed in the early 1990's to provide a better understanding of the water quality concerns of the watershed. To evaluate the water quality of the watershed, several monitoring/research studies were conducted to provide baseline information.

The Department of Ecology (Ecology) has identified the Hangman Creek watershed as a water body with quality and quantity issues. Past water quality studies have shown that state standards for fecal coliform, temperature, pH, and dissolved oxygen are often exceeded (SCCD 1994, 1999, 2000; WDOE, 1998). Past and current land uses within the watershed are varied, and contribute to the problem. Issues such as, stormwater runoff, sedimentation, stream bank erosion, water rights, instream flows, spawning habitat (cold water fisheries), urban development, wetland destruction, and agricultural and forestry practices are all major concerns for the area.

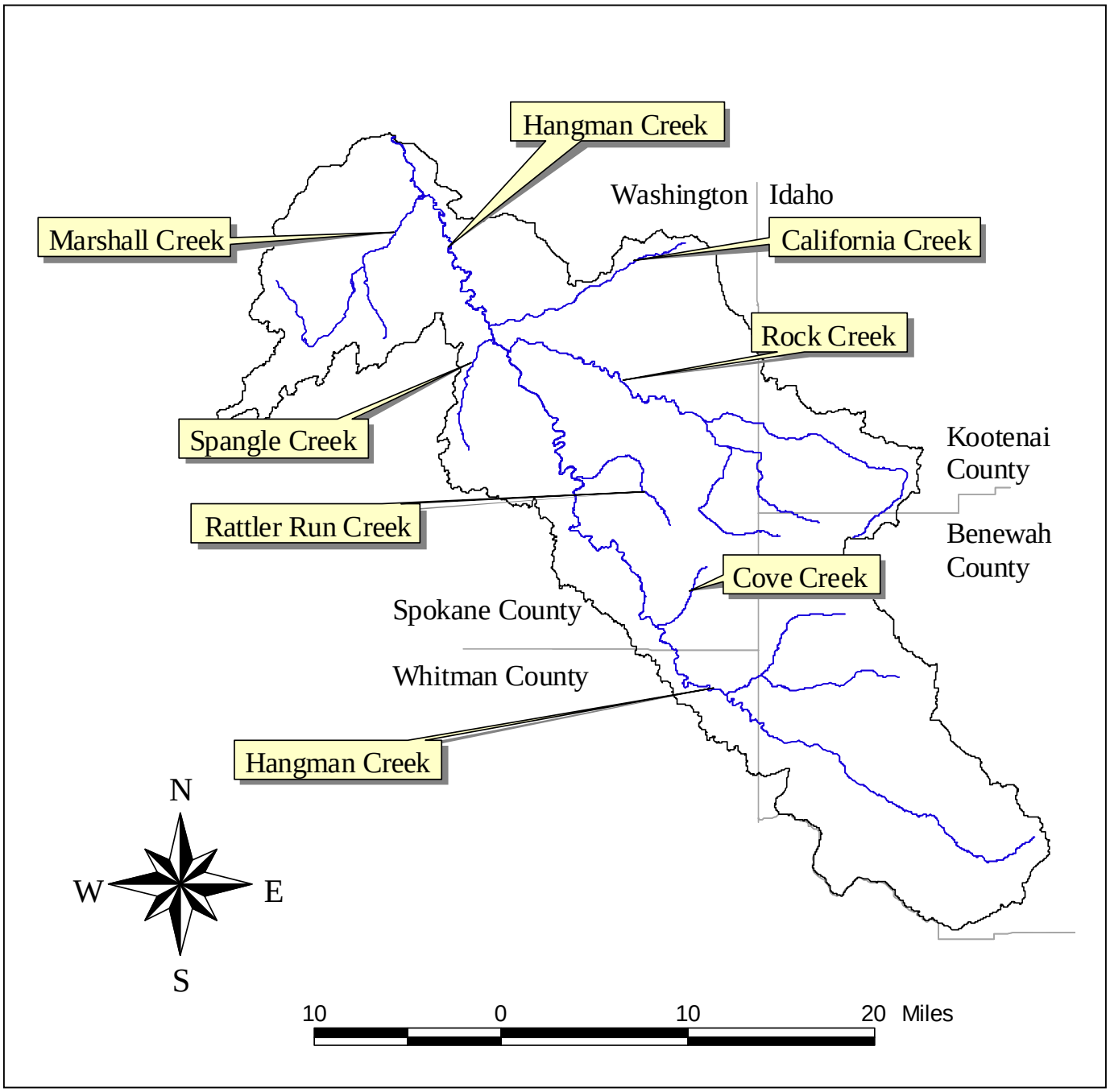


Figure 1: Location Map

A watershed-planning unit (Planning Unit) for Hangman Creek (WRIA 56) was initiated in late 1999 to evaluate and plan for water quantity management. The Planning Unit has representation by the City of Spokane, Spokane County, Whitman County, Hangman Hills Water District, Fairfield Triangle Grange, the Department of Ecology (State Caucus), and several residents. The Planning Unit chose to assess water quality in the Hangman Creek Watershed as part of the HB2514 management plan. The water quality assessment was in conjunction with the total maximum daily load (TMDL) water quality plan development.

Hangman Creek was identified on the Ecology 2002/2004 303(d) list for not achieving State water quality standards for fecal coliform, dissolved oxygen, turbidity, ammonia pH, and temperature. Recent monitoring has identified several other water quality problems not acknowledged by the 303(d) list (sediment load, low flows, and total phosphorus). This project was to further characterize the extent and severity of these water quality problems within the basin for the development of a TMDL clean-up plan.

This data report provides the results of monthly and event water quality sampling on Hangman Creek and its associated tributaries (Table 1). Monthly routine and high flow event samples were collected at 19 sites (Figure 2). Ten supplemental sites were sampled at various times (Table 2). These sites were sampled to provide water quality information on site-specific flow events at selected sample sites (Figure 3).

Discharge measurements were generally made at the time the samples were collected, although indirect estimations of discharge (normal depth calculation using Manning's equation) were completed for some high flow events. Field samples were delivered to the Spokane Tribal Laboratory for analysis.

1.1 Sampling Procedures

Fecal samples were collected as grab samples following the procedure outlined in the Ecology approved QAPP (Appendix A). Fecal coliform samples were placed in autoclaved sample bottles. Nutrients were analyzed from the suspended sediment sample (this provides a channel and vertically integrated sample – see below). For grab samples, the bottle was uncapped underwater, inverted, and submerged to a depth near the streambed without making contact. Sample bottles were kept away from the streambed to prevent the collection of debris and bed load from the stream bottom. The bottle was turned upright and raised through the water column at a rate that allowed the container to be filled just before it reached the water surface. The full bottle was then capped under water without retaining any air. Samples were stored in an ice chest. Samples were delivered to the Spokane Tribal Laboratory within 24 hours.

For nutrients and sediment sampling, the USGS equal width increment (EWI) sample method was used when possible. If the EWI method was not possible because of stream conditions, standard grab-samples were collected (see Appendix A). The EWI samples were taken according to U.S. Geological Survey (USGS) techniques in *Field Methods for Measurement of Fluvial Sediment* (Edwards T. K. and Glysson G. D., 1988). Samples

obtained by the EWI method produce a sample volume proportional to the amount of flow at each of the equally spaced verticals in a cross section. This equal spacing between the verticals yields a gross sample volume proportional to the total streamflow. For streams over five feet wide, a minimum of 10 verticals was used. For streams less than five feet wide, as many verticals as possible were used and spaced at a minimum of 0.25 feet.

Table 1: Routine Sample Sites

Site Name	**Site Location (Section, Township, Range)**	**Site Number on Figure 2**
Hangman Creek at the Stateline	Section 30, T20N, R46E	1
Hangman Creek at Fairbanks Road	Section 9, T20N, R45E	2
Hangman Creek at Marsh Road	Section 30, T21N, R45E	3
Hangman Creek at Spring Valley Road	Section 30, T21N, R45E	4
Hangman Creek at Chapman Road	Section 30, T21N, R45E	5
Hangman Creek at Roberts Road	Section 1, T21N, R44E	6
Hangman Creek at River Mile 21.0	Section 13, T23N, R43E	7
Hangman Creek at Duncan	Section 11, T23N, R43E	8
Hangman Creek upstream of Hangman Valley Golf Course	Section 28, T24N, R43E	9
Hangman Creek downstream of Hangman Valley Golf Course	Section 28, T24N, R43E	10
Hangman Creek at the USGS gage	Section 24, T25N, R42E	11
Cove Creek	Section 30, T21N, R45E	12
Rock Creek at Rockford	Section 33, T23N, R45E	13
Rock Creek at the mouth	Section 12, T23N, R43E	14
California Creek near Marsh Road	Section 18, T24N, R45E	15
California Creek at the mouth	Section 2, T23N, R43E	16
Spangle Creek at the mouth	Section 11, T23N, R43E	17
Marshall Creek at McKenzie Road	Section 22, T24N, R42E	18
Marshall Creek at the mouth	Section 6, T24N, R43E	19

Notes:
1. All sites were sampled monthly except Hangman Creek at Fairbanks Road, Marsh Road, Spring Valley Road, and Chapman Road.
2. The sites at Fairbanks Road, Marsh Road, Spring Valley Road, and Chapman Road were added to evaluate potential fecal influence from the Town of Latah and from local livestock.
3. Two high flow events were sampled on January 30, 2004 and February 19, 2004. Both events peaked at 4,020 cfs (provisional data) as measured at the USGS station.

EWI samples were obtained using US Geological Survey standard depth-integrated samplers. The samplers used pint or quart glass bottles for sample collection. Sample bottles were rinsed three times with deionized water.

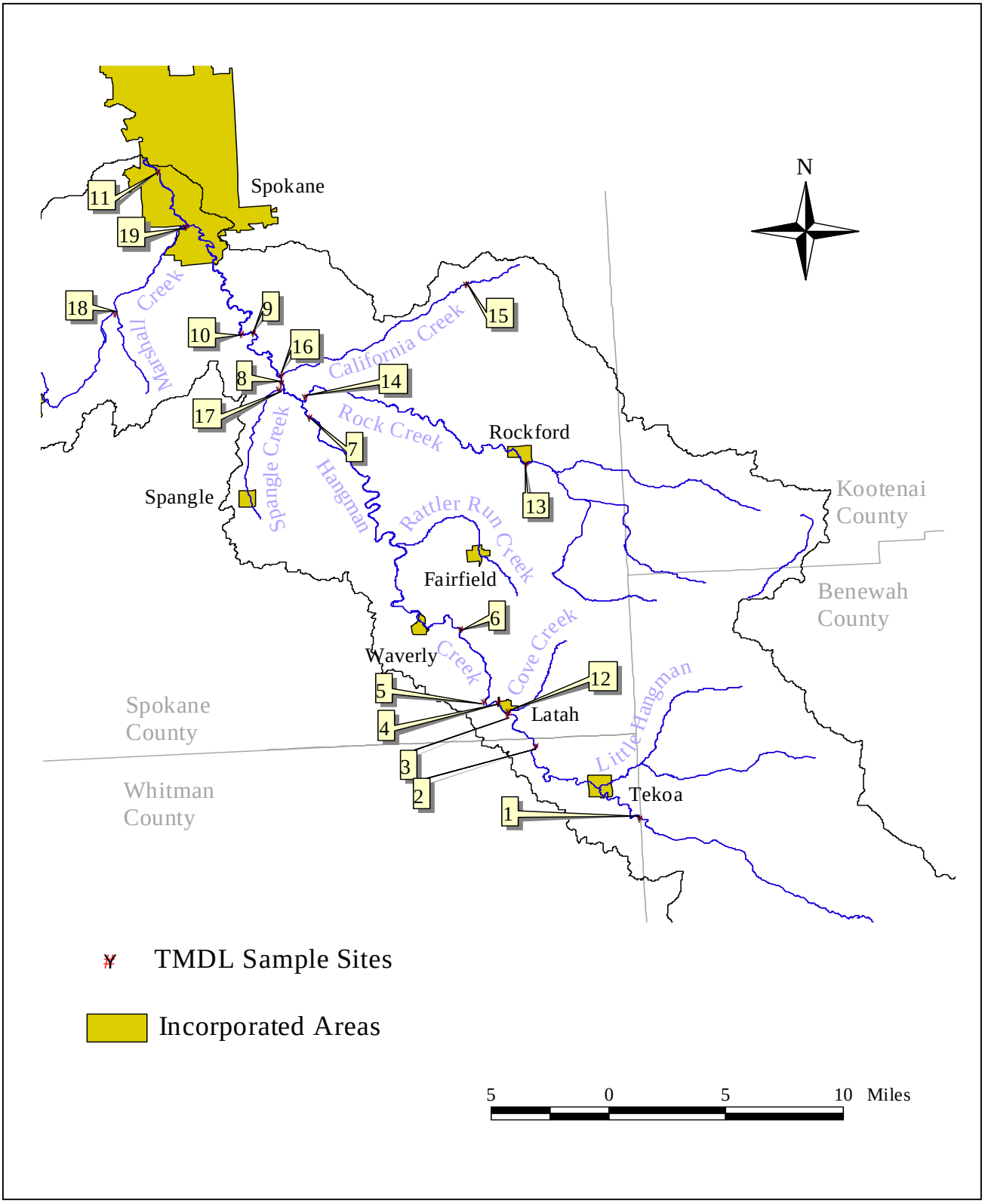


Figure 2: Routine Sample Sites

Discharge measurements were completed following standard USGS procedures outlined in *Rantz and others, 1982*. During high flow events when there was not enough time to complete a discharge measurement at each site, some site discharges were estimated using normal depth calculations. The sample sites were setup and surveyed to measure cross-section area, water surface elevation, and water surface slope through the cross-section. Several discharge measurements were completed during non-event times to back calculate the roughness coefficient (Manning's *n* value) for use in the normal depth calculations (Henderson, 1966).

Table 2: Selected Sample Sites

Sample Location	**Site Location (Section, Township, Range)**	**Site Number on Figure 3**	**Sample Months**
Hangman Creek at North Kentuck Trail	Sec. 17 T22N, R44E	20	Jan. 2004 event
Hangman Creek at Keevy Road	Sec. 8 T22N, R44E	21	Dec. 2003, Jan. 2004, Jan 2004 event, Feb. 2004, Mar. 2004
Stevens Creek at the mouth	Sec. 28 T24N, R43E	22	Feb. 2004, Mar. 2004
Ditch above Madison Road near Valleyford	Sec. 33 T24N, R44E	23	Jan. 2004 event
Ditch below Madison Road near Valleyford	Sec. 33 T24N, R44E	24	Jan. 2004 event
Hangman Creek upstream of Hangman Hills Treatment plant	Sec. 28 T24N, R43E	25	Feb. 2004 event
Hangman Creek downstream of Hangman Hills Treatment plant	Sec. 28 T24N, R43E	26	Feb. 2004 event
Cold Spring near 21st and Inland Empire Way - upper	Sec. 25 T25N, R42E	27	Feb. 2004, Mar. 2004
Cold Spring near 21st and Inland Empire Way - middle	Sec. 25 T25N, R42E	28	Mar. 2004
Cold Spring near 21st and Inland Empire Way - lower	Sec. 25 T25N, R42E	29	Feb. 2004, Mar. 2004

Notes:

1. Hangman Creek was sampled upstream and downstream of the Hangman Hills treatment plant to evaluate potential fecal and nutrient contributions.
2. The Cold Spring sites were sampled to evaluate the water quality of a significant spring to the Hangman Creek mainstem.
3. Stevens Creek was sampled when there was flow in the creek.
4. Hangman Creek at Keevy Road was the upstream sample point to evaluate potential livestock influence. The site was changed to evaluate a smaller area for influence.
5. The Madison Road sites were sampled to evaluate runoff from a disturbed area where sediment-laden water was flowing below the road.

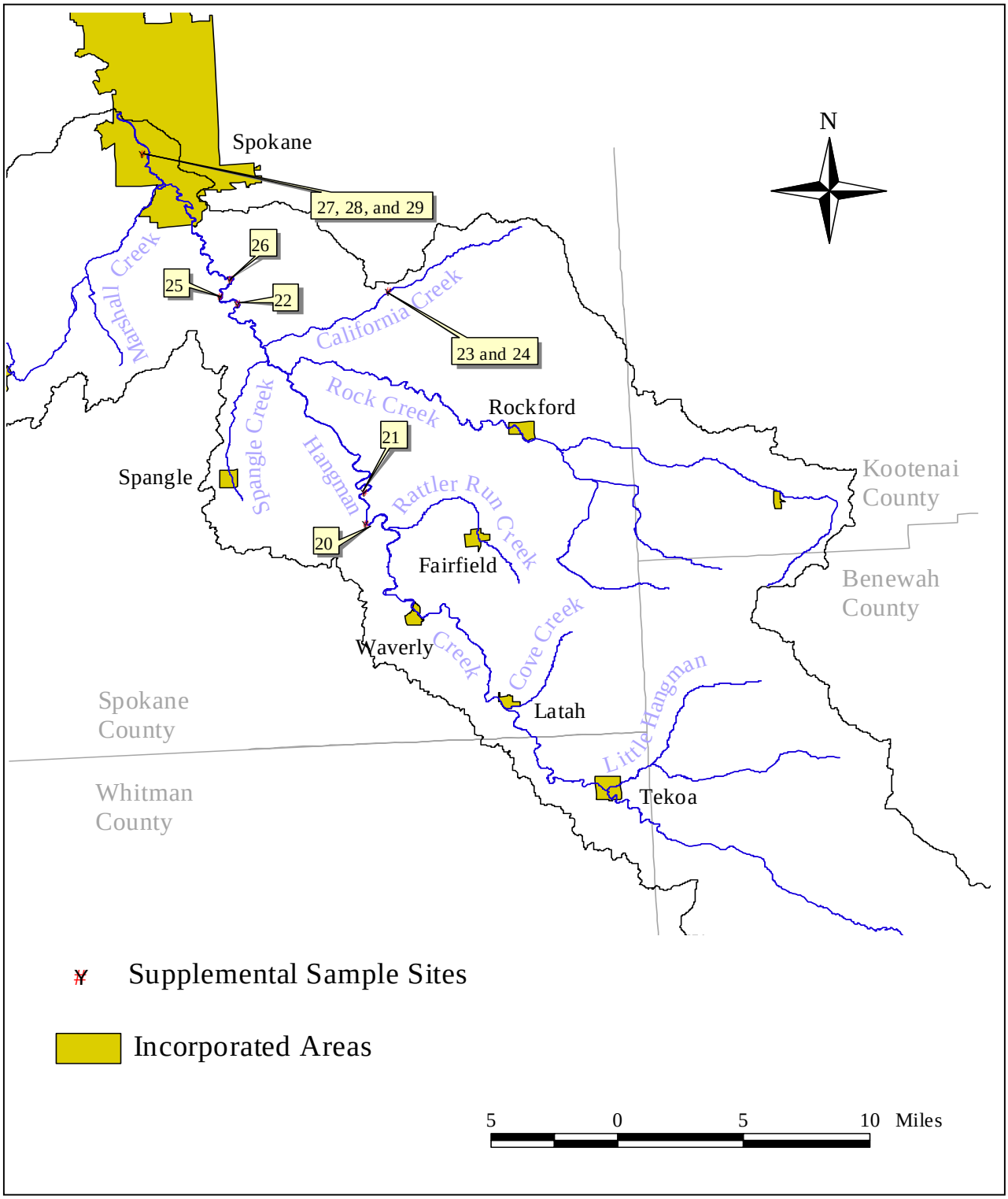


Figure 3: Selected Sample Sites

1.2 Field Activity Documentation

All fieldwork activities were documented using field water quality monitoring sheets. Field data that were recorded are listed below:

- date of sample collection
- time of sample collection
- location of sample collection
- instrument calibration checks
- notes regarding sample collection, instrument operation, water stage conditions, and weather conditions

The field water quality monitoring sheets were completed by the field team leader and provided to the project coordinator. The project coordinator checked the field sheets for completeness and consistency and recorded the data in the project database.

1.3 Sample Handling

Water samples were placed into containers prepared by the laboratory. Samples were placed inside a pre-chilled cooler immediately upon collection. Samples were transferred to the laboratory or to the project coordinator at the end of each day. Chain-of-custody sheets were filled out by each sample team leader upon delivery of samples to the Spokane Tribal Laboratory. The project coordinator was responsible for sample security, handling, and shipping.

<u>Replicate Samples</u>

Replicate samples are a set of environmental samples collected in a manner such that the samples are thought to be essentially identical in composition. Several types of replicate samples are possible, but concurrent replicate samples were predominantly collected. Concurrent samples are samples collected simultaneously, or by alternating subsamples between two or more collection bottles. In some cases, sequential samples were collected. Sequential samples are a replicate sample in which the samples are collected one after the other, typically over a short period of time. Replicate samples were collected and analyzed to establish the amount of variability in the data contributed by some portion of the collection and analytical process.

2.0 RESULTS

Hangman Creek is listed as a Class A waterway in the Washington Administrative Code (WAC) Chapter 173-201A. Class A waters are presumed to meet or exceed requirements for water supply, fish migration and propagation, and primary contact recreation. Numeric WAC criteria have not been set for nitrate-nitrogen (NO_3), nitrite-nitrogen (NO_2), ammonia-nitrogen (NH_3) and total phosphorus (Table 3). The Environmental Protection Agency (EPA) has developed recommended standards for these nutrients to protect designated uses. Parameter exceedances are summarized in Table 4.

Table 3: Washington Class A and EPA Water Quality Standards

Parameter	**Washington Class A Waters**	**USEPA**
Temperature (°C)	≤ 18	NA
Dissolved Oxygen (mg/l)	>8.0	>5.0
Fecal Coliform (geometric mean of all samples is less than the stated number of colonies/100ml)	100	200
(less than 10 % of the samples exceed the stated number of colonies/100ml)	200	400
pH (units)	6.5-8.5	NA
Turbidity Background <50 NTU Turbidity Background >50 NTU	< 5 NTU increase < 10 % increase	Less than 10 % reduction in depth of photosynthetic zone 1.45 NTU
Total Phosphorus (mg/l)	NA	0.030
Nitrate + Nitrite (mg/l)	NA	0.072
Nitrite (mg/l)	NA	0.06 or 1, see Notes
Ammonia (mg/l)	Varies with Temperature and pH	Varies with Temperature and pH

Notes:
1. NA is not applicable.
2. NTU is Nephelometric Turbidity Units.
3. The USEPA criteria for dissolved oxygen, turbidity, and the lower nitrite standard are the recommended limits for cold-water fisheries (1976 Criteria).
4. The USEPA criterion for fecal coliform is the recommended limit for swimming and bathing (1976 Criteria).
5. The USEPA criterion for total phosphorus is the recommended limit to prevent eutrophication.
6. Ecoregion 10 reference conditions for turbidity, total phosphorus and nitrate + Nitrite are based on the 25th percentile for all seasons (USEPA, 2000).
7. The USEPA upper nitrite criteria and nitrate criteria are the recommended limits for drinking water.
8. Ammonia limits vary with temperature and pH, see Appendix A for details.

Table 4: Summary of Exceedances

Site Location	Number of Samples	Turbidity (NTU)		Fecal Coliform >200 col/100 ml (Percent)	Number of Exceedances				
		(>5 <50)	(>50)		Nitrate (>10 mg/l)	Total Phosphorus (>0.10 mg/l)	pH Units (<6.5 or >8.5)	Dissolved Oxygen (<8 mg/l)	Temperature (>18 °C)
HC at Stateline	11	8	2	27	0	2	1	3	1
Cove Creek	11	8	0	45	0	6	2	3	1
HC at Roberts Road	11	6	2	18	0	4	1	4	2
RC at Rockford	11	3	1	27	4	3	2	0	1
RC at the mouth	11	3	1	27	4	3	3	0	2
HC at RM-21.0	11	4	2	27	0	3	2	0	2
HC at Duncan	11	4	2	9	0	3	4	2	4
CC near Marsh Rd	11	5	0	18	0	0	1	0	0
CC at the mouth	11	3	1	9	0	2	0	0	0
SC at the mouth	7	0	2	14	0	6	3	0	0
MC at McKenzie Rd	11	3	0	9	0	6	0	2	0
MC at the mouth	11	0	0	9	0	1	0	0	0
HC at USGS gage	11	NS	NS	18	0	NS	NM	NM	NM
HC at Fairbanks Rd	7	NS	NS	29	0	NS	NM	NM	NM
HC at Marsh Road	7	NS	NS	14	0	NS	NM	NM	NM
HC at Spring Valley Rd	7	NS	NS	29	0	NS	NM	NM	NM
HC at Chapman Rd	7	NS	NS	14	0	NS	NM	NM	NM
HC u/s of Golf Course	6	NS	NS	NS	0	0	NM	NM	NM
HC d/s Golf Course	6	NS	NS	NS	0	0	NM	NM	NM

Notes:

1. Nitrate and total phosphorus limits are for determining exceedances only. These limits are not state numeric water quality standards.
2. NTU is Nephelometric Turbidity Units.
3. mg/l is milligrams per liter.
4. HC is Hangman Creek.
5. RC is Rock Creek.
6. CC is California Creek.
7. SC is Spangle Creek.
8. u/s is upstream, d/s is downstream.
9. NS is not sampled.
10. NM is not measured.

Land use varied through out the watershed from predominantly forested uplands to urban conditions through Spokane. Dryland agriculture was the dominant land use throughout the watershed, with livestock use dominating in some areas. The Tekoa, Fairfield, and Rockford wastewater treatment facilities discharged to Hangman Creek, Rattler Run, and Rock Creek, respectively.

Eight monthly routine samples were collected at the identified sites. Three event samples were collected during two high flow events and after a significant summer rain. Discharge measurements were routinely made along with the water quality sampling except for high flow events. During high flow events, water surface slope and cross-section water surface elevation were measured and the discharge estimated using normal depth calculations.

2.1 Hangman Creek at the Idaho StateLine

The entire Idaho portion of the watershed (approximately 87,000 acres) is located above this monitoring site. This area contains the majority of the headwaters for the watershed and consists primarily of forested land (53,000 acres). In addition to timber production, agriculture is dominant in the lowland areas. Annual crop production (29,000 acres) and pastureland (4,600 acres) comprise the other land uses in the upper watershed. Urban influences are minor (300 acres), but there are a few small towns and many rural residences located within this portion of the watershed. The Town of Tensed is located on the mainstem.

The Hangman Creek site at the Idaho state line was monitored for eight routine monthly samples and for three event samples. The data collected on Hangman Creek at the Idaho state line provided a baseline of water quality conditions as Hangman Creek enters Washington from Idaho.

The total suspended solids (TSS) values ranged from a low of two mg/l to a high of 582 mg/l (Table 5). The mean TSS value was 82.1 mg/l. Turbidity values ranged from a low of 5.73 NTU to a high of 341 NTU. The mean turbidity value was 67.0 NTU.

The fecal coliform samples ranged from seven colonies/100 ml to 820 colonies/100 ml, with a geometric mean of 64 colonies/100 ml (Table 5). The site did not exceed the geometric mean criteria, but it did exceed the state limit of less than 10 percent of the samples having more than 200 colonies/100 ml.

Nitrate values ranged from 0.10 mg/l to a high of 6.49 mg/l (Table 5), all below the EPA limit of 10 mg/l. The mean nitrate value was 2.56 mg/l. Nitrite values ranged from less than the detection limit of 0.01 mg/l to 0.01 mg/l (Table 5), all below the more restrictive EPA limit for cold-water fisheries of 0.06 mg/l. Ammonia values ranged from a low of 0.01 mg/l to a high of 0.14 mg/l (Table 5). The mean ammonia value was 0.05 mg/l. The exceedance value for ammonia varies (depending on the temperature and pH of the water), but there were no ammonia exceedances. Total phosphorus ranged from a low of

0.03 mg/l to a high of 0.56 mg/l (Table 5), with a mean value of 0.15 mg/l. Total phosphorus levels exceeded the EPA limit (0.1 mg/l) two out of eleven samples.

The pH ranged from a low of 6.37 to a high of 7.61 (Table 6). There was one exceedance for pH. Conductivity ranged from a low of 75 µS to a high of 174 µS (Table 6). The mean conductivity value was 111 µS. Dissolved oxygen ranged from a low of 5.91 mg/l to a high of 13.5 mg/l (Table 6), with three violations out of eleven samples. The mean dissolved oxygen value was 10.1 mg/l. The water temperature ranged from a low of 0.1 °C to 20.6 °C (Table 6), with one exceedance out of ten samples.

2.2 Hangman Creek at Roberts Road

The Hangman Creek site at Roberts Road is found just upstream of Waverly, Washington and was monitored for eight routine monthly samples and three event samples. This site incorporates flows from Little Hangman Creek and Cove Creek. The area is primarily dryland agricultural crop production, but there is moderate livestock pastureland influence on Cove Creek, Little Hangman Creek, and the mainstem. Cove Creek is also home to an active colony of beavers and dam building. There are two urban centers located upstream of this site, the City of Tekoa and The Town of Latah. The City of Tekoa operates a nine-hole (32 acres) golf course located near the mainstem of the creek. Rural residences are widely spread throughout this portion of the watershed.

The TSS values ranged from a low of four mg/l to a high of 416 mg/l (Table 5). The mean TSS value was 65.6 mg/l Turbidity values ranged from a low of 3.78 NTU to a high of 290 NTU. The mean turbidity value was 68.5 NTU.

The fecal coliform samples ranged from two colonies/100 ml to 420 colonies/100 ml, with a geometric mean of 40 colonies/100 ml (Table 5). The site did not exceed the geometric mean criteria, but it did exceed the state limit of less than 10 percent of the samples having more than 200 colonies/100 ml.

Table 5: Summary of Laboratory Analysis

Site Location	**Turbidity** (NTU)		**TSS** (mg/l)		**Fecal Coliform** (col/100 ml)		**Nitrate** (mg/l)		**Nitrite** (mg/l)		**Ammonia** (mg/l)		**Total Phosphorus** (mg/l)	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
HC at Stateline	341	5.73	582	2	820	7	6.49	0.10	0.01	<0.01	0.01	0.14	0.56	0.03
Cove Creek	47.9	4.40	42	5	2270	3	7.08	1.66	0.04	<0.01	0.04	<0.01	0.39	0.08
HC at Roberts Road	290	3.78	416	4	420	2	8.76	0.03	0.04	<0.01	0.21	<0.01	0.54	0.05
RC at Rockford	134	1.73	154	2	1810	2	15.0	0.07	0.03	<0.01	0.59	0.01	0.45	0.03
RC at the mouth	189	1.14	290	2	350	5	15.7	0.29	0.03	<0.01	0.58	<0.01	0.51	0.03
HC at RM-21.0	363	1.81	490	2	570	6	7.77	0.02	0.02	<0.01	0.21	<0.01	0.70	0.03
HC at Duncan	302	1.93	493	2	320	5	9.98	0.38	0.02	<0.01	0.36	<0.01	0.71	0.03
CC near Marsh Road	23.4	3.05	13	2	720	1	0.25	0.01	<0.01	<0.01	0.04	<0.01	0.10	0.03
CC at the mouth	66.7	0.58	79	4	680	3	4.63	0.58	0.02	<0.01	0.05	<0.01	0.34	0.05
SC at the mouth	61.3	0.92	40	4	240	13	8.15	0.08	<0.01	<0.01	0.10	<0.01	0.37	0.10
MC at McKenzie Rd	6.99	0.58	18	5	420	1	1.98	0.91	0.02	<0.01	0.12	0.01	0.14	0.03
MC at the mouth	4.87	0.87	13	2	1210	5	2.08	0.05	0.02	<0.01	0.08	0.01	0.13	0.06
HC at USGS gage	NS	NS	NS	NS	900	1	NS	NS	NS	NS	NS	NS	NS	NS
HC at Fairbanks Rd	NS	NS	NS	NS	340	4	NS	NS	NS	NS	NS	NS	NS	NS
HC at Marsh Road	NS	NS	NS	NS	310	2	NS	NS	NS	NS	NS	NS	NS	NS
HC at Spring Valley Rd	NS	NS	NS	NS	680	7	NS	NS	NS	NS	NS	NS	NS	NS
HC at Chapman Road	NS	NS	NS	NS	270	10	NS	NS	NS	NS	NS	NS	NS	NS
HC u/s of Golf Course	NS	NS	NS	NS	NS	NS	7.20	0.10	<0.01	<0.01	0.04	<0.01	0.09	0.03
HC d/s Golf Course	NS	NS	NS	NS	NS	NS	7.25	0.02	0.01	<0.01	0.04	<0.01	0.09	0.02

Notes:
1. NTU is Nephelometric Turbidity Units.
2. mg/l is milligrams per liter.
3. HC is Hangman Creek.
4. RC is Rock Creek.
5. CC is California Creek.
6. SC is Spangle Creek.
7. u/s is upstream, d/s is downstream.
8. NS is not sampled.

Table 6: Summary of Field Analysis

Site Location	pH (Units)		Conductivity (µS/cm)		Dissolved Oxygen (mg/l)		Water Temperature (°C)	
	Max	Min	Max	Min	Max	Min	Max	Min
HC at Stateline	7.61	6.37	174	75	13.5	5.91	20.6	0.1
Cove Creek	7.90	5.58	300	156	14.7	6.24	18.4	0.2
HC at Roberts Road	8.24	5.73	222	99.0	13.8	5.5	23.2	-0.1
RC at Rockford	8.59	5.49	421	193	14.1	8.65	18.5	0.0
RC at the mouth	8.63	3.88	353	208	16.9	9.55	21.3	0.6
HC at RM-21.0	8.41	6.08	268	116	13.6	9.72	20.8	-0.2
HC at Duncan	8.59	6.08	289	132	20.9	7.33	21.5	0.1
CC near Marsh Road	7.44	5.34	116	29	19.1	9.38	12.0	0.1
CC at the mouth	8.13	6.88	282	136	20.6	9.02	16.0	1.1
SC at the mouth	8.79	6.88	409	188	20.7	11.0	16.0	1.0
MC at McKenzie Rd	7.66	6.85	267	233	12.6	1.99	14.0	0.9
MC at the mouth	8.51	6.21	275	58	18.0	7.15	17.0	0.3
HC at USGS gage	NM	NM	NM	NM	NM	NM	NM	NM
HC at Fairbanks Rd	NM	NM	NM	NM	NM	NM	NM	NM
HC at Marsh Road	NM	NM	NM	NM	NM	NM	NM	NM
HC at Spring Valley Rd	NM	NM	NM	NM	NM	NM	NM	NM
HC at Chapman Road	NM	NM	NM	NM	NM	NM	NM	NM
HC u/s of Golf Course	NM	NM	NM	NM	NM	NM	NM	NM
HC d/s Golf Course	NM	NM	NM	NM	NM	NM	NM	NM

Notes:
1. NTU is Nephelometric Turbidity Units.
2. mg/l is milligrams per liter.
3. µS/cm is microsiemens per centimeter.
4. HC is Hangman Creek.
5. RC is Rock Creek.
6. CC is California Creek.
7. SC is Spangle Creek.
8. MC is Marshall Creek.
9. u/s is upstream, d/s is downstream.
10. NM is not measured.

Nitrate values ranged from 0.03 mg/l to a high of 8.76 mg/l (Table 5), all below the EPA limit of 10 mg/l. The mean nitrate value was 3.57 mg/l. Nitrite values ranged from less than the detection limit of 0.01 mg/l to 0.04 mg/l (Table 5), all below the more restrictive EPA limit for cold-water fisheries of 0.06 mg/l. Ammonia values ranged from less than the detection limit of 0.01 mg/l to a high of 0.21 mg/l (Table 5). The mean ammonia value was 0.07 mg/l. The exceedance value for ammonia varies (depending on the temperature and pH of the water), but there were no ammonia exceedances. Total phosphorus ranged from a low of 0.05

mg/l to a high of 0.54 mg/l (Table 5), with a mean value of 0.17 mg/l. Total phosphorus levels exceeded the EPA limit (0.1 mg/l) four out of ten samples.

The pH ranged from a low of 5.73 to a high of 8.24 (Table 6). There was one exceedance for pH. Conductivity ranged from a low of 99 μS to a high of 222 μS (Table 6). The mean conductivity value was 156 μS. Dissolved oxygen ranged from a low of 5.50 mg/l to a high of 13.8 mg/l (Table 6), with one violation out of 11 samples. The mean dissolved oxygen value was 9.74 mg/l. The water temperature ranged from a low of –0.1 °C to 23.2 °C (Table 6), with three exceedances out of 11 samples.

2.3 Hangman Creek River Mile 21.0

The Hangman Creek site at River Mile 21.0 is just upstream of the confluence with Rock Creek and was monitored for eight routine monthly samples and for three event samples. This site is located at the mouth of a deep basalt canyon (approximately seven miles long) and is influenced by the addition of flow from Rattler Run Creek, and two small urban centers (The Town of Waverly and The Town of Fairfield). Waverly is located directly on the mainstem of Hangman Creek whereas the Town of Fairfield is located on a tributary (Rattler Run Creek). The land use in the area is primarily dryland agricultural production with minor to moderate livestock grazing influences.

The TSS values ranged from a low of two mg/l to a high of 490 mg/l (Table 5). The mean TSS value was 67.3 mg/l. Turbidity values ranged from a low of 1.81 NTU to a high of 363 NTU. The mean turbidity value was 58.1 NTU.

The fecal coliform samples ranged from six colonies/100 ml to 570 colonies/100 ml, with a geometric mean of 55 colonies/100 ml (Table 5). The site did not exceed the geometric mean criteria, but it did exceed the state limit of less than 10 percent of the samples having more than 200 colonies/100 ml.

Nitrate values ranged from 0.02 mg/l to a high of 7.77 mg/l (Table 5), all below the EPA limit of 10 mg/l. The mean nitrate value was 3.37 mg/l. Nitrite values ranged from less than the detection limit of 0.01 mg/l to 0.02 mg/l (Table 5), all below the more restrictive EPA limit for cold-water fisheries of 0.06 mg/l. Ammonia values ranged from a low of less than the detection limit of 0.01 mg/l to a high of 0.21 mg/l (Table 5). The mean ammonia value was 0.05 mg/l. The exceedance value for ammonia varies (depending on the temperature and pH of the water), but there were no ammonia exceedances. Total phosphorus ranged from a low of 0.03 mg/l to a high of 0.70 mg/l (Table 5), with a mean value of 0.16 mg/l. Total phosphorus levels exceeded the EPA limit (0.1 mg/l) three out of ten samples.

The pH ranged from a low of 6.08 to a high of 8.41 (Table 6). There were two exceedances for pH. Conductivity ranged from a low of 116 μS to a high of 268 μS (Table 6). The mean conductivity value was 190 μS. Dissolved oxygen ranged from a low of 9.72 mg/l to a high of 13.6 mg/l (Table 6). The mean dissolved oxygen value was 11.8 mg/l. The water

temperature ranged from a low of -0.2 °C to 20.8 °C (Table 6), with two exceedances out of 11 samples.

2.4 Hangman Creek at Duncan

The Hangman Creek site at Duncan is just downstream of the confluence with Rock Creek and was monitored for eight routine monthly samples and for three event samples. This site incorporates the influence of a significant tributary (Rock Creek) and the intermittent influence of Spangle Creek during spring runoff. The monitoring site is just downstream of the mouth of the Rock Creek basalt canyon (approximately seven miles long). Rock Creek is further influenced by The Town of Rockford, rural residences, and livestock grazing operations. Dryland agriculture and livestock grazing are the dominant land uses within the area. The Spangle Creek drainage is also predominantly dryland agriculture with influences from the Town of Spangle, Columbia Academy, livestock grazing, and rural residences.

The TSS values ranged from a low of two mg/l to a high of 493 mg/l (Table 5). The mean TSS value was 69.4 mg/l. Turbidity values ranged from a low of 1.93 NTU to a high of 302 NTU. The mean turbidity value was 50.2 NTU.

The fecal coliform samples ranged from five colonies/100 ml to 320 colonies/100 ml, with a geometric mean of 36 colonies/100 ml (Table 5). The site did not exceed the geometric mean criteria or the state limit of less than 10 percent of the samples having more than 200 colonies/100 ml.

Nitrate values ranged from 0.38 mg/l to a high of 9.98 mg/l (Table 5). Based on the analysis of duplicate samples, it cannot be concluded (at a 90 percent certainty) for the environmental sample at 9.98 mg/l that the true concentration in Hangman Creek did not exceed 10.0 mg/l. The mean nitrate value was 4.77 mg/l. Nitrite values ranged from less than the detection limit of 0.01 mg/l to 0.02 mg/l (Table 5), all below the more restrictive EPA limit for cold-water fisheries of 0.06 mg/l. Ammonia values ranged from a low of less than the detection limit of 0.01 mg/l to a high of 0.36 mg/l (Table 5). The mean ammonia value was 0.08 mg/l. The exceedance value for ammonia varies (depending on the temperature and pH of the water), but there were no ammonia exceedances. Total phosphorus ranged from a low of 0.03 mg/l to a high of 0.71 mg/l (Table 5), with a mean value of 0.16 mg/l. Total phosphorus levels exceeded the EPA limit (0.1 mg/l) three out of ten samples.

The pH ranged from a low of 6.08 to a high of 8.59 (Table 6). There were three exceedances for pH. Conductivity ranged from a low of 132 μS to a high of 289 μS (Table 6). The mean conductivity value was 210 μS. Dissolved oxygen ranged from a low of 7.33 mg/l to a high of 20.9 mg/l (Table 6), with two violations out of 11 samples. The mean dissolved oxygen value was 11.5 mg/l. The water temperature ranged from a low of 0.1 °C to 21.5 °C (Table 6), with four exceedances out of 11 samples.

2.5 Cove Creek

Cove Creek is a small tributary near the Town of Latah, Washington and was monitored for eight routine monthly samples and for three event samples. Cove Creek is influenced by adjacent dryland agriculture, the Town of Latah, and numerous beaver dams on the creek.

The TSS values ranged from a low of five mg/l to a high of 42 mg/l (Table 5). The mean TSS value was 14.3 mg/l. Turbidity values ranged from a low of 4.4 NTU to a high of 47.9 NTU. The mean turbidity value was 17.6 NTU.

The fecal coliform samples ranged from three colonies/100 ml to 2,270-colonies/100 ml, with a geometric mean of 84 colonies/100 ml (Table 5). The site did not exceed the geometric mean criteria, but it did exceed the state limit of less than 10 percent of the samples having more than 200 colonies/100 ml.

Nitrate values ranged from 1.66 mg/l to a high of 7.08 mg/l (Table 5), all below the EPA limit of 10 mg/l. The mean nitrate value was 3.55 mg/l. Nitrite values ranged from less than the detection limit of 0.01 mg/l to 0.04 mg/l (Table 5), all below the more restrictive EPA limit for cold-water fisheries of 0.06 mg/l. Ammonia values ranged from less than the detection limit of 0.01 mg/l to a high of 0.04 mg/l (Table 5). The mean ammonia value was 0.03 mg/l. The exceedance value for ammonia varies (depending on the temperature and pH of the water), but there were no ammonia exceedances. Total phosphorus ranged from a low of 0.08 mg/l to a high of 0.39 mg/l (Table 5), with a mean value of 0.15 mg/l. Total phosphorus levels exceeded the EPA limit (0.1 mg/l) six out of ten samples.

The pH ranged from a low of 5.58 to a high of 7.90 (Table 6). Conductivity ranged from a low of 156 µS to a high of 300 µS (Table 6). The mean conductivity value was 231 µS. Dissolved oxygen ranged from a low of 6.24 mg/l to a high of 14.7 mg/l (Table 6), with two violations out of 11 samples. The mean dissolved oxygen value was 10.4 mg/l. The water temperature ranged from a low of 0.2 °C to 18.4 °C (Table 6), with one exceedance out of 11 samples.

2.6 Rock Creek Upper

Rock Creek is the largest tributary to the Hangman Creek mainstem and was monitored for eight routine monthly samples and for three event samples. The Rock Creek upper site is located just upstream of the Town of Rockford, Washington. The Idaho portion of Rock the Creek watershed includes influences from the Town of Worley, the Coeur d'Alene Casino, and dryland agriculture. The Washington State portion of the watershed above the site is primarily dryland agriculture with moderate livestock grazing influence.

The TSS values ranged from a low of two mg/l to a high of 154 mg/l (Table 5). The mean TSS value was 30.4 mg/l. Turbidity values ranged from a low of 1.73 NTU to a high of 134 NTU. The mean turbidity value was 20.8 NTU.

The fecal coliform samples ranged from two colonies/100 ml to 1,810 colonies/100 ml, with a geometric mean of 36 colonies/100 ml (Table 5). The site did not exceed the geometric mean criteria, but it did exceed the state limit of less than 10 percent of the samples having more than 200 colonies/100 ml.

Nitrate values ranged from 0.07 mg/l to a high of 15.0 mg/l (Table 5). There were four samples that exceeded the EPA limit of 10 mg/l. The mean nitrate value was 6.17 mg/l. Nitrite values ranged from less than the detection limit of 0.01 mg/l to 0.03 mg/l (Table 5), all below the more restrictive EPA limit for cold-water fisheries of 0.06 mg/l. Ammonia values ranged from 0.01 mg/l to a high of 0.59 mg/l (Table 5). The mean ammonia value was 0.13 mg/l. The exceedance value for ammonia varies (depending on the temperature and pH of the water), but there were no ammonia exceedances. Total phosphorus ranged from a low of 0.03 mg/l to a high of 0.45 mg/l (Table 5), with a mean value of 0.11 mg/l. Total phosphorus levels exceeded the EPA limit (0.1 mg/l) three out of ten samples.

The pH ranged from a low of 5.49 to a high of 8.59 (Table 6). There were two pH exceedances out of ten samples. Conductivity ranged from a low of 193 µS to a high of 421 µ S (Table 6). The mean conductivity value was 277 µS. Dissolved oxygen ranged from a low of 8.65 mg/l to a high of 14.1 mg/l (Table 6), with no violations. The mean dissolved oxygen value was 11.3 mg/l. The water temperature ranged from a low of 0.0 °C to 18.5 °C (Table 6), with one exceedance out of ten samples.

2.7 Rock Creek Lower

Rock creek is the largest tributary to the Hangman Creek mainstem and was monitored for eight routine monthly samples and for three event samples. The Rock Creek lower site is located near the mouth at the Valley Chapel Road crossing. This site includes the influences from the Town of Rockford and dryland agricultural production. There is a significant livestock grazing influence directly upstream from the sampling site. Rural residential influences are minor throughout the drainage.

The TSS values ranged from a low of two mg/l to a high of 290 mg/l (Table 5). The mean TSS value was 39.9 mg/l. Turbidity values ranged from a low of 1.14 NTU to a high of 189 NTU. The mean turbidity value was 25.9 NTU.

The fecal coliform samples ranged from five colonies/100 ml to 350 colonies/100 ml, with a geometric mean of 94 colonies/100 ml (Table 5). The site did not exceed the geometric mean criteria, but did exceed the state limit of less than 10 percent of the samples having more than 200 colonies/100 ml.

Nitrate values ranged from 0.29 mg/l to a high of 15.7 mg/l (Table 5). There were four samples that exceeded the EPA limit of 10 mg/l. The mean nitrate value was 7.06 mg/l. Nitrite values ranged from less than the detection limit of 0.01 mg/l to 0.03 mg/l (Table 5), all below the more restrictive EPA limit for cold-water fisheries of 0.06 mg/l. Ammonia values

ranged from less than the detection limit of 0.01 mg/l to a high of 0.58 mg/l (Table 5). The mean ammonia value was 0.14 mg/l. The exceedance value for ammonia varies (depending on the temperature and pH of the water), but there were no ammonia exceedances. Total phosphorus ranged from a low of 0.03 mg/l to a high of 0.51 mg/l (Table 5), with a mean value of 0.12 mg/l. Total phosphorus levels exceeded the EPA limit (0.1 mg/l) three out of ten samples.

The pH ranged from a low of 3.88 to a high of 8.63 (Table 6). There were three pH exceedances out of 11 samples. Conductivity ranged from a low of 208 μS to a high of 353 μ S (Table 6). The mean conductivity value was 274 μS. Dissolved oxygen ranged from a low of 9.55 mg/l to a high of 16.9 mg/l (Table 6), with no violations. The mean dissolved oxygen value was 12.4 mg/l. The water temperature ranged from a low of 0.6 °C to 21.3 °C (Table 6), with two exceedances out of 11 samples.

2.8 Spangle Creek

Spangle Creek is a small intermittent tributary to the Hangman Creek mainstem and was monitored for five routine monthly samples and for two event samples. Spangle Creek is located just downstream of the confluence of Rock Creek and Hangman Creek, and was dry for three of the eight monthly sample events and the August event sampling. Spangle Creek is primarily influenced by dryland agricultural production. The Town of Spangle and the Columbia Academy both discharge into the creek and livestock grazing influences exist in the lower portion of the creek.

The TSS values ranged from a low of four mg/l to a high of 40 mg/l (Table 5). The mean TSS value was 14.0 mg/l. Turbidity values ranged from a low of 0.92 NTU to a high of 61.3 NTU. The mean turbidity value was 17.9 NTU.

The fecal coliform samples ranged from 13 colonies/100 ml to 240 colonies/100 ml, with a geometric mean of 43 colonies/100 ml (Table 5). The site did not exceed the geometric mean criteria of less than 100 colonies/100 ml, but did exceed the state limit of less than 10 percent of the samples having more than 200 colonies/100 ml.

Nitrate values ranged from 0.08 mg/l to a high of 8.15 mg/l (Table 5). No samples exceeded the EPA limit of 10 mg/l. The mean nitrate value was 3.59 mg/l. Nitrite values ranged from less than the detection limit of 0.01 mg/l to 0.01 mg/l (Table 5), all below the more restrictive EPA limit for cold-water fisheries of 0.06 mg/l. Ammonia values ranged from less than the detection limit of 0.01 mg/l to a high of 0.10 mg/l (Table 5). The mean ammonia value was 0.04 mg/l. The exceedance value for ammonia varies (depending on the temperature and pH of the water), but there were no ammonia exceedances. Total phosphorus ranged from a low of 0.10 mg/l to a high of 0.37 mg/l (Table 5), with a mean value of 0.20 mg/l. Total phosphorus levels exceeded the EPA limit (0.1 mg/l) six out of seven samples.

The pH ranged from a low of 6.88 to a high of 8.79 (Table 6). There were three pH exceedances out of seven samples. Conductivity ranged from a low of 188 μS to a high of 409 μS (Table 6). The mean conductivity value was 300 μS. Dissolved oxygen ranged from a low of 11.0 mg/l to a high of 20.7 mg/l (Table 6), with no violations. The mean dissolved oxygen value was 14.4 mg/l. The water temperature ranged from a low of 1.0 °C to 16.0 °C (Table 6), with no exceedances.

2.9 California Creek Upper

California Creek is a small tributary to the Hangman Creek mainstem, and was monitored for eight routine monthly samples and for three event samples. The upper site is primarily forested with many small rural residences and minor agricultural production. Several small livestock operations exist throughout the area. Timber harvest is also prevalent.

The TSS values ranged from a low of two mg/l to a high of 13 mg/l (Table 5). The mean TSS value was 5.5 mg/l. Turbidity values ranged from a low of 3.05 NTU to a high of 23.4 NTU. The mean turbidity value was 10.3 NTU.

The fecal coliform samples ranged from one colonies/100 ml to 720 colonies/100 ml, with a geometric mean of 28 colonies/100 ml (Table 5). The site did not exceed the geometric mean criteria of less than 100 colonies/100 ml, but did exceed the state limit of less than 10 percent of the samples having more than 200 colonies/100 ml.

Nitrate values ranged from 0.01 mg/l to a high of 0.25 mg/l (Table 5). No samples exceeded the EPA limit of 10 mg/l. The mean nitrate value was 0.09 mg/l. Nitrite values were all less than the detection limit of 0.01 mg/l (Table 5), all below the more restrictive EPA limit for cold-water fisheries of 0.06 mg/l. Ammonia values ranged from less than the detection limit of 0.01 mg/l to a high of 0.04 mg/l (Table 5). The mean ammonia value was 0.02 mg/l. The exceedance value for ammonia varies (depending on the temperature and pH of the water), but there were no ammonia exceedances. Total phosphorus ranged from a low of 0.03 mg/l to a high of 0.10 mg/l (Table 5), with a mean value of 0.05 mg/l. Total phosphorus levels did not exceeded the EPA limit (0.1 mg/l) for any of the samples. Based on the analysis of duplicate samples, it cannot be concluded (at a 90 percent certainty) for the environmental sample at 0.10 mg/l that the true concentration in California Creek did not exceed 0.10 mg/l.

The pH ranged from a low of 5.34 to a high of 7.44 (Table 6). There was one pH exceedance out of 11 samples Conductivity ranged from a low of 29.0 μS to a high of 116 μS (Table 6). The mean conductivity value was 52.6 μS. Dissolved oxygen ranged from a low of 9.38 mg/l to a high of 19.1 mg/l (Table 6), with no violations. The mean dissolved oxygen value was 13.5 mg/l. The water temperature ranged from a low of 0.1 °C to 12.0 °C (Table 6), with no exceedances.

2.10 California Creek Lower

California Creek is a small tributary to the Hangman Creek mainstem, and was monitored for eight routine monthly samples and for three event samples. This site is downstream of the California Creek basalt canyon. Above the canyon, the creek is influenced by dryland agriculture, livestock grazing, abundant rural residences, and the towns of Mica and Valleyford.

The TSS values ranged from a low of four mg/l to a high of 79 mg/l (Table 5). The mean TSS value was 19.7 mg/l. Turbidity values ranged from a low of 0.58 NTU to a high of 66.7 NTU. The mean turbidity value was 11.9 NTU.

The fecal coliform samples ranged from three colonies/100 ml to 680 colonies/100 ml, with a geometric mean of 28 colonies/100 ml (Table 5). The site did not exceed the geometric mean criteria of less than 100 colonies/100 ml or the state limit of less than 10 percent of the samples having more than 200 colonies/100 ml.

Nitrate values ranged from 0.58 mg/l to a high of 4.63 mg/l (Table 5). No samples exceeded the EPA limit of 10 mg/l. The mean nitrate value was 2.26 mg/l. Nitrite values were all less than the detection limit of 0.01 mg/l, except one sample at 0.02 mg/l (Table 5). All samples were below the more restrictive EPA limit for cold-water fisheries of 0.06 mg/l. Ammonia values ranged from less than the detection limit of 0.01 mg/l to a high of 0.05 mg/l (Table 5). The mean ammonia value was 0.02 mg/l. The exceedance value for ammonia varies (depending on the temperature and pH of the water), but there were no ammonia exceedances. Total phosphorus ranged from a low of 0.05 mg/l to a high of 0.34 mg/l (Table 5), with a mean value of 0.11 mg/l. Total phosphorus levels exceeded the EPA limit (0.1 mg/l) three out of ten samples.

The pH ranged from a low of 6.88 to a high of 8.13 (Table 6). Conductivity ranged from a low of 136 µS to a high of 282 µS (Table 6). The mean conductivity value was 212 µS. Dissolved oxygen ranged from a low of 9.02 mg/l to a high of 20.6 mg/l (Table 6), with no violations. The mean dissolved oxygen value was 13.2 mg/l. The water temperature ranged from a low of 1.1 °C to 16.0 °C (Table 6), with no exceedances.

2.11 Marshall Creek at McKenzie Road (Upper Site)

Marshall Creek is a tributary to the Hangman Creek mainstem. The upper Marshall Creek sample site is located near McKenzie Road and was monitored for eight routine monthly samples and for three event samples. This land use above this site is predominantly rural residential, with moderate livestock grazing influences. The area contains both forested and rangeland environments.

The TSS values ranged from a low of five mg/l to a high of 18 mg/l (Table 5). The mean TSS value was 9.3 mg/l. Turbidity values ranged from a low of 0.58 NTU to a high of 6.99 NTU. The mean turbidity value was 3.31 NTU.

The fecal coliform samples ranged from one colonie/100 ml to 420 colonies/100 ml, with a geometric mean of nine colonies/100 ml (Table 5). The site did not exceed the geometric mean criteria of less than 100 colonies/100 ml or the state limit of less than 10 percent of the samples having more than 200 colonies/100 ml.

Nitrate values ranged from 0.91 mg/l to a high of 1.98 mg/l (Table 5). No samples exceeded the EPA limit of 10 mg/l. The mean nitrate value was 1.62 mg/l. Nitrite values ranged from less than the detection limit of 0.01 mg/l to 0.02 mg/l (Table 5). All samples were below the more restrictive EPA limit for cold-water fisheries of 0.06 mg/l. Ammonia values ranged from 0.01 mg/l to a high of 0.12 mg/l (Table 5). The mean ammonia value was 0.05 mg/l. The exceedance value for ammonia varies (depending on the temperature and pH of the water), but there were no ammonia exceedances. Total phosphorus ranged from a low of 0.03 mg/l to a high of 0.14 mg/l (Table 5), with a mean value of 0.09 mg/l. Total phosphorus levels exceeded the EPA limit (0.1 mg/l) six out of ten samples.

The pH ranged from a low of 6.85 to a high of 7.66 (Table 6). Conductivity ranged from a low of 233 µS to a high of 267 µS (Table 6). The mean conductivity value was 252 µS. Dissolved oxygen ranged from a low of 1.99 mg/l to a high of 12.6 mg/l (Table 6), with two violations. The mean dissolved oxygen value was 9.37 mg/l. The water temperature ranged from a low of 0.9 °C to 14.0 °C (Table 6), with no exceedances.

2.12 Marshall Creek Near the Mouth (Lower Site)

Marshall Creek is a tributary to the Hangman Creek mainstem. The lower Marshall Creek sample site is located near the culvert under State Highway 195 and was monitored for eight routine monthly samples and for three event samples. The confluence with Hangman Creek is located at approximately River Mile 4.5 on Hangman Creek. The culvert runs underneath the highway (HWY 195) and drains the old meander cutoff of Hangman Creek (now a slough). High density housing is directly upstream of the site and rural residential is extensive throughout the system. The creek is also subject to many road crossings and an adjacent railroad embankment for much of its length.

The TSS values ranged from a low of two mg/l to a high of 13 mg/l (Table 5). The mean TSS value was 6.1 mg/l. Turbidity values ranged from a low of 0.87 NTU to a high of 4.87 NTU. The mean turbidity value was 2.24 NTU.

The fecal coliform samples ranged from five colonies/100 ml to 1,210-colonies/100 ml, with a geometric mean of 30 colonies/100 ml (Table 5). The site did not exceed the geometric mean criteria of less than 100 colonies/100 ml or the state limit of less than 10 percent of the samples having more than 200 colonies/100 ml.

Nitrate values ranged from 0.05 mg/l to a high of 2.08 mg/l (Table 5). No samples exceeded the EPA limit of 10 mg/l. The mean nitrate value was 1.22 mg/l. Nitrite values ranged from

less than the detection limit of 0.01 mg/l to 0.02 mg/l (Table 5). All samples were below the more restrictive EPA limit for cold-water fisheries of 0.06 mg/l. Ammonia values ranged from 0.01 mg/l to a high of 0.08 mg/l (Table 5). The mean ammonia value was 0.03 mg/l. The exceedance value for ammonia varies (depending on the temperature and pH of the water), but there were no ammonia exceedances. Total phosphorus ranged from a low of 0.06 mg/l to a high of 0.13 mg/l (Table 5), with a mean value of 0.09 mg/l. In one sample, total phosphorus levels exceed the EPA limit (0.1 mg/l).

The pH ranged from a low of 6.21 to a high of 8.51 (Table 6). There were two pH exceedances out of 11 samples. Conductivity ranged from a low of 58 µS to a high of 275 µ S (Table 6). The mean conductivity value was 238 µS. Dissolved oxygen ranged from a low of 7.15 mg/l to a high of 18.0 mg/l (Table 6), with one violation. The mean dissolved oxygen value was 12.0 mg/l. The water temperature ranged from a low of 0.3 °C to 17.0 °C (Table 6), with no exceedances.

2.13 Hangman Creek Upstream of Hangman Valley Golf Course

Hangman Creek was sampled upstream and downstream of the Hangman Valley Golf Course to evaluate potential nutrient loading. The upstream site was monitored for five routine monthly samples and one event sample. The site was monitored for nutrients only. There were no significant increases in nutrients downstream of the golf course.

Nitrate values ranged from 0.10 mg/l to a high of 7.20 mg/l (Table 5). No samples exceeded the EPA limit of 10 mg/l. The mean nitrate value was 1.56 mg/l. Nitrite values were all less than the detection limit of 0.01 mg/l (Table 5). Ammonia values ranged from less than the detection limit of 0.01 mg/l to a high of 0.04 mg/l (Table 5). The mean ammonia value was 0.03 mg/l. Total phosphorus ranged from a low of 0.03 mg/l to a high of 0.09 mg/l (Table 5), with a mean value of 0.07 mg/l. Total phosphorus levels did not exceed the EPA limit (0.1 mg/l).

2.14 Hangman Creek Downstream of Hangman Valley Golf Course

Hangman Creek was sampled upstream and downstream of the Hangman Valley Golf Course to evaluate potential nutrient loading. The downstream site was monitored for five routine monthly samples and one event sample. The site was monitored for nutrients only. There were no significant increases in nutrients downstream of the golf course.

Nitrate values ranged from 0.02 mg/l to a high of 7.25 mg/l (Table 5). No samples exceeded the EPA limit of 10 mg/l. The mean nitrate value was 1.54 mg/l. Nitrite values were all less than the detection limit of 0.01 mg/l except for one sample at 0.01 mg/l (Table 5). Ammonia values ranged from less than the detection limit of 0.01 mg/l to a high of 0.04 mg/l (Table 5). The mean ammonia value was 0.02 mg/l. Total phosphorus ranged from a low of 0.02 mg/l to a high of 0.09 mg/l (Table 5), with a mean value of 0.05 mg/l. Total phosphorus levels did not exceed the EPA limit (0.1 mg/l).

2.15 Hangman Creek at Fairbanks Road

Hangman Creek was sampled for fecal coliform bacteria at four selected sites near the Town of Latah in the upper Hangman watershed; at Fairbanks Road, Marsh Road, Spring Valley Road, and Chapman Road. The first site was at Fairbanks Road and represents the upstream background conditions. This site was monitored for five routine monthly samples and two event samples.

The fecal coliform samples ranged from four colonies/100 ml to 340 colonies/100 ml, with a geometric mean of 46 colonies/100 ml (Table 5). The site did not exceed the geometric mean criteria of less than 100 colonies/100 ml, but did exceed the state limit of less than 10 percent of the samples having more than 200 colonies/100 ml.

2.16 Hangman Creek at Marsh Road

The second site was at Marsh Road and is downstream of a historic livestock area and upstream of the Town of Latah. This site was monitored for five routine monthly samples and two event samples.

The fecal coliform samples ranged from two colonies/100 ml to 310 colonies/100 ml, with a geometric mean of 33 colonies/100 ml (Table 5). The site did not exceed the geometric mean criteria of less than 100 colonies/100 ml, but did exceed the state limit of less than 10 percent of the samples having more than 200 colonies/100 ml.

2.17 Hangman Creek at Spring Valley Road

The third site was at Spring Valley Road and is downstream of the Town of Latah and upstream of an active livestock grazing area adjacent to Hangman Creek. This site was monitored for five routine monthly samples and two event samples.

The fecal coliform samples ranged from seven colonies/100 ml to 680 colonies/100 ml, with a geometric mean of 68 colonies/100 ml (Table 5). The site did not exceed the geometric mean criteria of less than 100 colonies/100 ml, but did exceed the state limit of less than 10 percent of the samples having more than 200 colonies/100 ml.

2.18 Hangman Creek at Chapman Road

The fourth site was at Chapman Road and is downstream of an active livestock grazing area adjacent to Hangman Creek. This site was monitored for five routine monthly samples and two event samples.

The fecal coliform samples ranged from ten colonies/100 ml to 270 colonies/100 ml, with a geometric mean of 48 colonies/100 ml (Table 5). The site did not exceed the geometric mean

criteria of less than 100 colonies/100 ml, but did exceed the state limit of less than 10 percent of the samples having more than 200 colonies/100 ml.

2.19 Hangman Creek at the USGS Gage

Hangman Creek was sampled for fecal at USGS gage site near the mouth of Hangman Creek. The site monitored as the downstream site for fecal evaluation. This site was monitored for seven routine monthly samples and three event samples.

The fecal coliform samples ranged from one colony/100 ml to 900 colonies/100 ml, with a geometric mean of 46 colonies/100 ml (Table 5). The site did not exceed the geometric mean criteria of less than 100 colonies/100 ml, but did exceed the state limit of less than 10 percent of the samples having more than 200 colonies/100 ml.

2.20 Wastewater Treatment Facility Data

The Fairfield, Rockford, and Tekoa wastewater treatment facilities were sampled during the routine monthly sampling (Table 7). Samples were collected by the treatment plant operator on the day of the monthly sampling, and then gathered by conservation district personnel during the field sampling. The treatment plant samples were delivered to the Spokane Tribal Laboratory at the same time as the field samples. For the December and January sampling months, the wastewater treatment plant operators could not be contacted prior to the sample day, and this prevented coordinated sampling. Sampling schedules were sent to the plant operators and the remaining samples were collected on the proper days. Samples were collected as close to the routine monthly sampling as possible. The Rockford treatment facility does not discharge during the summer, so no samples were collected for the May through July sample months.

Table 7: Wastewater Treatment Facility Sample Data

Sample Date	Rockford		Fairfield		Tekoa	
	Discharge (gallons/day)	TP (mg/l)	Discharge (gallons/day)	TP (mg/l)	Discharge (gallons/day)	TP (mg/l)
Dec. 15, 03	NS	NS	NS	NS	269,000	1.157
Jan. 14, 04	239,040	2.269	109,617	3.030	278,000	0.247
Feb. 4, 04	158,400	2.280	185,122	1.980	403,000	1.910
Mar. 3, 04	138,440	1.583	258,706	1.447	369,000	0.982
Apr. 13, 04	230,400	3.640	127,952	1.967	285,000	1.320

May 3, 04	NS	NS	101,601	2.012	212,000	1.352
Jun. 2, 04	NS	NS	119,638	2.702	292,000	0.842
Jul. 7, 04	NS	NS	28,641	3.017	178,000	2.500

Notes:

1. NS is not sampled.
2. mg/l is milligrams per liter.
3. December and January sampling were not coordinated initially, and were sampled as close to the routine sampling date as possible.
4. Rockford treatment facility does not discharge during the summer months, and no samples were collected for the May through July sample months.

3.0 DISCUSSION

3.1 Site Locations

The primary water quality sampling sites (Figure 1) were selected by Ecology in conjunction with the Spokane Conservation District. Most sites were based on recommendations from the identified data gaps outlined in the Draft Hangman Creek Water Resources Management Plan (2004). Some sites were selected to evaluate site-specific pollution potential. Several tributaries were also identified as being under represented to evaluate the potential loading. The tributaries included Cove Creek, Spangle Creek, Rock Creek, California Creek, and Marshall Creek.

Three site-specific potential pollution-loading scenarios were evaluated that entailed sampling upstream and downstream of the sites. The scenarios were fecal coliform from livestock operations, effluent from a wastewater treatment plant, and nutrient contributions from golf course management.

The sample sites for evaluating fecal coliform loading from livestock operations were initially located on the Hangman mainstem upstream of the Rock Creek confluence. The upper site, Keevy Road, was sampled during the first two routine monthly samplings. Permission could not be obtained to sample the lower site, and after the third monthly sampling, a new series of sites near the Town of Latah, Washington were selected for monitoring. No significant fecal coliform increase was found to be due to the livestock operations.

The Hangman Valley wastewater treatment plant was monitored for effluent discharge to Hangman Creek. Samples upstream and downstream of the wastewater treatment plant were collected for two monthly routine samples. The sampling verified the treatment facility's on-site sampling and was discontinued. No significant change in fecal coliform or nutrients was found downstream of the treatment facility.

Golf course management (fertilizer applications – nutrients) was evaluated for the Hangman Valley Golf Course. The golf course borders Hangman Creek for approximately 3,500 feet, and water quality samples were collected immediately upstream and downstream of the golf course. No significant changes in nutrients were detected downstream of the golf course.

3.2 Event Sampling

There were three event samples; January 30, 2004, February 19, 2005, and August 25, 2005. The January and February samples were for high flows, both peaked at a flow of 4,020 cfs as measured by the Highbridge Park USGS gage (Station 12424000, provisional data). The August 25 event was a significant rain (greater than half an inch) after two weeks of no recorded rain. The high flow events were both less than the average annual flood (6,510 cfs) for Hangman Creek (Table 8). Because the high flows for Water Year 2004 were less than

the 2-year flood, sampling for events greater than 6,000 cfs will continue through Water Year 2005.

As would be expected, the high flow events generally had the highest turbidity, total suspended sediment, fecal coliform, and total phosphorus levels. Nitrates were also generally elevated during the high flow events. Discharge for the high flow events at some sample sites was estimated using a normal depth calculation (Manning's equation).

Table 8: Hangman Creek Flood Statistics

Return Interval (Years)	**Discharge** (cfs)
2	6,510
10	13,300
25	16,600
50	19,000
100	21,400

Notes:
1. From USGS WRI 97-4277, Magnitude and Frequency of Floods in Washington.

For the August event sampling, only fecal coliform samples were collected. The results suggest that summer events are significant inputs for fecal bacteria. Of the 17 sites sampled for fecal in August, 14 had fecal counts greater that 200 colonies per 100 ml. Ten of the 17 sites had the highest fecal count for the study. Although the total loading was lower (stream flows generally remain low compared to the average annual flow), the state limits were exceeded at most sites during the summer event sampling.

3.3 QA/QC Replicate and Blank Analysis

The quality assurance for the project used both field blanks and replicate samples to measure the bias and variability. Bias is the systematic error inherent in a method or measurement system. The variability is the random error in independent measurements as the result of repeated application of the process under specific conditions. The quality assurance plan used a random design to estimate the typical or "representative" quality of the environmental data.

Blank samples were submitted to the laboratory to measure the unintentional introduction of the target analyte into the sample. The blank samples consisted of de-ionized water obtained from the Spokane Tribal Laboratory in dedicated amber glass bottles. The blank water was free of the analytes of interest and was used to test for contamination. All blank samples were kept refrigerated until used in the field.

Blank analysis was conducted for total suspended solids, turbidity, nitrite, nitrate, ammonia and total phosphorous. All blank analysis for total suspended solids, nitrite, and nitrate were below the detection limit. All analysis for ammonia were at the detection limit of 0.01 mg/l. All turbidity analysis had a measurable concentration with a high concentration of 0.87 NTU and a mean concentration of 0.067 NTU. Total phosphorous had one sample below the

detection limit of 0.005 mg/l, one at the detection limit, and one sample at 0.013 mg/l (Table 9).

Table 9: Blank Analysis Results

Parameter	Blank-1	Blank-2	Blank-3
Total Suspended Solids (mg/l)	<2	<2	<2
Turbidity (NTUs)	0.87	0.32	0.82
Nitrite (mg/l)	<0.01	<0.01	<0.01
Nitrate (mg/l)	<0.01	<0.01	<0.01
Ammonia (mg/l)	0.01	0.01	0.01
Total Phosphorous (mg/l)	0.005	<0.005	0.013

Notes:
1. NTU is Nephelometric Turbidity Units.
2. mg/l is milligrams per liter.

Replicate samples consisted of two or more samples that were considered to be essentially identical in composition. The replicate samples were collected, processed, transported, and analyzed the same way. Sample volumes, times, equipment, and personnel were kept the same whenever possible. Concurrent replicates, samples that were collected at the same time, were generally collected. Some sequential replicates, samples collected one after another, were collected when concurrent sampling was not possible. The replicate sample variability was estimated using a piecewise linear model (USGS, 2003). The replicate data were split into two groups based on ranges of mean concentration. The mean standard deviation and relative standard deviation for each range was computed. The results provide estimates of the variability by using either the standard deviation or relative standard deviation; which ever describes the data best. The break point is the sample concentration where the sample result changes from being better described using the standard deviation to being better described using the relative standard deviation (Table 10).

For the parameter limit in Table 10, an exceedance value was estimated based on the replicate analysis. The exceedance value is the value where it can be concluded that the true concentration in the stream didn't exceed the listed limit (with a 90 percent certainty). For example, if the nitrate value in a sample was less than 9.84 mg/l, then even with the variability associated with the sampling, it is 90 percent certain that the true value in the stream did not exceed 10.0 mg/l. If the sample value is between 9.84 and 10.0 mg/l, it cannot be concluded (with 90 percent certainty) that the true concentration in the stream did not exceed the 10.0 mg/l limit.

3.4 Equipment

New pH, conductivity, and dissolved oxygen meters were purchased for this project. The conductivity and dissolved oxygen meters functioned properly throughout the project, but the pH meters (Hanna HI 98140) did not. After the first sampling, low values were noted from the field forms. The pH meters were recalibrated when the sampling teams returned to the

conservation district laboratory. The results suggested that the pH probes appeared to have drifted low, and were at fault. Several pH readings for the December routine sampling were below the state standard of 6.5 (Six of the twelve samples were below 6.5). The probes appeared to function properly in the laboratory, but not under field conditions. After the January sampling, the probes were returned to the manufacturer. Shorts in the probes were responsible for the field problems. The probes did not function if they were submerged more than an inch past the tip or if rain got the probe top wet. The probes would short and provide a faulty pH reading, sometimes drifting low and at other times they would be "stuck" in the range of 7.3 to 7.5 units. The new probes still did not function in the field. The manufacturer was called in March and indicated that they knew about the probe problem. The pH meters were returned to the manufacturer and new meters (VWR SP21) were purchased for the April sampling event. The new meters have performed satisfactorily. Because of the problems with the first meters, the pH data from December 2003 through March 2004 is suspect. Results in tables include all values, even for the December 2003 through March 2004 sampling events.

Table 10: Replicate Analysis Results and 90 Percent Confidence Limits

Parameter	Standard Deviation		Relative Standard Deviation		Break Point	90 Percent Certainty Evaluation	
	Statistical Value	Number of Replicates	Statistical Value	Number of Replicates		Limit	Exceedance Value
TSS	0.663	32	13.3	6	8.5	100	85.5
Turbidity	0.338	32	2.52	6	11	50	48.4
Nitrate	0.00898	27	1.31	11	3.0	10	9.84
Ammonia	0.00265	32	1.39	6	0.04	1.72	1.69
Total P	0.0026	28	2.58	10	0.1	0.1	0.097
Fecal	29.2	34	28	12	150	200	147.2

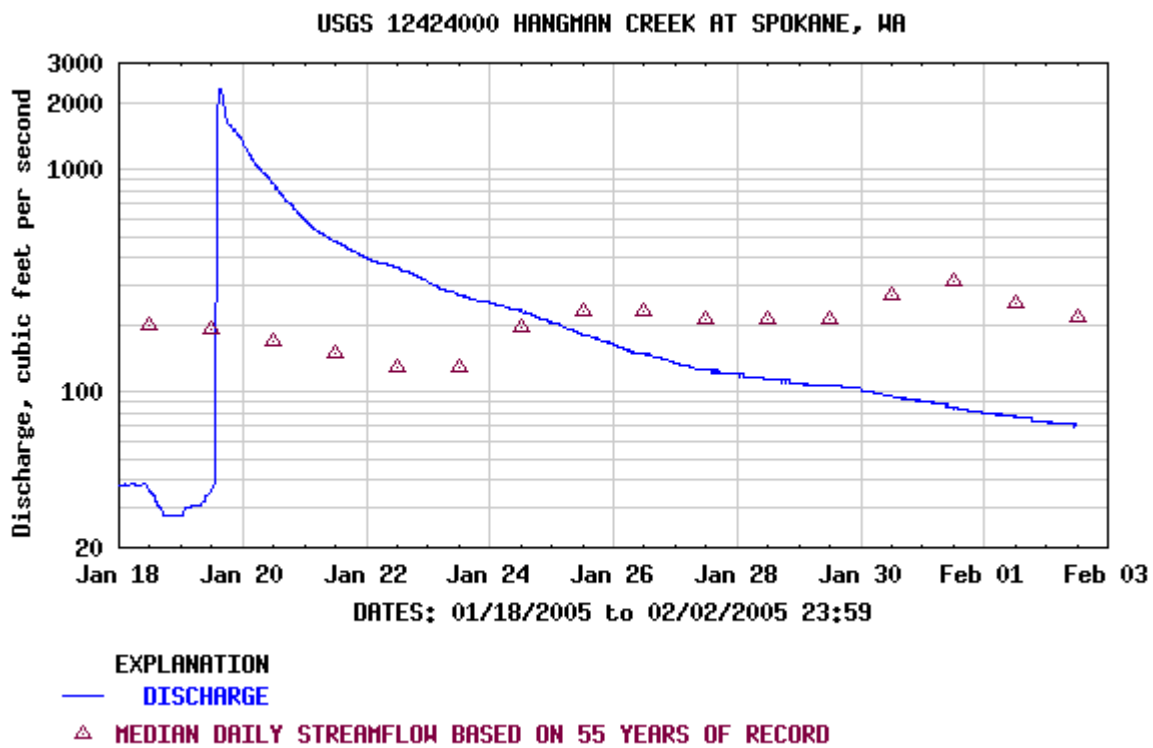
Notes:

1. All values are milligram per liter except for fecal, which is colonies per 100 ml, and turbidity which is Nephelometric Turbidity Units (NTUs).
2. TSS is total suspended solids.
3. The break point is the sample concentration that divides the replicate samples into two groups, one that uses the standard deviation and one that uses the relative standard deviation to define the sample variance.
4. The exceedance value is the value below which it can be concluded with 90 percent certainty that the true concentration in the stream did not exceed the concentration limit listed in the "Limit" column.
5. The statistical value is the mean standard deviation or relative standard deviation for the number of replicate samples.

3.5 Hydrologic Features

Hydraulically, the Hangman Creek watershed responds uniquely to significant rain events, snow melt, and summer low flow conditions. For significant rainfall or snowmelt events (in general, approximately one to two inches of water equivalent precipitation), Hangman Creek

can increase in flow several orders of magnitude in a few hours (Figure 4). During a typical rainfall runoff event, the Rock Creek sub-watershed peaks within approximately 12 hours, followed by Hangman peaking four to six hours later.



Note: Graph from USGS real-time web page for Hangman Creek gage, station 12424000

Figure 4: Hangman Discharge at USGS gage, January 2005

During low summer flows, Hangman Creek has been documented to have both gaining and losing reaches (see the detailed discussion in the QAPP, Appendix A). During summer flows less than five cfs at the USGS gage; the upper portion of Hangman Creek above Keevy Road and the reach downstream of California Creek to Marshall Creek both lose water to the ground water system. Below Marshall Creek, significant ground water inputs increase the flow up to three times (Figure 5).

Most of the tributaries have increasing flows from the upper watershed to their mouths, with the exception of Marshall Creek. Even during the two high flow events, Marshall Creek flow at the mouth was less than the upper flow at McKenzie Road. The largest loss was 2.78 cfs during the coldest sampling month, January (approximately –20 °F). The average loss was 1.98 cfs over the entire sampling season. The consequence of the losing reach is reflected in the sampling results, most of the parameters generally stayed the same or decreased at the mouth of Marshall Creek.

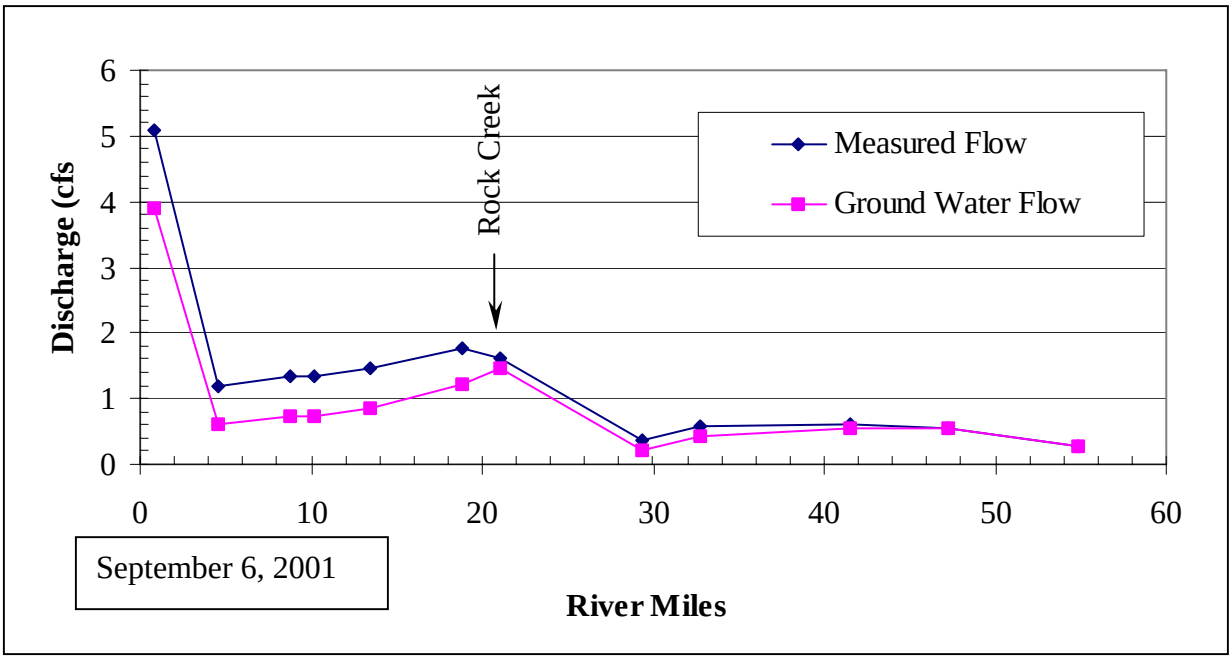


Figure 5: Hangman Creek Ground Water and Stream Flow

4.0 REFERENCES

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Appendix A
Approved Quality Assurance Project Plan (QAPP)

Hangman Creek Watershed Water Quality Sampling
Quality Assurance Project Plan

November 2003

Spokane County Conservation District
N. 210 Havana St.
Spokane, WA 99202
509/535-7274

Washington State Department of Ecology
Water Quality Optional Element Grant, HB 2514 Watershed Planning
No. G0300121

Walt Edelen
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Darren Lantzer
Laboratory Supervisor
Spokane Tribal Laboratory

Elaine Snouwaert
TMDL Project Supervisor
Department of Ecology

2.0 Table of Contents and Distribution list
Optional – Not included.

3.0 Organization and Schedule

The project planning team consists of:

Rick Noll, Project Coordinator, SCCD
Walt Edelen, Manager, SCCD Water Resources
Charlie Peterson, Lead Field Technician
Dan Ross, Senior Field Technician
Amy Voeller, Field Technician
Jennifer Grimm, Field Technician
Elaine Snouwaert, Ecology Project Manager
Joe Joy, Ecology Environmental Assessment Program
Darren Lantzer, Spokane Tribal Laboratory

Project decision-makers will consists of:

Rick Noll – Environmental and Quality Control sample data
Elaine Snouwaert – Project and sample review
Joe Joy, Ecology Environmental Assessment Program

The stakeholders directly affected by the outcome of the study are:

Hangman Creek HB 2514 Planning committee
Department of Ecology, Water Quality and Environmental Assessment Programs
Watershed residents

Rick Noll (SCCD) will provide overall organization and coordination of the project. Rick Noll, Charlie Peterson, Walt Edelen, Dan Ross, and Amy Voeller (all SCCD) will conduct the field sampling. Darren Lantzer, Spokane Tribal Laboratory will oversee laboratory analysis and laboratory QA/QC. Elaine Snouwaert and Joe Joy of the Department of Ecology will use the data to evaluate reaches of Hangman Creek and its tributaries for inclusion in the development of a TMDL plan.

HB 2514 Water Quality Optional Element Budget

Budget by Element	Water Year 2004
Salaries/Benefits	$ 25,000
Travel	1,000
Equipment	1,000
Materials/Supplies	2,150
Laboratory Costs	15,000
Overhead	6,250
Total Budget by Element	$ 50,400

Additional Funding as Needed from TMDL Grant Budget

Budget by Element	Water Year 2004
Salaries/Benefits	$ 10,000
Travel	1,000
Equipment	10,000
Materials/Supplies	1,000
Laboratory Costs	10,000
Overhead	2,500
Total Budget by Element	$ 34,500

Table 1: Project Timetable

Activity	Date	Remarks
Reconnaissance/site setup	Nov 17-26	Establish sample sites and TBMs for discharge
Routine field sampling	Monthly	Sampling to start the week of December 8
Event Sampling	As needed	Significant flow events will be sampled on the rising and falling limb (discharge > 2,000 cfs)
Sample delivery	Next day	Within 24 hours of sampling
Data entry into EIM	N/A	Included in final report, end of project
Progress reports	Quarterly	Quarterly report will be supplied to Ecology
End Field Sampling	July 2004	Sampling and data collection completed
Draft Report	Sept. 2004	Review by Ecology & HB 2514 Planning Unit
Final report	October 2004	Final with corrections
Sample disposal	Two weeks	Laboratory will hold samples for two weeks

Notes:
1. Dates approximate, final start is dependent on review of QAPP, weather, and final site setup.
2. TBM is temporary benchmark.
3. N/A is not applicable.

Note:
Funding from the TMDL grant may not be entirely used for this project. Both equipment and laboratory costs include contingency funds if it is determined that the sampling should be expanded.

4.0 Background and Problem Statement

The Department of Ecology (DOE) has identified the Hangman Creek watershed (also known as the Latah Creek watershed) as a water body with quality and quantity issues. Past water quality studies have shown that state standards for fecal coliform, temperature, pH, and dissolved oxygen are often exceeded (SCCD 1994, 1999, 2000; WDOE, 1998). Past and current land uses within the watershed are varied, and contribute to the problem. Issues such as, stormwater runoff, sedimentation, stream bank erosion, water rights, instream flows, spawning habitat (cold water fisheries), urban development, wetland destruction, and agricultural and forestry practices are all major concerns for the area.

A watershed planning unit for Hangman Creek (WRIA 56 was initiated in late 1999. The Planning Unit has committed representation by the City of Spokane, Spokane County, Whitman County, Hangman Hills Water District, Fairfield Triangle Grange, the Department of Ecology (State Caucus), and several residents.

The Planning Unit has chosen to address water quality in the Hangman Creek Watershed. The basin's growth and continued poor land management has led to environmental stresses that have reduced water quality over the years. Hangman Creek was identified on the 1998 303(d) list for not achieving State water quality standards for fecal coliform, dissolved oxygen, pH, and temperature. Recent monitoring has identified several other water quality problems not acknowledged by the 303(d) list (sediment load, turbidity, ammonia, low flows, and total phosphorus). This project will further characterize the extent and severity of these water quality problems within the basin in preparation for a set of total maximum daily load (TMDL) evaluations.

Historical Basis for the Project

The Hangman Creek watershed drains approximately 431,000 acres and spans across two states and four counties (Figure 1). More than 60 percent of the watershed resides in eastern Washington State while the remaining portion, including the headwaters, originates in the western foothills of the Rocky Mountains near Sanders, Idaho. Land use influences, (agriculture, impervious surfaces, timber harvest, roads, etc.) as well as stream channel and flood plain alterations over the last 100-years have contributed to "flashy" flow conditions, unstable stream banks, and substandard water quality.

Hangman Creek is often described as one of the most degraded waterbodies in eastern Washington State. It is designated as a Class A Washington waterway in the Washington Administrative Code (WAC) Chapter 173-201A. However, point and non-point pollution sources continue to be found throughout the watershed.

There are various factors leading to the non-compliance of water quality standards on Hangman Creek. Agriculture is the significant land use within the basin (64 percent). The largest agricultural production areas are located in the upper to middle reaches of the watershed. Most of the cropland is non-irrigated, annual small grain production. Other crops include peas, lentils, canola, and turfgrass seed. The development of agriculture in the watershed led to a significant reduction of riparian vegetation and extensive channel

alterations. The removal of native riparian vegetative buffers has reduced the natural filtering function and increased the rate of stream bank erosion.

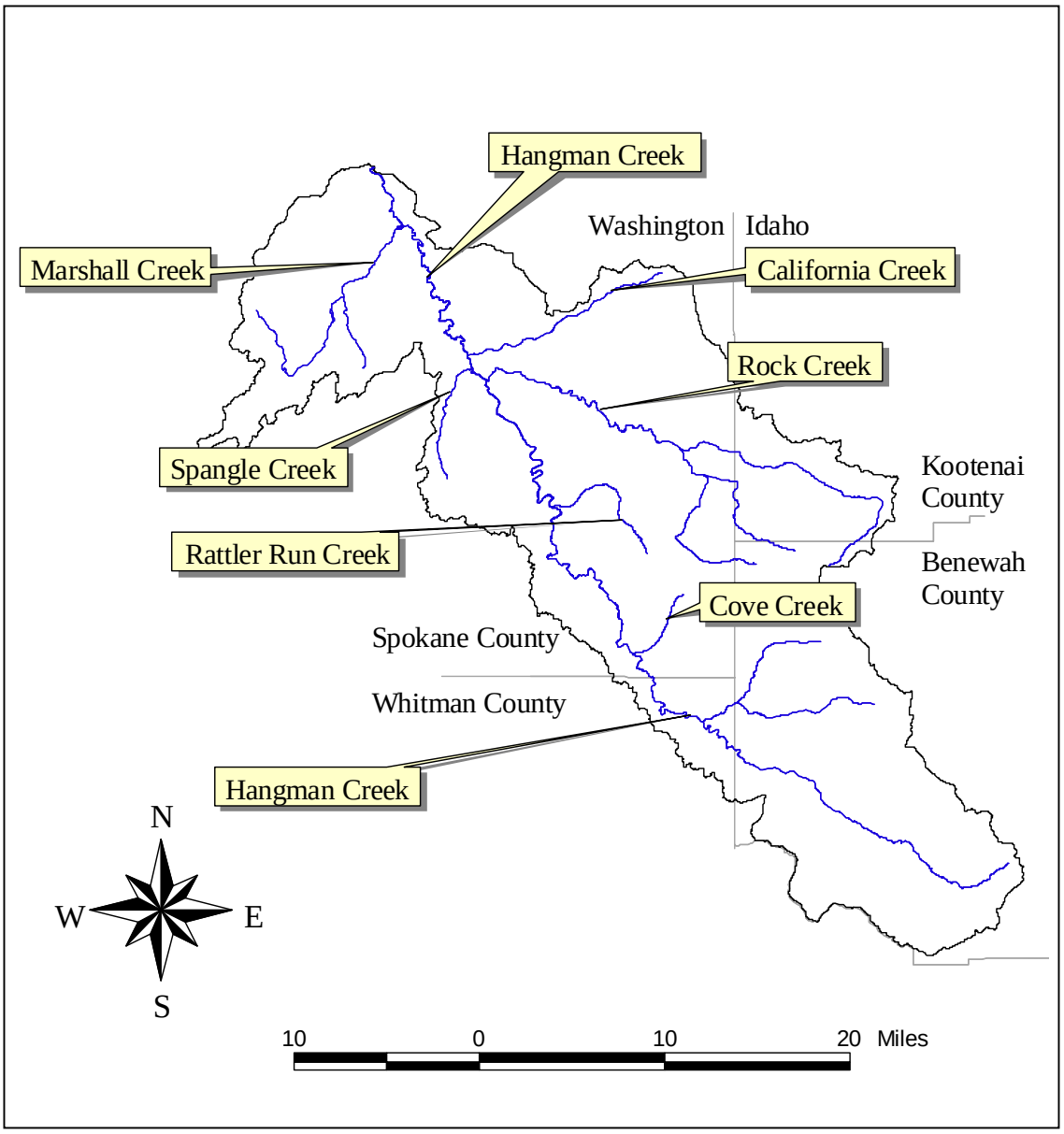

Figure 1: Location Map

The watershed also has an undetermined quantity of livestock that have unrestricted access to small tributaries and the mainstem of Hangman Creek. Over the years, the removal of woody vegetation and continuous trampling by livestock has significantly degraded the riparian areas and stream banks. These issues contribute to fecal coliform, temperature, and dissolved oxygen violations that have been documented throughout the basin.

The basin has many small rural towns and two golf courses (with a third currently being developed) located on major tributaries and the mainstem of Hangman Creek. Several of these towns have wastewater treatment plants that discharge directly into a tributary or the mainstem of Hangman Creek (Table 2). The flows during the summer are often inadequate for effluent inputs and may contribute to low dissolved oxygen levels and other water quality violations.

Table 2: Permitted Surface Water Point Source Discharge Locations

Facility	Permit Number	Discharge Location
Cheney WWTP	WA0020842C	Minnie Creek
Fairfield STP	WA0045489C	Rattler Run Creek
Freeman School District #358	WA0045403C	Little Cottonwood Creek
Rockford STP	WA0044831C	Rock Creek
Spangle STP	WA0045471B	Spangle Creek
Tekoa STP	WA0023141C	Hangman Creek

Notes:
1. WWTP is wastewater treatment plant.
2. STP is sewage treatment plant.
3. There are four permitted ground water discharges within the watershed.

The lower reaches of the watershed are moderately urbanized, but future growth projections by the City of Spokane indicate that the Hangman basin will absorb approximately 50 percent of the city's growth over the next 10 years (SRTC, 1997). Past and current development in these areas has removed riparian vegetation and exacerbated the sediment and nutrient loading problems. Additional stormwater runoff from current and newly urbanized areas may also contribute to these loading problems. The unconsolidated sediments in the lower watershed consist mainly of alluvium and flood deposits that are highly erodible.

Fish habitat and distribution throughout the watershed has radically changed over the last one hundred years. Hangman Creek once had viable populations of native trout and healthy runs of salmon and steelhead (SCCD, 1998). The removal of riparian vegetation, channel alterations, and heavy sedimentation has significantly reduced the spawning and rearing habitat on Hangman Creek. The primary species now found in the stream are adapted to warmer, slower waters and considered undesirable as sport fish. Resident trout populations are severely depressed.

Hangman Creek is suspected to be the largest contributor of bedload and suspended sediment to the Spokane River. The majority of the bedload portion of the sediment load is transported downstream and deposited behind Avista's Nine Mile Dam. The suspended sediments continue through the dam's bypass system and settle out in Lake Spokane.

Although the impacts of sediment to Lake Spokane have not been thoroughly studied, high phosphorus and nutrient levels have been correlated to high suspended sediment values (SCCD, 1999, Joe Joy, Ecology - personal communication, 2003).

Both phosphorus and suspended sediment are known water quality issues for both the Spokane River and Lake Spokane. The Department of Ecology Dissolved Oxygen draft pollutant loading assessment for the Spokane River and Lake Spokane indicates that numerous historic studies have identified phosphorus loading to Lake Spokane to be directly responsible for low dissolved oxygen, excessive phytoplankton populations, and overall poor water quality during the summer period. The studies also indicate that the poor water quality can be directly related to upstream sources. The pollutant loading assessment also identifies higher nutrient concentrations in both Hangman Creek and the Little Spokane River, compared to the Spokane River at the Stateline.

The DOE recognized Hangman Creek as an impaired Washington State waterway and identified it on the 1998 303(d) list. Hangman Creek was listed for exceedances in temperature, low dissolved oxygen, pH values, and fecal coliform bacteria concentrations. These listings only identified two short reaches of the creek, near the mouth and near the Town of Tekoa. More recent studies undertaken by the Spokane County Conservation District and others have confirmed that these problems are more widespread, and that other water quality problems are present.

It is not difficult to assess the outcome of the future for water quality in the Hangman Creek watershed if the current situation is not addressed. The lower watershed will be subjected to heavy urban development. Throughout the watershed, agricultural producers will continue to farm to the edges of the creek, livestock will trample the banks and pollute the water, the creek will discharge hundreds of thousands of tons of sediment into the Spokane River, and fish habitat will dwindle until only warm water species thrive. In summary, all beneficial uses will continue to be impaired.

Previous Studies and Work

There are two main sources of water quality data on Hangman Creek. The Department of Ecology maintains a long-term station near the mouth. The Spokane County Conservation District conducted a basin-wide water quality study in the mid-1990's. There are other sources of water quality data, but they are disjunct and limited in scope. Temperature, suspended sediment, turbidity, nutrient, dissolved oxygen, and pH have been the primary parameters measured.

The Washington State Department of Ecology

Water Quality Monitoring Station # 56A070 Hangman Cr at Mouth. This station is considered a long-term station (1970 – 2003).

Water Quality Monitoring Station # 56A200 Hangman Creek at Bradshaw Road. This station was only sampled from October 1998 through September 1999.

The Spokane County Conservation District

Basin-wide water quality study (1994 – 1997) – five different stations (mainstem and tributaries)
Sediment Study – 1998-1999 – suspended and bedload concentrations
Paired watershed BMP evaluation data (1997-1998) –on two small sub-watersheds
Rattler Run farm planning and BMP Implementation Project Data
Instream Flow Study – temperature, flows (2002)
Seepage run flow and water quality data, September 2001

Documented Water Quality Exceedances

Temperature: For cold-water biota and trout, the duration of temperature exceedances is as important as the number of exceedances. Hangman Creek has continuously violated this water quality parameter for decades. The fisheries in the basin have suffered and gradually moved towards the dominance of warm water species. The long-term ambient data collected monthly by Ecology and the more recent data collected by the SCCD have shown the temperature problem is widespread and severe.

Instream Flow Recommendation (Water Temperature Monitoring) - The results of continuous water temperature monitoring of several of the stations over a six-month period averages approximately 20 °C, and the average maximums are between 25 and 27 °C.

Seepage Runs – Water quality samples and discharge measurements were taken at 18 sites on a single day along the main stem of Hangman Creek on September 9th 2001. The water samples were taken to evaluate the low flow water quality conditions (See Tables 3 and 4) and to characterize the ground water input to the creek. Seepage runs were also conducted on July 18th and September 4th in 2002.

Other Areas of Concern.

The lower reaches of the watershed are moderately urbanized, but future growth projections by the City of Spokane indicate that the Hangman basin will absorb approximately 50 percent of the city's growth over the next 10 years (STRC 1997). Past and current development in these areas has removed riparian vegetation and exacerbated the sediment and nutrient loading problems. The unconsolidated sediments in the lower watershed consist mainly of alluvium and flood deposits that are highly erodible. Most of the suspended sediment load comes from non-point sources such as roads, annual cropland, and eroding streambanks (SCCD, 1994). A recent sediment sampling study indicated that the total annual sediment load discharged from the mouth of Hangman Creek for 1998 and 1999 was estimated at 52,000 tons and 211,000 tons respectively (SCCD 2000). The average annual flow for 1998 was 166 cfs and for 1999 it was 315 cfs. Field erosion is suspected to be the primary contributor to suspended sediment loads.

The severity of the water quality violations in Hangman Creek has remained high for many decades. Routine water quality samples were taken over a three-year period (1994 – 1997) at five sites, along with selected samples during high flow events to characterize the water quality of the Hangman Creek watershed. Discharge measurements, or discharge values estimated from stage measurements were routinely made along with the

water quality sample collection. The five monitored sites were: Hangman Creek at the Idaho state line, Little Hangman Creek, Rattler Run Creek, Hangman Creek at Bradshaw Road, and Rock Creek at Jackson Road. All stations monitored (Table 5) exceeded one or more of either the Washington State Class A Water Quality standards or EPA standards (Table 6).

Table 3: Conservation District Seepage Run Water Temperature Results

Temperature (°C)			
	2001 September 9	**2002 July 18**	**2002 September 4**
Stateline	12.6	21.0 e	NM
HC at Tekoa	16.3	26.0 e	NM
HC at Marsh Rd	16.0	29.2 e	NM
Cove Creek	13.1	18.5 e	NM
HC at Roberts Rd	17.6	27.3 e	19.1e
Rattler Run Creek	13.8	17.0	NM
HC at Bradshaw Rd	18.4 e	25.9 e	17.6
HC at Keevy Rd	19.2 e	NM	14.3
HC u/s Rock Ck	20.4 e	23.8 e	15.6
Rock Creek	19.9 e	24.4 e	16.0
HC u/s California Ck	18.8 e	26.6 e	NM
California Ck	16.0	18.0 e	NM
HC at HV Golf Course	20.7 e	28.6 e	16.3
HC at Grunte Home	20.3 e	26.7 e	15.4
HC at Yellowstone	21.2 e	25.1 e	16.4
HC u/s Marshall Ck	20.5 e	22.7 e	14.3
Marshall Ck	17.5	16.0	8.0
USGS Gage site	18.2 e	NM	NM

Notes:
1. e is exceeds Ecology standard.
2. NM is not measured.
3. u/s is upstream.

All sites exceeded the background turbidity values established at Hangman Creek at the Idaho state line. All sites met the fecal coliform geometric mean limit, but exceeded the limit of less than 10 percent of the samples that are allowed to be greater than 200 colonies per 100 ml of sample. Nitrate levels exceeded EPA limits on all the tributaries, but not on Hangman Creek at either the Idaho state line or Bradshaw Road. Nitrite levels exceeded the more restrictive EPA limits for cold water fisheries only on Little Hangman Creek and Rattler Run Creek. The EPA drinking water nitrite limit of 1.0 mg/l was not exceeded at any site. The ammonia criteria was exceeded only at the Rattler Run site. All sites exceeded total phosphorus EPA limits. Most of the total phosphorus exceedances were during the winter, however both Little Hangman Creek and Rattler Run Creek exceeded the limit throughout the year. Rattler Run Creek exceeded the total phosphorus limit on every sample collected. Temperature and dissolved oxygen limits

were exceeded at all sites. The pH limits were exceeded at Rattler Run Creek, Hangman Creek at Bradshaw Road, and Rock Creek.

Other parameters measured during the September 6, 2001 seepage run are detailed in Table 4.

Project Objectives:
The data collected to date have shown that several water quality parameters do not meet state and federal standards and that beneficial uses are not being met. These data are not yet adequate to fully describe the sources and transport mechanisms necessary to derive TMDLs, and to calculate the various source load reductions required to meet water quality standards.

Table 4: Seepage Run Parameter Summary

	Discharge (cfs)			Total P (µg/l)	Fecal Coliform (colonies /100ml)	pH (units)	Dissolved Oxygen (mg/l)	Temperature (°C)		
	2001 Sept 6	2002 July 18	2002 Sept 4	2001 Sept 6	2001 Sept 6	2001 Sept 6	2001 Sept 6	2002 July 18	2002 Sept. 4	2001 Sept 6
Stateline	0.23	0.15	0.16	63	59	7.21	7.14[e]	12.6	21.0 [e]	NM
HC at Tekoa	0.29	1.48	0.72	79	28	7.94	11.49	16.3	26.0 [e]	NM
HC at Marsh Rd	0.55	2.19	1.21	64	46	7.70	10.05	16.0	29.2 [e]	NM
Cove Creek	0.07	0.18	0.11	100	190	7.65	10.32	13.1	18.5 [e]	NM
HC at Roberts Rd	0.62	2.99	1.66	77	16	7.86	9.41	17.6	27.3 [e]	19.1
Rattler Run Creek	0.08	0.23	0.15	256 [e]	310 [e]	7.81	9.24	13.8	17.0	NM
HC at Bradshaw Rd	0.59	3.75	1.43	97	16	8.00	7.61 [e]	18.4 [e]	25.9 [e]	17.6
HC at Keevy Rd	0.35	3.32	1.10	58	2	8.64 [e]	11.55	19.2 [e]	NM	14.3
HC u/s Rock Ck	1.62	5.62	2.31	72	7	9.23 [e]	16.64	20.4 [e]	23.8 [e]	15.6
Rock Creek	0.41	1.33	0.74	35	790 [e]	9.15 [e]	8.37	19.9 [e]	24.4 [e]	16.0
HC u/s California Ck	1.77	5.73	2.47	74	4	8.93 [e]	10.21	18.8 [e]	26.6 [e]	NM
California Ck	0.04	0.59	0.12	95	290 [e]	8.34	10.23	16.0	18.0 [e]	NM
HC d/s Golf Course	1.43	7.07	3.72	32	19	8.52 [e]	13.90	20.7 [e]	28.6 [e]	16.3
HC at Grunte Home	1.33	8.21	2.80	41	17	8.18	10.86	20.3 [e]	26.7 [e]	15.4
HC at Yellowstone	1.33	8.85	2.40	29	3	8.29	10.75	21.2 [e]	25.1 [e]	16.4
HC u/s Marshall Ck	1.20	9.76	3.47	32	2	7.83	10.58	20.5 [e]	22.7 [e]	14.3
Marshall Ck	.60	0.98	1.74	65	1600 [e]	7.56	7.56 [e]	17.5	16.0	8.0
USGS Gage site	4.30	14.0	10.0	22	65	8.17	12.56	18.2 [e]	NM	NM

Notes:

1. Total Phosphorus is not listed on the 1998 DOE 303(d) list, but exceedances of EPA recommended levels have been documented in previous SCCD sampling within the Hangman Creek watershed.
2. Fecal coliform was considered an exceedance if greater than 200 colonies per 100 ml sample. Not enough samples were obtained to adequately characterize exceedances.
3. HC is Hangman Creek.
4. u/s is upstream.
5. d/s is downstream.
6. e indicates an exceedance of DOE water quality standards, except for total phosphorus which is an EPA recommended limit.
7. There were no exceedances for nitrate, nitrite, or ammonia. Two ammonia samples had corresponding pH values greater than 9.00. The exceedances criteria are dependent on pH, and the pH limit used in the calculation of exceedances is 9.00. For the samples with pH values greater than 9.00, extrapolations were used to estimate the limits.

Table 5: Historic Water Quality Exceedances

Parameter		Hangman Creek at the Idaho State Line	Little Hangman Creek	Rattler Run Creek	Hangman Creek at Bradshaw Road	Rock Creek at Jackson Road
Turbidity Low Flows	Exceedances	NA	7	7	1	6
	Number of Samples	NA	19	41	16	44
Turbidity High Flows	Exceedances	NA	6	6	14	46
	Number of Samples	NA	10	10	23	63
Fecal Coliform	Percent > 200 col/100 ml	16	24	30	15	27
Nitrate NO_3	Exceeds EPA Limit	0	1	14	0	3
	Number of Samples	25	25	57	27	59
Nitrite NO_2	Exceeds EPA Limit	0	1	2	0	0
	Number of Samples	25	25	57	27	59
Ammonia	Exceedances	0	0	4	0	0
	Number of Samples	24	24	47	19	50
Total Phosphorus	Exceeds EPA Limit	10	18	57	14	34
	Number of Samples	25	25	57	29	61
pH	Exceedances	0	0	8	5	3
	Number of Samples	25	25	53	23	58
Dissolved Oxygen	Exceedances	7	8	1	6	7
	Number of Samples	19	20	51	25	57
Temperature	Exceedances	7	5	1	11	14
	Number of Samples	25	30	76	33	88

Notes:

1. NA is not applicable. Turbidity values from Hangman Creek at the Idaho state line were used as background values to establish the limits for the rest of the sample sites.
2. For turbidity, the low flows are less than 100 (10 for Rattler Run Creek) cfs and the high flows are greater than 100 (10 for Rattler Run Creek) cfs.
3. The number of temperature exceedances is for grab samples only. Continuous temperature recorders were installed at some sites, but the exceedances recorded by the continuous temperature recorders are not included here.
4. For Nitrate, Nitrite, and Total Phosphorus, the EPA recommended limits are used. No Washington State Standards for these parameters are presently contained in the Water Quality Standards for Surface Waters of the State of Washington.

5.0 Project Description

Goals

The problems this study is attempting to evaluate are:

- Characterize fecal coliform, suspended sediment, and phosphorus loading from various parts of the basin.
- Obtain additional data to assist with 303(d) list determinations and a set of total maximum daily load (TMDL) evaluations on fecal coliform, total phosphorus, and suspended sediment/turbidity.

From these problem evaluations, the following decision statements were developed:

- Determine whether the parameter concentration exceeds current Ecology water quality standards and requires the reach to be placed on the 303(d) list and included in the upcoming TMDL cleanup plan.
- Determine if certain land uses cause significant increases in monitored parameters and requires the land use to be modified in the upcoming TMDL cleanup plan.

Answers we need from the data:

- What are the fecal coliform loads from Idaho, selected major tributaries, nonpoint sources, stormwater, and reaches of the main stem?
- What are the total phosphorus and suspended sediment loads from Idaho, selected major tributaries, municipal wastewater treatment plants, and reaches of the main stem?
- How do fecal coliform, suspended sediment, and phosphorus loads vary during the winter and spring at flow events greater than 2,000 cfs?
- What are the severity and geographic scope of other water quality problems that should be addressed in the future?

Project Objectives will reflect the goals and decision statements by:

- Conducting monthly monitoring from December through July to provide additional data for determining the fecal coliform, total phosphorus, suspended sediment, and associated parameter loads within the Hangman Creek basin.
- Conducting monitoring during three events when discharge in the creek is greater than 2,000 cfs to determine fecal loading during the rising and falling hydrograph.
- Coordinating monthly monitoring with municipal treatment plant effluent sampling conducted by treatment plan staff.
- Coordinating (or expanding) sampling at Spokane CSOs discharging to Hangman Creek during rain events concurrent with routine or event monitoring.
- Characterizing fecal coliform loading from a livestock grazing area along the creek.

Objectives

The objective of the study is to determine where and under what conditions water quality parameters (fecal coliform, suspended sediment, and total phosphorus) exceed Ecology standards or EPA recommended levels, and if certain land uses are contributing to significant increases in monitored parameters. The target population is the representative stream sample from tributaries and mainstem reaches in the watershed that have not been fully characterized in the past. The sample locations will be sampled over a range of normal flow conditions (higher flows during the winter months and low flows during the spring and summer months) and rapidly changing flow conditions (runoff events where Hangman Creek, as monitored by the USGS gage, is expected to exceed 2,000 cfs).

For each parameter sampled, the statistic used to describe the target population will be the level of exceedance outlined in Table 6. Turbidity and TSS will be evaluated for the possibility of using turbidity as a surrogate for suspended sediment to determine criteria compliance. The listing policy will follow the Water Quality Standards for Surface Waters of the State of Washington, Chapter 173-201A WAC, amended July 1, 2003. Mean, maximum, and minimum statistics will also be included. Instantaneous and/or seasonal loads will be calculated for each site. The scope of the decisions will include all samples collected through July 2004. The action level is detailed in Table 6, and any sites that have samples that exceed the action level will be recommended for placement on the Ecology 303(d) list and inclusion in the upcoming TMDL cleanup plan. Any alternative courses of action for individual sites or parameters will be outlined in the upcoming TMDL clean up plan.

The decision-rule statement for this project is as follows:
If any sample results exceed the limits or guidelines presented in Table 6, the site and parameter will be recommended for placement on the Ecology 303(d) list and inclusion in the upcoming TMDL cleanup plan.

Table 6: Washington Class A water and EPA Standards for Selected Parameters

Parameter	Washington Class A Waters	EPA
Temperature (°C)	≤ 18	NA
Dissolved Oxygen (mg/l)	>8.0	>5.0
Fecal Coliform (geometric mean of all samples is less than the stated number of colonies/100ml) (less than 10 % of the samples exceed the stated number of colonies/100ml)	100 200	200 400
pH (units)	6.5-8.5	NA
Turbidity Background <50 NTU Turbidity Background >50 NTU	< 5 NTU increase < 10 % increase	Less than 10 % reduction in depth of photosynthetic zone 1.45 NTU
Total Phosphorus (mg/l)	NA	0.030
Nitrate + Nitrite (mg/l)	NA	0.072
Nitrite (mg/l)	NA	0.06 or 1, see Notes
Ammonia (mg/l)	Varies with Temperature and pH [8,9]	Varies with Temperature and pH [8,9]

Notes:

1. NA is not applicable.
2. NTU is Nephelometric Turbidity Units.
3. The EPA criteria for dissolved oxygen, turbidity, and the lower nitrite standard are the recommended limits for cold water fisheries (1976 Criteria).
4. The EPA criteria for fecal coliform is the recommended limit for swimming and bathing (1976 Criteria).
5. The EPA criteria for total phosphorus is the recommended limit to prevent eutrophication.
6. Ecoregion 10 reference conditions for turbidity, total phosphorus and nitrate + Nitrite are based on the 25th percentile for all seasons (USEPA, 2000).
7. The EPA upper nitrite criteria and nitrate criteria are the recommended limits for drinking water.
8. Ammonia acute criteria shall not exceed a 1-hour average concentration once in every three years calculated as: Maximum = 0.52/[(FT)(FPH)(2)]. $FT = 10^{[0.03(20-TCAP)]}$ when TCAP≤ T ≤ 30. TCAP = 20°C when salmonids are present, and 25°C when salmonids are absent. $FT = 10^{[0.03(20-T)]}$ when 0 ≤ T ≤ TCAP. FPH = 1 when 8 ≤ pH ≤ 9. $FPH = (1+10^{7.4-pH})/1.25$ when 6.5 ≤ pH ≤ 8.
9. Ammonia chronic criteria shall not exceed a four day average concentration once every three years calculated as: Maximum = 0.80/[(FT)(FPH)(RATIO)], where TCAP = 15°C when salmonids are present, and 20°C when salmonids are absent. FT and FPH are as detailed in Note 8, and RATIO = 16 when 7.7 ≤ pH ≤ 9, and $RATIO = [(24)10^{7.7-pH}]/(1+10^{7.4-pH})$ when 6.5≤ pH≤7.7.

6.0 Data Quality Objectives

The data quality and measurement quality objectives are outlined in Table 7. For low concentrations, considered to be an order of magnitude greater than the laboratory minimum detection limit, the accuracy limit will be considered three times the detection limit.

Table 7: Data Quality Objectives

Parameter	**Accuracy (percent deviation from true value, except pH)**	**Precision (percent relative standard deviation, except pH)**	**Bias (percent of true value)**	**Minimum Detection Limits**
pH	0.30 units	0.10 units	0.10 units	NA
Temperature	20	10	NA	NA
Conductivity	20	10	NA	NA
Dissolved Oxygen	20	10	NA	NA
Suspended Solids	40	25	10	2
Turbidity	30	15	10	0.05
Nitrates	30	10	10	0.01
Nitrites	30	10	10	0.01
ammonia as N sample value < 0.1 mg/l	50	40	10	0.01
ammonia as N sample value ≥ 0.1 mg/l	30	20	10	0.01
Phosphorus	30	10	10	0.005
Fecal coliform	NA	25	NA	1

Notes:

1. NA is not applicable.
2. Ammonia RSD are split depending on the sample value because low sample values may have small numerical differences that could be very large percentage differences. For example, a sample result of 0.01 mg/l and a duplicate result of 0.02 mg/l show a small numerical difference (0.01 mg/l) but a large percentage difference (100 percent).

7.0 Sampling Design

This project is designed to evaluate the water quality of tributaries and select reaches of Hangman Creek for determining fecal coliform, total phosphorus, and suspended sediment loads. The tributaries and reaches (Figure 2) were selected based on an evaluation of previous water quality sampling work. Rock Creek, Spangle Creek, Cove Creek, California Creek, and Marshall Creek were selected because they have generally had monitoring limited to a single sample near the mouth. The HB 2514 planning committee identified the sites on Hangman Creek (except for the livestock area) in 2003 as areas needing further evaluation. The sites integrate water quality characteristics from several sources and upstream reaches. The livestock area was selected to specifically evaluate the influence of livestock grazing near the creek on fecal coliform levels for the upcoming TMDL cleanup plan. The upstream livestock sample site is currently awaiting landowner approval. If approval is not obtained, the upstream site will be moved to Keevy Road.

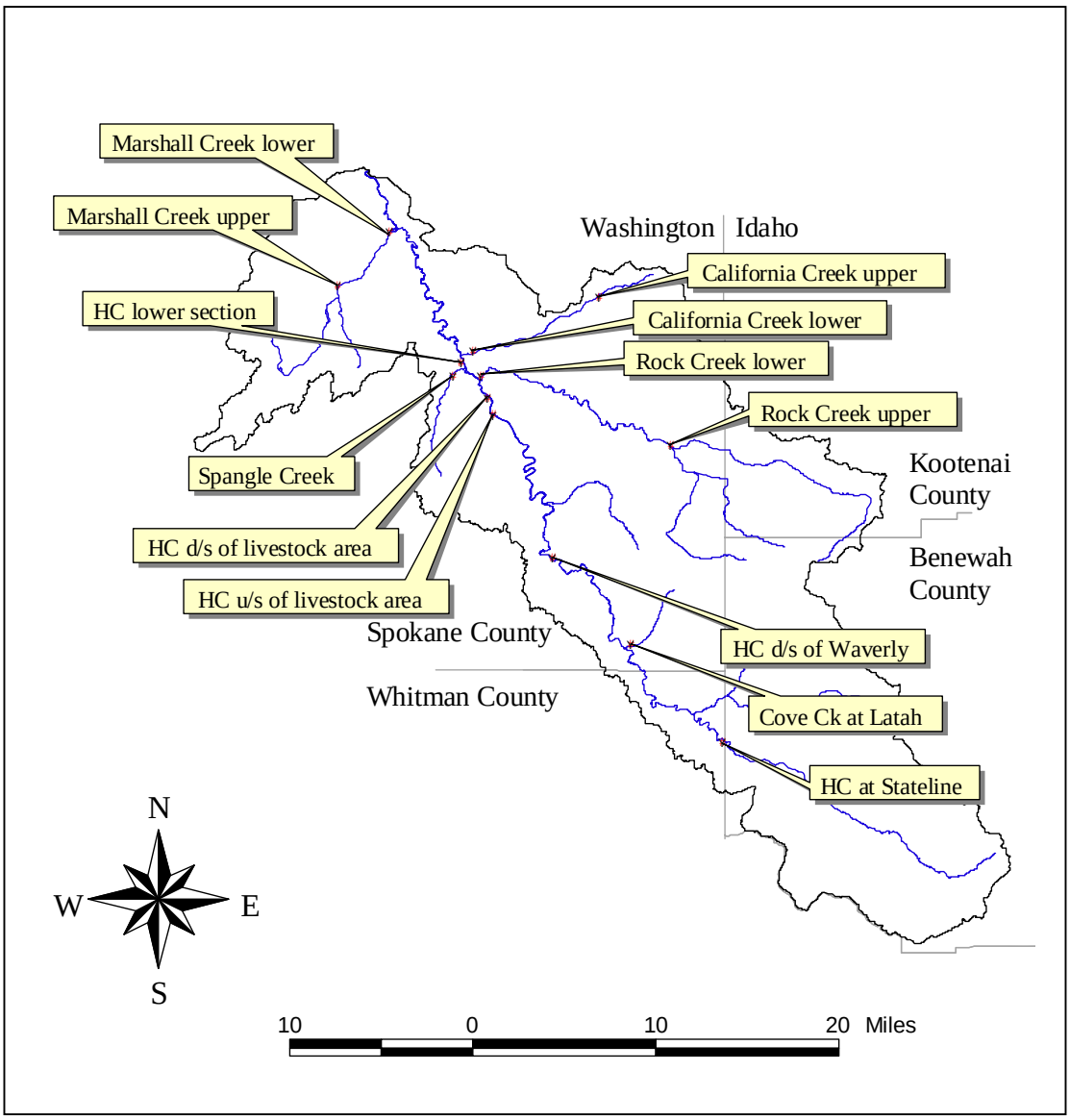

Figure 2: Sample Site Locations

Total phosphorus samples will be collected by municipal WWTP and STP personnel in coordination with project sampling times. Additional fecal coliform samples will be collected from combined sewer overflows (CSO) and Hangman Creek near the mouth (at the USGS gaging site). CSOs only flow during significant storm events, and sampling will be coordinated with current City of Spokane sampling schedules if possible.

Samples will be collected from upstream sites to downstream sites, but will not be timed to sample changes in a single block of water. Two type of samples will be collected, routine and event. Routine samples are samples collected on a regular monthly basis. Routine samples may be collected over two days if flow conditions are stable. Event samples are collected to evaluate the effects of significant flow events on water quality. For event sampling, samples will be collected on the rising limb and falling limb of the

hydrograph, if possible. Events are defined as a Hangman Creek flow that is expected to exceed 2,000 cfs at the mouth as measured by the USGS gage. The USGS gage has a web-based monitoring system where the flows are updated and graphed every four hours. Real time data can be obtained by calling the gage house and obtaining the actual stage measurements. The instantaneous stage measurement can then be converted to a stream flow using the current stage-discharge rating.

Stream discharge measurements or estimations will be completed with all samples at all sites. Because of the time involved in sampling and measuring discharge, three sampling teams will be used for each sample run. One sampling team will sample all sites that can be sampled by wading for both the sample collection and the discharge measurements. The second sample team will sample sites that can be sampled by wading, using a boat and a tag line, or a hand line from a bridge. The third team will sample all sites that are only accessible using a bridge crane or truck mounted boom. Water quality samples will generally be collected first, and discharges measured or estimated later. During routine sampling, depending on flow levels, discharge measurements may be done at the time of sampling collection. During event sampling, flows will be measured or estimated after all water quality samples are collected.

The project design calls for the collection of: nutrients (phosphate, nitrate, nitrite, and ammonia), sediment (suspended solids and turbidity), and biological (fecal coliform bacteria). For the CSOs, Hangman Creek near the mouth, and the upper livestock site, these sites will be sampled for fecal coliform bacteria only. The lower livestock sample site will be sampled for all parameters. Waster water treatment plants and sewage treatment plants will collect total phosphorus samples in additional to their normal required parameters. All field sample sites will also measure dissolved oxygen, conductivity, pH, and temperature at the time of sample collection.

8.0 Field Procedures

Field sampling procedures will be completed to minimize disturbance to the stream environment. Samples that will be collected by wading into the stream will be collected upstream from the entry point.

The fecal coliform bacteria samples will be sampled using grab samples. Fecal coliform samples will be placed in autoclaved sample bottles. Nutrients will generally be analyzed from the suspended sample (this provides a channel and vertically integrated sample – see below). For grab samples, the bottle is uncapped, inverted, and submerged to a depth near the streambed without making contact. Sample bottles will be kept away from the streambed to prevent the collection of debris and bed load from the stream bottom. At this point the bottle is slowly turned upright with the mouth angled towards the direction of flow. As the bottle is turned upright, it is raised through the water column at a rate that will allow the container to be filled just before it reaches the water surface. This prevents sampling the water-air interface of the stream. The full bottle is then capped under water without retaining any air. Details on sample containers, preservation, and holding times are located in Table 8. Samples will be stored in the dark and on ice. Samples will be delivered to the Spokane Tribal Laboratory by district vehicle within 24 hours.

Table 8: Field Procedures

Parameter	Sample Size (milliliters)	Container Type	Preservation	Holding Time
Suspended Solids	Various	Glass or Plastic	Hold < 4 °C	48 hours
Turbidity				
Nitrates	500	HPDE Poly	Hold < 4 °C	24 hours
Nitrates				
Ammonia				
Phosphorus				
Fecal coliforms	500	Sterile Poly	Hold < 4 °C	<30 hours

Notes:
1. The sample size for suspended solids and turbidity will vary by the number of verticals. Sample size could be approximately from 0.5 to 3.0 liters.
2. All samples will be turned into the laboratory at the same time; therefore the shortest holding time (24 hours) will be used for all samples.

For nutrients and sediment sampling, the USGS equal width increment (EWI) sample method will be used when possible. The EWI samples will be taken according to U.S. Geological Survey (USGS) techniques in *Field Methods for Measurement of Fluvial Sediment* (Edwards T. K. and Glysson G. D., 1988). Samples obtained by the EWI method require a sample volume proportional to the amount of flow at each of the equally spaced verticals in a cross section. This equal spacing between the verticals yields a gross sample volume proportional to the total streamflow. For streams over five feet wide, a minimum of 10 verticals will be used. For streams under five feet wide, as many verticals as possible will be used spaced at a minimum of three inches.

EWI samples will be obtained using US Geological Survey standard depth-integrated samplers. The samplers use pint or quart glass bottles or three liter plastic bottles for sample collection. Sample bottles will be rinsed three times with deionized water.

For sediment samples during event sampling (and possibly at some routine sample sites), standard box samples will be obtained and a box coefficient calculated. Box samples are samples from a selected single sample point, and are used when time does not permit a complete EWI measurement. A single vertically integrated sample is collected at the point to represent the sample. Later when time is not critical in the sampling run, full EWI samples are collected and compared to box samples collected at the same time and a correction coefficient is estimated (a box coefficient). All box sample results are multiplied by the box coefficient to estimate the true sediment concentration. Box samples are used during the event sampling because of the need to collects samples a quickly as possible because the flow conditions are constantly changing.

Discharge measurements will be completed following standard USGS procedures outlined in *Rantz and others, 1982*. During periods when time does not allow standard discharge measurements (such as during events where water quality samples are being collected rapidly) normal depth calculations will be used. The sample sites will be setup and surveyed to measure cross-section water surface elevation and water surface slope through the cross-section. Several discharge measurements will be completed during non-event times to back calculate the roughness coefficient (Manning's *n* value) for use in the normal depth calculations (Henderson, 1966).

All sample containers will be labeled with:

- Site identification
- Sample date and time
- Samplers initials
- Sample parameters

For Fecal coliform samples, the laboratory will be notified if the sample is suspected to result in high counts, and the laboratory will do additional dilutions to cover a wider range of possible results. Replicate samples will be labeled to prevent the laboratory from knowing the actual sample site. Artificial site locations and times will be placed on the sample bottles and the actual times and locations noted in the field logbook.

Field notes and activities will be documented on dated field sheets. Changes will be made by drawing a line through the error, initialing the lineout, and writing the correct entry. Notes will include information such as:

- Site location
- Personnel
- Any problems encountered or changes to sampling routine
- Site and weather conditions
- Samples collected
- Field measurement results

- Quality control samples collected and pseudo-identification used

9.0 Laboratory Procedures

The Spokane Tribal Laboratory was selected to analyze samples for this project. The Spokane Tribal Laboratory is accredited with the Washington Department of Ecology (Accreditation #T004) for all parameters to be analyzed (see Table 9). The Spokane Tribal Laboratory quality assurance plan is included in Appendix A.

Table 9: Laboratory Procedures

Parameter	**Sample Matrix**	**Expected Range of Results (mg/l unless noted)**	**Laboratory Detection Limits**	**Analytical Method**
Suspended Solids	Surface Water	DL – 2,000	2 mg/l	EPA 160.2
Turbidity	Surface Water	DL – 200 NTU	0.05 NTU	EPA 180-1
Nitrites	Surface Water	DL – 1.00	0.01mg/l	EPA 300.0
Nitrates	Surface Water	DL – 10.0	0.01mg/l	EPA 300.0
Ammonia	Surface Water	DL – 2.00	0.01mg/l	EPA 350.1
Phosphorus	Surface Water	DL – 5.00	0.005mg/l	EPA 365.1
Fecal coliforms	Surface Water	DL –2,000 colonies/100 ml	1 colony/100 ml	Standard Methods 9222D

Notes:
1. DL is detection limit.
2. NTU is Nephelometric Turbidity Units.

10.0 Quality Control

Both quality control and quality assurance are an integral part of this project. Quality assurance consists of the procedures used to control the unmeasurable components of the project. These components consist of such things as sampling at the right placed with the right equipment using the right techniques. The quality assurance aspect of this project has been addressed previously.

The quality control (QC) consists of the data generated to estimate the magnitude of the bias and variability in the processes for obtaining the environmental data. The quality control samples are used to be sure that the sampling process is not influencing the sample results. The data from the QC samples measure errors in the environmental data. The two types of errors measured are bias and variability.

Bias is systematic error inherent in a method or measurement system. The error can be positive (contamination) or negative (loss). Variability is random error in independent measurements as the result of repeated application of the same process under specific conditions.

Data generated from quality control samples are a requisite for evaluating the quality of the sampling and processing techniques. The quality control data also are used to evaluate the samples themselves. Without QC data, environmental sample data cannot be adequately interpreted because the errors associated with the sample data are unknown. The various types of QC samples collected during this project are described below.

Blank Samples

Blank samples are collected and analyzed to ensure that environmental samples have not been contaminated by the overall data-collection process. The blank solution used is a solution that is free of the analytes of interest. Any measured value signal in a blank sample for an analyte that was absent in the blank solution is believed to be due to contamination. Bias in the collection of samples due to contamination will be evaluated using field blanks.

Field blanks consists of a blank solution that is subjected to all aspects of sample collection, field processing, transportation, and laboratory handling as an environmental sample. If contamination is found in the field blank, other blanks, known as topical blanks, will be evaluated to segregate different parts of the overall data-collection process. The other types of topical blanks that could be evaluated on an “as-needed” basis are:

- Trip blanks
- Equipment blanks
- Source solution blanks
- Ambient blanks

It is not anticipated that any of the above topical blanks will be required or sampled.

Reference Samples

Reference samples consists of reference solutions prepared by a laboratory whose composition is certified for one or more properties so that they can be used to assess measurement methods. Samples of reference material are submitted for analysis to ensure that an analytical method is accurate for the known properties of the reference material. The selected reference material properties will be similar to the environmental sample properties. No spiked samples are scheduled for this project. Reference samples are scheduled to be included twice during the project.

Replicate Samples

Replicate samples, also referred to as duplicated samples, are a set of environmental samples collected in a manner such that the samples are thought to be essentially identical in composition. Replicate samples are collected and analyzed to establish the amount of variability in the data contributed by some portion of the collection and analytical process. Several types of replicate samples are possible, but the type collected for this project will be predominantly concurrent replicate samples. Concurrent samples are samples collected simultaneously, or by alternating subsamples between two or more collection bottles. In some cases, sequential samples may be collected. Sequential samples are a replicate sample in which the samples are collected one after the other, typically over a short period of time.

Replicate samples for fecal coliform bacteria, nutrients, and sediment will be collected throughout the project during routine sample runs because of the speed required to obtain the event samples during changing flow conditions. For the routine sample runs, 13 sites will be sampled monthly. During these runs, approximately 128 fecal environmental samples are scheduled to be collected, 108 nutrients and sediment environmental samples are scheduled to be collected, and 45 concurrent replicate samples for fecal, sediment and nutrients are scheduled to be collected. Some fecal sampling locations, such as CSOs, will only be samples when flowing.

Along with the replicate samples, six field blanks each for fecal, sediment, and nutrients will be collected. Two reference samples will be submitted for nutrients. The reference samples will be obtained from the USGS Denver laboratory.

Suspended Sediment – special handling

Suspended-sediment concentrations are determined from samples collected by using depth-integrating samplers. Samples usually are obtained at several verticals in the cross-section, or a single sample may be obtained at a fixed point and a coefficient applied to determine the mean concentration in the cross-section.

Sediment samples collected at several verticals usually fill several samples bottles from the depth-integrating samplers. Samples with more than one collection bottle will be combined in the field and a subsample collected for analysis. Three composite samples will be evaluated for variability. Once the complete composite sample is collected, the

subsample for analysis and three replicate samples will be collected and analyzed by the laboratory.

Samples obtained from a single sample at a fixed point will be corrected with a coefficient applied to determine the mean concentration in the cross-section. The single sample from a fixed point, along with a complete composite sample from the full set of verticals will be collected simultaneously. Both samples will be submitted to the laboratory for analysis.

11.0 Data Management Procedures

Optional – not included.

12.0 Audits and Reports
Optional – not included.

13.0 Data Review, Verification, and Validation

A data quality assessment will be performed after completing the field and laboratory activities. The field records, including field sample collection forms, will be organized and reviewed for accuracy and completeness.

Analytical data is expected to be received from the laboratory in both hard copy and electronic formats. The data will be logged in, reviewed to ensure that all analytical requests are present, organized in files, and catalogued. A complete set of data files, both hard copy and electronic, will be maintained in the project files. Data review procedures associated with the monitoring samples includes evaluating sample holding times, field duplicate, and laboratory duplicate samples.

Quality Control Procedures

Approximately 45 randomly selected environmental samples will also have duplicate samples collected. The duplicate sampling sites were chosen at random during the sampling design. The laboratory staff will not be informed of the sample identity until all samples from that event are analyzed. Six blanks will be submitted as samples to the laboratory. Blank samples will undergo all the processing a normal field sample receives, including running through the USGS sampler.

The contract laboratory has been certified by the Washington Department of Ecology. The laboratory conducts quality assurance checks that are provided with each sample set data results. The routine laboratory QC procedures used by the Spokane Tribal Laboratory have been approved by the DOE.

Performance and System Audits

System audits will be conducted monthly, once on the field activities and once on the laboratory results. Field activity audits will determine whether procedures are being followed and documented. All fieldwork activities are documented using field water quality monitoring sheets. The field data that will be recorded on the water quality monitoring sheets are listed below.

- Date of sample collection
- Time of sample collection
- Location of sample collection
- Sample numbers (including associated duplicate and split sample numbers)
- Instrument calibration checks, and
- Notes regarding sample collection, instrument operation, water stage conditions, and weather conditions

The field water quality-monitoring sheet is to be completed by the field team leader and provided to the project coordinator. The project coordinator will record the data in the project database after checking the field sheets for completeness and consistency.

Preventive Maintenance

Field instruments and test equipment will be calibrated according to the manufacturers recommended procedures on a regular basis during sampling activities. Instruments will typically be calibrated at the beginning of the day or prior to taking measurements, unless otherwise specified in the instrument manual.

Data Assessment Procedures

Data from the laboratory analysis will be reviewed to ensure the data quality objectives have been achieved. Data quality will be assessed by using pooled estimates of the standard deviations and the relative standard deviation for each parameter.

The pooled estimate of the standard deviation (S) is given by:

$$\text{Pooled } S = \sqrt{(\sum D^2 / 2m)}, \text{ where:}$$

D = sample value – duplicate value, and

m = the number of sample pairs;

(S. M. Lombard, written commun., 1999).

The pooled relative standard deviation is given by the median value of the relative standard deviation estimated for each sample pair.

The relative standard deviation is given by:

$$\text{RSD (in \%)} = \frac{(|\text{sample value} - \text{duplicate value}| / \sqrt{2})}{(\text{sample value} + \text{duplicate value})/2} (100);$$

(S. M. Lombard, written commun., 1999).

14.0 Data Quality Assessment

The data quality objectives outlined in Section 6.0 will be assessed at the end of the project. The project data will be used to evaluate environmental sample results against a fixed numerical value, or the regulatory standards that could place a stream reach or tributary on the 303(d) list.

The decision process for determining compliance with the water quality standards will initially assume that there is no bias in the sample results. Initial environmental sample results will be compared to the standards for exceedance.

Duplicate results will be used to estimate the standard deviation associated with the project sampling. Replicate analysis will be used to determine the standard deviation.

$$SD = \sqrt{(C_1-C_2)^2/2}$$

$$RSD = \sqrt{((C_1-C_2)^2/2)/(C_1+C_2)/2}$$

The sample/duplicate variability will be estimated using a piecewise linear model. The replicate data will be split into groups based on the ranges of the mean concentrations. The mean standard deviation or relative standard deviation for each range will be computed. A plot of the computed means as linear estimates of standard deviation versus mean concentration will be completed.

The variability determined using the field replicates is assumed to be the true standard deviation (field variability) for all possible samples. The field variability will be used to estimate the uncertainty of the concentrations measured in a single sample and to estimate the minimum difference in means that can be determined with confidence.

Bias will be evaluated using the results from the field blanks. Because of the nature of the parameters being evaluated (nutrients, fecal coliform, and sediment) sample contamination is not expected to be a significant problem. If consistent contamination is found and is not able to be corrected by the use of topical blanks as described in Section 10.0, the action level will be evaluated to account for the bias. If bias is account for, all laboratory results will be reported as received from the laboratory. Any environmental sample results that account for bias will be clearly noted. Both the laboratory results and any results that need to account for bias will be detailed in the report appendix.

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Appendix B
Monthly Data Summary

Notes:

1. e with a discharge indicates the discharge value was estimated using indirect methods.
2. Fecal coliform values for February 4, 2004 samples at H. Spring were not determined because of interference. The Spokane Tribal Laboratory reported that the fecal levels were probably high, but could not be determined from the interference.
3. NTU is Nephelometric Turbidity Units.
4. cfs is cubic feet per second
5. mg/l is milligrams per liter
6. NM is not measured.
7. NS is not samples.
8. col/100 ml is colonies per 100 milliliters.
9. US is upstream
10. DS is downstream
11. Total P is Total Phosphorus.
12. H. Spring is a spring on private property.
13. HC is Hangman Creek.
14. CA Ck. is California Creek.
15. USGS is U.S. Geological Survey.
16. RM is River Mile.

Hangman Creek TMDL Data Compilation for December 10, 2003 Sampling.

Sample Sites	Discharge (cfs)	pH (unit)	Conductivity (*us*)	DO		Temperature °C		TSS (mg/l)	Turbidity (NTU)	Nitrite (mg/l)	Nitrate (mg/l)	Ammonia (mg/l)	Total P (mg/l)	Fecal Coliform col/100ml
				(mg/l)	percent	Air	Water							
HC at Stateline	6.10	6.81	148	9.90	70.1	0.7	1.2	8	30.8	<0.01	1.68	0.03	0.09	120
Cove Ck.	0.25	5.58	287	10.5	77.0	6.5	1.7	6	9.43	<0.01	1.76	0.02	0.12	100
HC at Roberts Road	14.0	5.73	222	5.50	39.0	1.2	0.8	5	5.14	<0.01	0.45	0.02	0.05	15
Keevy Road	17.8	6.88	262	9.55	101	10.3	0.4	NS	NS	NS	NS	NS	NS	29
RC at Rockford	3.21	5.49	277	10.6	NM	-1.0	0.0	<2	4.29	<0.01	2.52	0.10	0.041	3
RC at the mouth	7.79	6.64	328	9.55	67.5	0.9	1.1	2	1.26	<0.01	1.07	0.02	0.03	20
HC at RM-21.0	21.7	7.1	268	12.8	101	3.5	1.2	3	2.37	<0.01	0.49	0.01	0.05	14
HC at Duncan	38.8	6.36	289	7.54	52.4	3.9	1.2	2	1.93	<0.01	0.70	0.03	0.07	8
CC near Marsh Rd	0.31	5.34	60	12.0	83.8	1.5	0.7	<2	4.72	<0.01	0.08	0.01	0.04	5
CC at the mouth	0.65	7.11	282	9.38	66.2	2.1	1.5	<2	0.59	<0.01	1.89	0.01	0.05	<1
SC at the mouth	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry
MC at McKenzie Rd	3.38	7.25	263	9.11	65.5	NM	NM	6	2.32	0.01	1.83	0.05	0.14	6
MC at the mouth	1.27	6.21	265	9.25	64.1	4.7	1.4	13	4.87	0.01	1.66	0.07	0.13	18
HC at USGS gage	32.3	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	26

Hangman Creek TMDL Data Compilation for January 5, 2004 Sampling.

Sample Sites	Discharge (cfs)	pH (unit)	Conductivity (*us*)	DO		Temperature °C		TSS (mg/l)	Turbidity (NTU)	Nitrite (mg/l)	Nitrate (mg/l)	Ammonia (mg/l)	Total P (mg/l)	Coliform col/100ml
				(mg/l)	percent	Air	Water							
HC at Stateline	4.91	6.37	151	10.4	72.4	-2.3	0.1	2	18.2	0.01	3.62	0.06	0.06	31
Cove Ck.	0.33	6.36	296	12.3	83.5	0.0	0.2	8	15.5	<0.01	2.20	0.03	0.08	41
HC at Roberts Road	7.90	6.5	202	11.6	79.3	0.0	-0.1	4	35.1	0.04	6.00	0.13	0.09	2
Keevy Road	9.85	6.63	212	12.5	85.9	-15.0	0.8	NS	NS	NS	NS	NS	NS	5
RC at Rockford	0.74	6.94	269	12.6	87.5	-12.0	0.2	2	3.64	<0.01	3.34	0.03	0.03	2
RC at the mouth	2.43	6.82	336	16.9	117	-13.0	0.6	3	1.30	<0.01	3.79	0.02	0.03	180
HC at RM-21.0	11.8	6.32	250	12.7	87.1	-7.9	-0.2	2	16.5	<0.01	4.35	0.02	0.04	6
HC at Duncan	17.0	6.97	245	20.9	144	-16.0	0.1	4	10.3	<0.01	3.75	0.02	0.04	8
CC near Marsh Rd	NM	7.04	116	14.9	102	<0.0	0.1	<2	4.20	<0.01	0.09	0.02	0.03	1
CC at the mouth	0.88	6.92	257	15.7	108	<0.0	1.1	<2	1.01	<0.01	2.08	0.01	0.05	<1
SC at the mouth	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry
MC at McKenzie Rd	3.10	6.97	254	12.6	86.4	<0.0	0.9	7	2.37	<0.01	1.94	0.09	0.11	22
MC at the mouth	0.32	7.03	58	14.0	96.6	<0.0	0.3	2	1.17	<0.01	2.08	0.08	0.10	10
HC at USGS gage	2	7.21	352	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	16

Hangman Creek TMDL Data Compilation for January 30, 2004 Event Sampling

Sample Sites	Discharge (cfs)	pH (unit)	Conductivity (*us*)	DO		Temperature °C		TSS (mg/l)	Turbidity (NTU)	Nitrite (mg/l)	Nitrate (mg/l)	Ammonia (mg/l)	Total P (mg/l)	Coliform col/100ml
				(mg/l)	percent	Air	Water							
HC at Stateline	1445	6.92	89	13.3	96.5	4.0	2.6	177	201	<0.01	4.39	0.13	0.39	820
Cove Ck.	18.2	7.50	161	12.8	97.5	4.0	3.6	42	47.9	0.01	5.74	0.04	0.39	290
HC at Roberts Road	2050	6.97	120	13.2	95.2	4.0	1.8	160	271	0.02	6.84	0.21	0.52	420
Keevy Road	NM	7.12	134	12.1	86.1	2.9	2.9	NS	NS	NS	NS	NS	NS	420
N. Kentuck Trail	NM	NM	NM	NM	NM	NM	NM	128	73	0.16	24.7	0.67	0.37	NS
RC at Rockford	1100	6.97	193	14.1	98.4	3.0	1.0	154	134	0.02	12.3	0.59	0.45	150
RC at the mouth	1480	7.38	219	13.3	94.3	5.0	1.5	290	189	0.02	13.8	0.58	0.51	160
HC at RM-21.0	1818	7.20	NM	13.1	94.4	6.7	1.5	490	363	0.01	7.77	0.21	0.70	410
HC at Duncan	3201	7.27	170	13.0	97.0	NM	1.9	493	302	0.02	9.98	0.36	0.71	320
CC near Marsh Rd	1.12	7.13	37	19.1	137	4.0	2.0	13	23.4	<0.01	0.25	0.04	0.10	43
CC at the mouth	66.9	6.88	146	20.6	145	3.8	1.8	79	66.7	<0.01	4.59	0.05	0.34	22
SC at the mouth	25.4	6.88	188	20.7	148	3.0	1.0	40	61.3	<0.01	5.75	0.10	0.36	14
MC at McKenzie Rd	4.10	6.89	258	11.6	93.0	4.7	6.1	18	6.99	0.01	1.82	0.12	0.14	6
MC at the mouth	2.23	8.43	263	18.0	141	4.9	5.2	6	2.69	<0.01	1.85	0.02	0.10	37
Above Madison	NM	NM	NM	NM	NM	NM	NM	3	25.1	<0.01	5.84	0.14	0.46	NS
Below Madison	NM	NM	NM	NM	NM	NM	NM	545	502	<0.01	5.66	0.14	0.98	NS
HC at USGS gage	4020	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	900

Hangman Creek TMDL Data Compilation for February 4, 2004 Sampling

Sample Sites	Discharge (cfs)	pH (unit)	Conductivity (*us*)	DO		Temperature °C		TSS (mg/l)	Turbidity (NTU)	Nitrite (mg/l)	Nitrate (mg/l)	Ammonia (mg/l)	Total P (mg/l)	Coliform col/100ml
				(mg/l)	percent	Air	Water							
HC at Stateline	96.5	6.83	122	13.5	94.6	5.6	1.1	5	23.8	<0.01	4.88	0.03	0.10	42
Cove Ck.	4.07	7.72	197	11.9	88.9	2.9	2.6	5	14.4	<0.01	5.09	0.01	0.13	3
HC at Roberts Road	135	7.32	145	12.5	94.6	2.6	1.7	7	23.6	0.01	7.21	0.05	0.12	43
Keevy Road	150	7.53	143	13.7	96.1	7.0	1.1	NM	NM	NM	NM	NM	NM	1600
RC at Rockford	52.4	7.64	283	12.5	92.3	11.3	2.4	3	8.50	0.03	14	0.14	0.14	7
RC at the mouth	82.1	7.83	270	14.1	100	NM	1.7	<2	6.14	0.03	15.4	0.10	0.11	39
HC at RM-21.0	165	7.41	153	13.6	96.3	4.0	1.6	7	22.2	0.02	7.47	0.04	0.13	16
HC at Duncan	267	7.76	196	14.4	103	1.0	1.4	4	17.3	0.02	9.98	0.06	0.12	9
CC near Marsh Rd	0.71	7.28	40	14.1	99.8	0.0	0.5	<2	10.4	<0.01	0.17	0.01	0.05	28
CC at the mouth	7.03	8.13	204	15.1	109	1.0	2.0	<2	6.69	<.01	2.97	0.02	0.11	19
SC at the mouth	2.22	8.11	329	15.1	109	1.0	1.5	<2	3.29	<0.01	4.45	0.01	0.20	15
MC at McKenzie Rd	3.32	7.02	267	9.80	81.2	1.0	7.0	9	6.04	<0.01	1.98	0.08	0.13	2
MC at the mouth	2.18	7.93	275	13.5	101	2.0	3.0	4	2.42	<0.01	1.75	0.03	0.10	9
Cold Spring Upper	0.24	7.01	343	13.5	111	3.0	6.0	3	1.51	0.03	4.01	0.02	0.08	Not Determined
Cold. Spring Lower	NM	NM	NM	NM	NM	NM	NM	2	2.12	0.02	3.98	0.01	0.08	Not Determined
Stevens Creek	0.44	7.01	445	13.9	104	1.5	3	<2	1.04	0.03	4.70	0.01	0.10	16
HC at USGS gage	292	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	26

Hangman Creek TMDL Data Compilation for February 19, 2004 Event Sampling

Sample Sites	Discharge (cfs)	pH (unit)	Conductivity (*us*)	DO		Temperature °C		TSS (mg/l)	Turbidity (NTU)	Nitrite (mg/l)	Nitrate (mg/l)	Ammonia (mg/l)	Total P (mg/l)	Coliform col/100ml
				(mg/l)	percent	Air	Water							
HC at Stateline	757	6.96	79	13.1	90.4	3.4	2.6	582	341	<0.01	6.49	0.14	0.56	700
HC at Stateline Box	757	NM	NM	NM	NM	NM	NM	684	349	0.01	6.54	0.14	0.59	NS
Cove Ck.	19.5	7.57	156	14.4	107	3.0	3.3	31	42.4	<0.01	7.08	0.02	0.21	14
HC at Roberts Road	1540	7.15	108	13.8	99.4	5.8	2.1	416	290	0.01	8.76	0.14	0.54	180
HC at Roberts Road Box	1540	NM	NM	NM	NM	NM	NM	412	316	0.01	8.84	0.14	0.53	NS
RC at Rockford	591	7.17	220	11.4	88	2.7	1.8	92	38.5	0.02	15.0	0.32	0.22	67
RC at the mouth	728	7.43	235	13.9	102	2.8	2.5	40	44.4	0.02	15.7	0.32	0.22	190
HC at RM-21.0	1420e	7.22	127	13.6	99.9	12.0	3.0	149	135	0.01	7.14	0.10	0.35	136
HC at Duncan	2091	7.33	164	11.9	92.0	12.0	3.1	158	129	0.01	9.82	0.16	0.32	110
CC near Marsh Rd	5.34	6.92	29	14.3	104	2.0	2.0	9	17.2	<0.01	0.14	<0.01	0.07	150
CC at the mouth	53.6	7.64	136	15.0	111	3.5	2.9	19	30.5	<0.01	4.63	0.02	0.19	41
SC at the mouth	16.9	7.92	241	13.9	101	3.5	2.5	14	52.8	<0.01	8.15	0.08	0.37	54
MC at McKenzie Rd	3.45	6.85	256	12.1	102	6.0	6.6	15	5.81	<0.01	1.75	0.09	0.11	3
MC at the mouth	2.45	8.51	253	14.2	117	6.0	6.6	4	1.68	0.02	1.62	0.01	0.09	16
HC at Fairbanks Rd	1410e	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	340
MC at McKenzie Rd box	3.45	NM	NM	NM	NM	NM	NM	11.00	3.17	0.02	1.73	0.08	0.11	NS
U/S HH Treatment	NM	NM	NM	NM	NM	NM	NM	NM	NM	<0.01	10.1	0.18	0.39	NS
D/S HH Treatment	NM	NM	NM	NM	NM	NM	NM	NM	NM	0.01	10.1	0.18	0.39	NS
HC at Spring Valley	1430e	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	490
HC at Chapman Rd	1430e	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	270
HC at Marsh Road	1410	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	310
HC at USGS gage	4020	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	102

Hangman Creek TMDL Data Compilation for March 3, 2004 Sampling.

Sample Sites	Discharge (cfs)	pH (unit)	Conductivity (*us*)	DO		Temperature °C		TSS (mg/l)	Turbidity (NTU)	Nitrite (mg/l)	Nitrate (mg/l)	Ammonia (mg/l)	Total P (mg/l)	Coliform col/100ml
				(mg/l)	percent	Air	Water							
HC at Stateline	95.4	6.83	83	12.8	94.3	12.6	3.0	8	18.6	<0.01	2.57	0.01	0.08	12
Cove Ck.	4.73	7.72	191	14.7	106	7.2	2.7	6	12.1	<0.01	5.79	<0.01	0.10	11
HC at Roberts Road	127e	7.32	130	11.1	89.2	4.7	2.3	8	18.9	<0.01	4.48	0.01	0.09	12
Keevy Road	140	7.53	143	13.7	96.1	7.0	1.1	NS	NS	NS	NS	NS	NS	1600
RC at Rockford	52.1	7.67	208	12.8	96.5	3.5	3.0	5	8.66	0.01	10.9	0.01	0.08	3
RC at the mouth	100	3.88	208	14.2	104	1.0	2.7	4	7.95	<0.01	11.2	<0.01	0.08	200
HC at RM-21.0	152	7.41	123	12.9	95.0	2.0	3.6	3	17.1	<0.01	4.88	<0.01	0.09	6
HC at Duncan	299	7.76	152	13.2	101	NM	3.0	4	14.5	<0.01	6.89	0.01	0.08	5
CC near Marsh Rd	1.28	7.28	31	15.8	114	0.0	1.6	<2	10.2	<0.01	0.06	<0.01	0.04	9
CC at the mouth	10.3	8.13	173	14.3	104	1.1	2.0	5	6.55	<0.01	2.14	<0.01	0.07	3
SC at the mouth	7.99	8.11	257	14.6	108	3.0	2.0	<2	2.34	<0.01	5.13	<0.01	0.14	<1
MC at McKenzie Rd	3.72	7.02	241	11.2	93.6	0.0	5.5	10	3.01	<0.01	1.80	0.04	0.12	1
MC at the mouth	2.20	7.93	244	15.1	111	0.8	2.0	4	1.80	<0.01	1.44	0.02	0.08	5
Cold Spring Upper	NM	NM	NM	NM	NM	NM	NM	12	4.32	<0.01	4.20	<0.01	0.08	22
Cold Spring Mid	0.31	8.61	308	18.0	141	0.0	5.0	NS	NS	NS	NS	NS	NS	NS
Cold Spring Lower	NM	NM	NM	NM	NM	NM	NM	4	2.12	<0.01	3.91	<0.01	0.07	31
Stevens Creek	1.68	NM	NM	13.2	101	1.5	3.8	4	8.51	<0.01	5.50	0.01	0.13	86
HC at Chapman Rd.	127	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	10
HC at Marsh Rd.	122	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	14
HC at Fairbanks Rd.	122	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	5
HC at Spring Valley	127	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	18
U/S Hangman Valley Golf Course	NM	NM	NM	NM	NM	NM	NM	NM	NM	<0.01	7.20	<0.01	0.09	NM
D/S Hangman Valley Golf Course	NM	NM	NM	NM	NM	NM	NM	NM	NM	<0.01	7.25	0.01	0.09	NM
HC at USGS gage	288	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	52

Hangman Creek TMDL Data Compilation for April 13, 2004 Sampling.

Sample Sites	Discharge (cfs)	pH (unit)	Conductivity (*us*)	DO (mg/l)	DO percent	Temperature °C Air	Temperature °C Water	TSS (mg/l)	Turbidity (NTU)	Nitrite (mg/l)	Nitrate (mg/l)	Ammonia (mg/l)	Total P (mg/l)	Coliform col/100ml
HC at Stateline	25.8	7.45	78	8.91	84.8	17.3	11.90	6	6.28	<0.01	0.81	0.01	0.03	7
Cove Ck.	1.23	7.90	219	9.61	93.4	18.0	13.3	9	5.29	0.02	2.72	0.03	0.09	35
HC at Roberts Road	34.5	7.76	115	8.46	83.4	12.8	13.6	9	4.05	<0.01	0.85	0.02	0.04	6
RC at Rockford	7.23	8.25	421	10.8	101	16.5	12.1	5	2.16	0.01	1.88	0.02	0.03	241
RC at the mouth	12.3	6.71	353	10.9	98.9	26.0	13.7	3	1.14	0.02	1.58	0.01	0.03	232
HC at RM-21.0	39.3	6.08	212	10.2	93.9	26.0	14.2	4	2.33	<0.01	0.65	0.02	0.03	142
HC at Duncan	58.7	6.08	271	8.83	85.0	NM	14.6	9	2.77	0.02	0.87	0.02	0.03	177
CC near Marsh Rd	0.86	7.34	36.1	14.4	117	10.0	6.3	4	4.16	<0.01	0.01	<0.01	0.03	14
CC at the mouth	3.44	8.09	167	13.9	121	14.0	9.2	7	2.57	0.02	1.58	0.02	0.08	22
SC at the mouth	0.61	8.55	320	13.9	125	12.0	10.5	6	1.12	<0.01	1.49	0.01	0.10	13
MC at McKenzie Rd	3.21	7.66	233	12.3	117	18.5	12.6	5	0.58	0.02	1.56	0.01	0.05	1
MC at the mouth	2.14	7.95	233	12.4	117	15.7	11.0	6	0.87	0.01	0.96	0.01	0.06	12
U/S Hangman Hills. Golf Course	63.2e	NM	NM	NM	NM	NM	NM	5	<0.01	<0.01	0.94	0.01	0.03	NS
D/S Hangman Hills. Golf Course	63.2e	NM	NM	NM	NM	NM	NM	6	<0.01	0.01	0.91	0.02	0.03	NS
Marshall Ck at Qualchan Dr.	1.80	8.49	NM	11.3	112	18.5	13.8	NS	NS	NS	NS	NS	NS	NS
HC at Fairbanks Rd	33.3e	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	4
HC at Marsh Rd.	33.3e	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	7
HC at Spring Valley	34.5e	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	7
HC at Chapman Rd.	34.5e	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	46
HC at USGS gage	52.0	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	1

Hangman Creek TMDL Data Compilation for May 3, 2004 Sampling.

Sample Sites	Discharge (cfs)	pH (unit)	Conductivity (*us*)	DO		Temperature °C		TSS (mg/l)	Turbidity (NTU)	Nitrite (mg/l)	Nitrate (mg/l)	Ammonia (mg/l)	Total P (mg/l)	Coliform col/100ml
				(mg/l)	percent	Air	Water							
HC at Stateline	13.5	7.38	105	7.69	76.6	18.0	15.2	4	5.73	<0.01	0.51	0.02	0.04	120
Cove Ck.	0.73	7.30	229	6.60	72.3	24.4	14.5	13	4.94	<0.01	1.75	0.03	0.09	410
HC at Roberts Road	18.8	7.96	196	7.86	91.4	23.7	22.0	7	3.78	<0.01	0.35	0.02	0.04	76
RC at Rockford	4.01	7.76	271	10.6	105	21.0	16.0	3	2.54	<0.01	1.09	0.06	0.05	26
RC at the mouth	13.0	8.09	272	11.4	115	26.0	16.5	5	1.42	0.03	0.73	0.07	0.05	5
HC at RM-21.0	24.7	8.33	183	11.4	120	26.0	18.0	7	2.22	<0.01	0.40	0.04	0.06	20
HC at Duncan	38.0	8.59	203	10.8	116	27.0	20.0	3	2.22	<0.01	0.38	0.05	0.05	20
CC near Marsh Rd	0.47	7.26	48	12.0	107	10.0	8.00	2	3.52	<0.01	0.02	<0.01	0.04	3
CC at the mouth	4.14	7.99	222	10.4	98.2	11.0	11.8	4	1.64	<0.01	1.35	0.02	0.07	17
SC at the mouth	0.24	8.70	355	11.0	105	11.5	12.2	4	0.92	<0.01	0.08	0.03	0.13	240
MC at McKenzie Rd	2.75	7.64	255	8.94	87.5	23.0	13.0	8	2.31	<0.01	1.42	0.02	0.05	140
MC at the mouth	1.63	8.00	256	10.6	103	21.0	14.6	4	1.13	<0.01	0.62	0.02	0.07	70
U/S Hangman Hills Golf Course	42.4	NM	NM	NM	NM	NM	NM	NM	NM	<0.01	0.45	0.04	0.04	NS
D/S Hangman Hills Golf Course	42.4	NM	NM	NM	NM	NM	NM	NM	NM	<0.01	0.44	0.03	0.03	NS
Marshall Ck at Qualchan Dr.	1.18	8.42	251	9.26	93.7	29.0	15.0	NS	NS	NS	NS	NS	NS	NS
HC at Fairbanks Rd	18.1	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	35
HC at Marsh Rd.	18.1	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	2
HC at Spring Valley	18.8	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	66
HC at Chapman Rd.	18.8	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	57
HC at USGS gage	52.0	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	10

Hangman Creek TMDL Data Compilation for June 6, 2004 Sampling.

Sample Sites	Discharge (cfs)	pH (unit)	Conductivity (*us*)	DO		Temperature °C		TSS (mg/l)	Turbidity (NTU)	Nitrite (mg/l)	Nitrate (mg/l)	Ammonia (mg/l)	Total P (mg/l)	Coliform col/100ml
				(mg/l)	percent	Air	Water							
HC at Stateline	61.3	7.32	75	8.84	86.6	15.7	14.3	13	18.1	<0.01	0.56	0.01	0.08	13
Cove Ck.	1.22	7.48	236	8.65	86.6	33.9	18.4	16	20.1	<0.01	1.66	0.04	0.11	290
HC at Roberts Road	76.9	8.24	99	7.45	82.8	25.6	22.5	18	25.3	<0.01	0.76	0.02	0.08	210
RC at Rockford	4.92	8.59	253	11.9	127	23.0	18.5	7	3.87	<0.01	0.59	0.02	0.05	48
RC at the mouth	20.6	8.63	238	11.8	125	27.0	18.4	7	4.78	<0.01	0.29	0.03	0.06	350
HC at RM-21.0	84.7	8.41	116	9.79	108	27.0	19.5	6	18.2	<0.01	0.56	0.03	0.08	38
HC at Duncan	105	8.01	132	9.43	101	26.0	18.3	11	19.3	<0.01	0.57	0.03	0.08	26
CC near Marsh Rd	0.82	7.15	47	12.8	109	12.0	8.00	2	21.9	<0.01	0.02	<0.01	0.03	108
CC at the mouth	2.23	8.13	210	12.2	113	19.0	12.0	4	2.37	<0.01	0.83	0.02	0.07	10
SC at the mouth	0.38	8.79	409	11.7	122	20.0	16.0	6	3.76	<0.01	0.11	0.03	0.13	180
MC at McKenzie Rd	2.78	7.44	256	9.11	87.9	20.5	13.0	7	1.94	<0.01	1.18	0.02	0.04	3
MC at the mouth	1.49	7.74	257	9.53	97.2	19.0	15.0	9	3.47	<0.01	0.05	0.04	0.06	77
U/S Hangman Valley Golf Course	105	NM	NM	NM	NM	NM	NM	NM	NM	<0.01	0.55	0.04	0.09	NM
D/S Hangman Hills Golf Course	105	NM	NM	NM	NM	NM	NM	NM	NM	<0.01	0.58	0.04	0.08	NM
HC at Fairbanks Rd	75.7	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	50
HC at Marsh Rd.	75.7	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	73
HC at Spring Valley	76.9	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	47
HC at Chapman Rd.	76.9	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	98
HC at USGS gage	90	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	70

Hangman Creek TMDL Data Compilation for July 7, 2004 Sampling.

Sample Sites	Discharge (cfs)	pH (unit)	Conductivity (*us*)	DO		Temperature °C		TSS (mg/l)	Turbidity (NTU)	Nitrite (mg/l)	Nitrate (mg/l)	Ammonia (mg/l)	Total P (mg/l)	Coliform col/100ml
				(mg/l)	percent	Air	Water							
HC at Stateline	2.54	7.15	113	7.05	80.5	22.0	20.6	16	6.63	<0.01	0.10	0.02	0.06	30
Cove Ck.	0.18	7.70	300	6.24	69.7	22.6	16.4	7	4.40	0.04	1.67	0.04	0.16	270
HC at Roberts Road	3.83	7.94	165	8.08	95.5	21.6	23.2	22	8.36	<0.01	0.03	<0.01	0.11	46
RC at Rockford	0.87	7.29	263	8.8	92.9	18.0	17.8	3	1.73	<0.01	0.07	0.02	0.03	220
RC at the mouth	0.32	8.07	285	10.2	116	20.0	21.3	5	2.05	<0.01	<0.01	<0.01	0.08	55
HC at RM-21.0	7.66	8.03	204	9.72	109	20.0	20.8	2	1.81	<0.01	0.02	0.01	0.06	570
HC at Duncan	6.95	8.33	222	7.33	87	20.8	21.5	6	2.89	<0.01	<0.01	<0.01	0.09	150
CC near Marsh Rd	0.23	7.44	68	10.1	95	14.0	12.00	3	3.05	<0.01	0.05	<0.01	0.04	720
CC at the mouth	0.73	8.13	262	10.1	105	19.0	16.0	<2	0.58	<0.01	0.58	<0.01	0.07	89
SC at the mouth	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
MC at McKenzie Rd	2.03	7.28	258	4.32	41.6	18.0	14.0	8	1.73	0.01	0.91	0.02	0.03	33
MC at the mouth	0.50	7.68	261	8.12	84.6	22.0	17.0	9	2.28	<0.01	0.21	0.03	0.08	40
U/S Hangman Hills Golf Course	6.95	NM	NM	NM	NM	NM	NM	NM	NM	<0.01	0.10	<0.01	0.07	NM
D/S Hangman Hills Golf Course	6.95	NM	NM	NM	NM	NM	NM	NM	NM	<0.01	0.02	<0.01	0.06	NM
HC at Fairbanks Rd	3.65	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	120
HC at Marsh Rd.	3.65	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	73
HC at Spring Valley	3.83	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	54
HC at Chapman Rd.	3.83	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	76
HC at USGS gage	24.0	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	71

Hangman Creek TMDL Data Compilation for August 25, 2004 Event Sampling.

Sample Sites	Discharge (cfs)	pH (unit)	Conductivity (*us*)	DO		Temperature °C		TSS (mg/l)	Turbidity (NTU)	Nitrite (mg/l)	Nitrate (mg/l)	Ammonia (mg/l)	Total P (mg/l)	Coliform col/100ml
				(mg/l)	percent	Air	Water							
HC at Stateline	0.51	7.61	174.0	5.91	63.2	18.7	17.0	NS	NS	NS	NS	NS	NS	210
Cove Ck.	0.12	7.56	264.0	6.24	63.3	16.1	15.0	NS	NS	NS	NS	NS	NS	2270
HC at Roberts Road	1.05	7.68	213	7.54	79.2	16.3	16.0	NS	NS	NS	NS	NS	NS	71
RC at Rockford	0.20	7.91	387	8.65	86.1	NM	14.6	NS	NS	NS	NS	NS	NS	1810
RC at the mouth	1.51	8.51	270	10.35	109.6	17.6	17.7	NS	NS	NS	NS	NS	NS	260
HC at RM-21.0	2.64	8.25	261	10.26	106.8	17.8	16.9	NS	NS	NS	NS	NS	NS	520
HC at Duncan	4.42	8.52	266	8.98	95.5	17.7	19.1	NS	NS	NS	NS	NS	NS	100
CC near Marsh Rd	0.32	7.12	65.8	9.38	89.1	13.0	12.0	NS	NS	NS	NS	NS	NS	320
CC at the mouth	0.56	7.50	270	9.02	91.2	14.5	15.0	NS	NS	NS	NS	NS	NS	680
SC at the mouth	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY
MC at McKenzie Rd	1.78	7.56	235	1.99	19.0	17.5	13.0	NS	NS	NS	NS	NS	NS	420
MC at the mouth	0.38	7.58	256	7.15	72.3	17.5	15.0	NS	NS	NS	NS	NS	NS	1210
U/S Hangman Hills Golf Course	4.42	NM	NM	NM	NM	NM	NM	NM	NM	<0.01	0.11	<0.01	0.031	NS
D/S Hangman Hills Golf Course	4.42	NM	NM	NM	NM	NM	NM	NM	NM	<0.01	0.02	0.02	0.024	NS
HC at Fairbanks Rd	0.93	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	290
HC at Marsh Rd.	0.93	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	141
HC at Spring Valley	1.05	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	680
HC at Chapman Rd.	1.05	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	81
HC at USGS gage	9.60	NM	NM	NM	NM	NM	NM	NS	NS	NS	NS	NS	NS	710
Tekoa Grab	NA	NM	NM	NM	NM	NM	NM	8360	5190	NM	NM	NM	NM	<1

Appendix C
Replicate Analysis Results

Replicate analysis for Total Suspended Solids

Date	Sample (mg/l)	Replicate (mg/l)	Mean	Standard Deviation	Relative Standard Deviation
1/5/2003	4	3	3.5	0.71	20.20
1/5/2003	2	3	2.5	0.71	28.28
1/5/2003	1	2	1.5	0.71	47.14
1/5/2003	2	1	1.5	0.71	47.14
2/4/2004	7	6	6.5	0.71	10.88
2/4/2004	3	3	3	0.00	0.00
2/4/2004	7	4	5.5	2.12	38.57
2/4/2004	1	1	1	0.00	0.00
2/4/2004	1	1	1	0.00	0.00
2/4/2004	1	1	1	0.00	0.00
2/4/2004	4	4	4	0.00	0.00
2/18/2004	416	438	427	15.56	3.64
2/18/2004	19	20	19.5	0.71	3.63
3/3/2004	4	4	4	0.00	0.00
3/3/2004	5	3	4	1.41	35.36
3/3/2004	1	1	1	0.00	0.00
3/3/2004	1	3	2	1.41	70.71
3/3/2004	4	4	4	0.00	0.00
3/3/2004	8	7	7.5	0.71	9.43
4/13/2004	4	3	3.5	0.71	20.20
4/13/2004	6	6	6	0.00	0.00
4/13/2004	5	4	4.5	0.71	15.71
4/13/2004	6	5	5.5	0.71	12.86
4/13/2004	9	12	10.5	2.12	20.20
4/13/2004	6	4	5	1.41	28.28
5/3/2004	13	9	11	2.83	25.71
5/3/2004	7	11	9	2.83	31.43
5/3/2004	4	4	4	0.00	0.00
5/3/2004	8	9	8.5	0.71	8.32
5/3/2004	4	5	4.5	0.71	15.71
5/3/2004	3	3	3	0.00	0.00
6/2/2004	7	6	6.5	0.71	10.88
6/2/2004	18	18	18	0.00	0.00
6/2/2004	6	4	5	1.41	28.28
6/2/2004	4	6	5	1.41	28.28
6/2/2004	9	8	8.5	0.71	8.32
7/7/2004	5	3	4	1.41	35.36
7/7/2004	2	4	3	1.41	47.14

Replicate analysis for Turbidity

Date	Sample (NTU)	Replicate (NTU)	Mean	Standard Deviation	Relative Standard Deviation
1/5/2003	4	3	3.5	0.71	20.20
1/5/2003	2	3	2.5	0.71	28.28
1/5/2003	1.01	1.3	1.155	0.21	17.75
1/5/2003	1.17	3.4	2.28	1.58	69.01
2/4/2004	23.6	23.5	23.55	0.07	0.30
2/4/2004	8.5	8.8	8.65	0.21	2.45
2/4/2004	22.2	21.8	22	0.28	1.29
2/4/2004	6.69	6.43	6.56	0.18	2.80
2/4/2004	3.29	3.1	3.195	0.13	4.21
2/4/2004	10.4	10.4	10.4	0.00	0.00
2/4/2004	2.42	1.8	2.11	0.44	20.78
2/18/2004	30.5	32.8	31.65	1.63	5.14
2/18/2004	290	305	297.5	10.61	3.57
3/3/2004	7.95	8.14	8.045	0.13	1.67
3/3/2004	8.66	8.7	8.68	0.03	0.33
3/3/2004	2.34	4.98	3.66	1.87	51.00
3/3/2004	10.2	10.5	10.35	0.21	2.05
3/3/2004	1.8	1.28	1.54	0.37	23.88
3/3/2004	18.6	18.9	18.75	0.21	1.13
4/13/2004	5.29	4.65	4.97	0.45	9.11
4/13/2004	6.29	6.61	6.45	0.23	3.51
4/13/2004	2.16	1.61	1.885	0.39	20.63
4/13/2004	1.12	1.34	1.23	0.16	12.65
4/13/2004	0.87	0.95	0.91	0.06	6.22
4/13/2004	4.16	4.51	4.335	0.25	5.71
1/3/1900	3.78	3.65	3.715	0.09	2.47
5/3/2004	4.94	4.83	4.885	0.08	1.59
5/3/2004	1.64	1.56	1.6	0.06	3.54
5/3/2004	2.31	2.48	2.395	0.12	5.02
5/3/2004	1.13	1.04	1.085	0.06	5.87
5/3/2004	2.54	3.81	3.175	0.90	28.28
6/2/2004	3.87	4.34	4.105	0.33	8.10
6/2/2004	25.3	24	24.65	0.92	3.73
6/2/2004	3.76	3.32	3.54	0.31	8.79
6/2/2004	2.37	2.22	2.295	0.11	4.62
6/2/2004	3.47	3.28	3.375	0.13	3.98
7/7/2004	2.05	2.19	2.12	0.10	4.67
7/7/2004	1.81	2.14	1.975	0.23	11.81

Replicate analysis for Nitrite

Replicate analysis for nitrite was not done because of the large number of results that were less than detection limit.

Replicate analysis for Nitrate

Date	Sample (mg/l)	Replicate (mg/l)	Mean	Standard Deviation	Relative Standard Deviation
1/5/2003	3.75	3.73	3.74	0.01	0.38
1/5/2003	3.34	3.77	3.555	0.30	8.55
1/5/2003	2.08	2.14	2.11	0.04	2.01
1/5/2003	2.08	2.1	2.09	0.01	0.68
2/4/2004	7.21	7.18	7.195	0.02	0.29
2/4/2004	14	14	14	0.00	0.00
2/4/2004	7.47	7.42	7.445	0.04	0.47
2/4/2004	2.97	2.96	2.965	0.01	0.24
2/4/2004	4.45	4.4	4.425	0.04	0.80
2/4/2004	0.17	0.12	0.145	0.04	24.38
2/4/2004	1.75	1.75	1.75	0.00	0.00
2/18/2004	4.63	4.64	4.635	0.01	0.15
2/18/2004	8.76	8.79	8.775	0.02	0.24
3/3/2004	11.2	11.1	11.15	0.07	0.63
3/3/2004	10.9	10.9	10.9	0.00	0.00
3/3/2004	5.13	5.34	5.235	0.15	2.84
3/3/2004	0.057	0.08	0.0685	0.02	23.74
3/3/2004	1.44	1.42	1.43	0.01	0.99
3/3/2004	2.57	2.61	2.59	0.03	1.09
4/13/2004	0.01	0.02	0.015	0.01	47.14
4/13/2004	0.96	0.95	0.955	0.01	0.74
4/13/2004	1.49	1.5	1.495	0.01	0.47
4/13/2004	1.88	1.87	1.875	0.01	0.38
4/13/2004	0.81	0.81	0.81	0.00	0.00
4/13/2004	2.72	2.7	2.71	0.01	0.52
5/3/2004	0.35	0.35	0.35	0.00	0.00
5/3/2004	1.75	1.74	1.745	0.01	0.41
5/3/2004	1.35	1.36	1.355	0.01	0.52
5/3/2004	1.42	1.43	1.425	0.01	0.50
5/3/2004	0.62	0.62	0.62	0.00	0.00
5/3/2004	1.09	1.09	1.09	0.00	0.00
6/2/2004	0.59	0.6	0.595	0.01	1.19
6/2/2004	0.76	0.77	0.765	0.01	0.92
6/2/2004	0.11	0.11	0.11	0.00	0.00
6/2/2004	0.83	0.83	0.83	0.00	0.00
6/2/2004	**0.48**	**0.47**	0.475	0.01	1.49
7/7/2004	0.001	0.001	0.001	0.00	0.00
7/7/2004	0.02	0.02	0.02	0.00	0.00

Replicate analysis for Ammonia

Date	Sample (mg/l)	Replicate (mg/l)	Mean	Standard Deviation	Relative Standard Deviation
1/5/2004	0.02	0.03	0.025	0.01	28.28
1/5/2004	0.03	0.03	0.03	0.00	0.00
1/5/2004	0.01	0.02	0.015	0.01	47.14
1/5/2004	0.08	0.09	0.085	0.01	8.32
2/4/2004	0.05	0.05	0.05	0.00	0.00
2/4/2004	0.14	0.14	0.14	0.00	0.00
2/4/2004	0.04	0.04	0.04	0.00	0.00
2/4/2004	0.02	0.01	0.015	0.01	47.14
2/4/2004	0.01	0.01	0.01	0.00	0.00
2/4/2004	0.01	0.02	0.015	0.01	47.14
2/4/2004	0.04	0.03	0.035	0.01	20.20
2/18/2004	0.02	0.02	0.02	0.00	0.00
2/18/2004	0.14	0.14	0.14	0.00	0.00
3/3/2004	0.01	0.01	0.01	0.00	0.00
3/3/2004	0.02	0.02	0.02	0.00	0.00
3/3/2004	0.01	0.01	0.01	0.00	0.00
3/3/2004	0.01	0.005	0.0075	0.00	47.14
3/3/2004	0.01	0.01	0.01	0.00	0.00
3/3/2004	0.01	0.005	0.0075	0.00	47.14
4/13/2004	0.01	0.02	0.015	0.01	47.14
4/13/2004	0.03	0.02	0.025	0.01	28.28
4/13/2004	0.02	0.02	0.02	0.00	0.00
4/13/2004	0.01	0.01	0.01	0.00	0.00
4/13/2004	0.01	0.01	0.01	0.00	0.00
4/13/2004	0.005	0.005	0.005	0.00	0.00
5/3/2004	0.03	0.03	0.03	0.00	0.00
5/3/2004	0.02	0.02	0.02	0.00	0.00
5/3/2004	0.02	0.02	0.02	0.00	0.00
5/3/2004	0.02	0.02	0.02	0.00	0.00
5/3/2004	0.02	0.02	0.02	0.00	0.00
5/3/2004	0.06	0.06	0.06	0.00	0.00
6/2/2004	0.02	0.03	0.025	0.01	28.28
6/2/2004	0.04	0.02	0.03	0.01	47.14
6/2/2004	0.03	0.03	0.03	0.00	0.00
6/2/2004	0.02	0.02	0.02	0.00	0.00
6/2/2004	0.04	0.03	0.035	0.01	20.20
7/7/2004	0.005	0.005	0.005	0.00	0.00
7/7/2004	0.005	0.005	0.005	0.00	0.00

Replicate analysis for Total Phosphorus

Date	Sample (mg/l)	Replicate (mg/l)	Mean	Standard Deviation	Relative Standard Deviation
1/5/2003	0.037	0.034	0.0355	0.00	5.98
1/5/2003	0.025	0.026	0.0255	0.00	2.77
1/5/2003	0.051	0.04	0.0455	0.01	17.09
1/5/2003	0.104	0.105	0.1045	0.00	0.68
2/4/2004	0.12	0.121	0.1205	0.00	0.59
2/4/2004	0.14	0.131	0.1355	0.01	4.70
2/4/2004	0.13	0.126	0.128	0.00	2.21
2/4/2004	0.107	0.096	0.1015	0.01	7.66
2/4/2004	0.199	0.191	0.195	0.01	2.90
2/4/2004	0.045	0.052	0.0485	0.00	10.21
2/4/2004	0.096	0.096	0.096	0.00	0.00
2/18/2004	0.188	0.191	0.1895	0.00	1.12
2/18/2004	0.535	0.54	0.5375	0.00	0.66
3/3/2004	0.077	0.073	0.075	0.00	3.77
3/3/2004	0.076	0.075	0.0755	0.00	0.94
3/3/2004	0.135	0.133	0.134	0.00	1.06
3/3/2004	0.04	0.043	0.0415	0.00	5.11
3/3/2004	0.08	0.081	0.0805	0.00	0.88
3/3/2004	0.077	0.077	0.077	0.00	0.00
4/13/2004	0.033	0.037	0.035	0.00	8.08
4/13/2004	0.09	0.091	0.0905	0.00	0.78
4/13/2004	0.033	0.03	0.0315	0.00	6.73
4/13/2004	0.102	0.093	0.0975	0.01	6.53
4/13/2004	0.056	0.054	0.055	0.00	2.57
4/13/2004	0.027	0.022	0.0245	0.00	14.43
5/3/2004	0.089	0.076	0.0825	0.01	11.14
5/3/2004	0.042	0.043	0.0425	0.00	1.66
5/3/2004	0.067	0.063	0.065	0.00	4.35
5/3/2004	0.048	0.054	0.051	0.00	8.32
5/3/2004	0.072	0.067	0.0695	0.00	5.09
5/3/2004	0.049	0.05	0.0495	0.00	1.43
6/2/2004	0.053	0.05	0.0515	0.00	4.12
6/2/2004	0.084	0.084	0.084	0.00	0.00
6/2/2004	0.129	0.137	0.133	0.01	4.25
6/2/2004	0.069	0.067	0.068	0.00	2.08
6/2/2004	0.064	0.07	0.067	0.00	6.33
7/7/2004	0.076	0.072	0.074	0.00	3.82
7/7/2004	0.06	0.063	0.0615	0.00	3.45

Replicate analysis for Fecal Coliform

Date	Sample (mg/l)	Replicate (mg/l)	Mean	Standard Deviation	Relative Standard Deviation
12/10/2003	100	50	75	35.36	47.14
12/10/2003	15	24	19.5	6.36	32.64
1/5/2003	31	1	16	21.21	132.58
1/5/2003	41	15	28	18.38	65.66
1/5/2003	180	7	93.5	122.33	130.83
1/5/2003	10	4	7	4.24	60.61
2/4/2004	9	150	79.5	99.70	125.41
2/4/2004	39	40	39.5	0.71	1.79
2/4/2004	28	12	20	11.31	56.57
2/4/2004	2	2	2	0.00	0.00
2/4/2004	15	11	13	2.83	21.76
3/3/2004	11	25	18	9.90	55.00
3/3/2004	3	1	2	1.41	70.71
3/3/2004	1	1	1	0.00	0.00
3/3/2004	200	7	103.5	136.47	131.86
3/3/2004	3	4	3.5	0.71	20.20
3/3/2004	5	4	4.5	0.71	15.71
4/13/2004	13	10	11.5	2.12	18.45
4/13/2004	14	29	21.5	10.61	49.33
4/13/2004	1	0.05	0.525	0.67	127.95
5/3/2004	120	4	62	82.02	132.30
5/3/2004	3	2	2.5	0.71	28.28
5/3/2004	240	7	123.5	164.76	133.41
5/3/2004	26	30	28	2.83	10.10
6/2/2004	13	23	18	7.07	39.28
6/2/2004	290	109	199.5	127.99	64.15
6/2/2004	108	90	99	12.73	12.86
6/2/2004	3	60	31.5	40.31	127.95
6/2/2004	48	42	45	4.24	9.43
7/7/2004	150	98	124	36.77	29.65
7/7/2004	55	49	52	4.24	8.16
7/7/2004	710	460	585	176.78	30.22
7/7/2004	33	36	34.5	2.12	6.15
8/25/2004	71	130	100.5	41.72	41.51
8/25/2004	71	180	125.5	77.07	61.41
8/25/2004	71	110	90.5	27.58	30.47
8/25/2004	320	150	235	120.21	51.15
8/25/2004	680	570	625	77.78	12.45

Replicate analysis for Fecal Coliform

Date	Sample (mg/l)	Replicate (mg/l)	Mean	Standard Deviation	Relative Standard Deviation
8/25/2004	820	550	685	190.92	27.87
8/25/2004	710	860	785	106.07	13.51
8/25/2004	1210	1080	1145	91.92	8.03
8/25/2004	81	74	77.5	4.95	6.39
8/25/2004	2270	3160	2715	629.33	23.18
8/25/2004	1810	960	1385	601.04	43.40
8/25/2004	1810	1790	1800	14.14	0.79
8/25/2004	520	990	755	332.34	44.02
8/25/2004	520	660	590	98.99	16.78

Appendix D
Hangman Creek Data, 1994-1997

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NOTES FOR DATA TABLES

Notes:

1. NS is not sampled.
2. NM is not measured.
3. NR is not recorded.
4. MD is measured discharge (see Note 7).
5. No stage discharge relationship was developed for the Hangman Creek at Keevy Road site. Stage measurements from an arbitrary datum of 0.00 feet were recorded and are listed.
6. On days with multiple discharge data, the time of the measurements is indicated in parentheses.
7. Discharge data identified with an “MD” (see Note 4) indicates flows that were measured in the field.
8. Ammonia data identified with an “e” are data that exceeded the calculated limits based on the temperature and pH of the sample water.
9. Ammonia data identified with an “m” have either pH or temperature data missing that prevents the calculation of an exceedance value.

FIELD CHEMISTRY DATA

Hangman Creek at the Idaho State Line

Sample Date	Sample Time	Water Temperature (^oC)	pH (Units)	Conductivity (µS)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (%)
10-Oct-94	14:00	10.4	7.30	231	8.1	73
24-Oct-94	13:30	7.6	7.80	236	8.7	73
07-Nov-94	14:50	3.9	6.94	146	10.5	80
21-Nov-94	2:25	0.4	6.99	45.1	10.7	74
05-Dec-94	13:45	-0.5	6.63	160	NM	NM
19-Dec-94	14:17	1.0	7.15	106	NM	NM
09-Jan-95	13:55	1.6	7.48	92.0	NM	NM
23-Jan-95	13:55	1.0	7.66	101	NM	NM
06-Feb-95	13:00	4.7	7.50	82.0	NM	NM
20-Feb-95	14:05	6.8	7.31	64.0	11.1	90
06-Mar-95	12:45	2.4	7.86	108	11.7	86
20-Mar-95	13:38	6.0	7.38	95.2	NM	NM
03-Apr-95	12:35	7.3	7.48	107	10.4	86
17-Apr-95	12:47	8.0	7.25	107	11.1	97
01-May-95	13:50	12.1	7.55	120	11.1	102
15-May-95	13:05	15.0	7.55	115	9.0	89
30-May-95	13:25	21.8	7.39	134	7.4	84
12-Jun-95	13:00	19.7	7.18	122	7.3	80
26-Jun-95	13:47	22.4	6.84	114	6.4	73
10-Jul-95	13:35	22.8	7.27	142	6.2	72
24-Jul-95	12:40	21.9	7.41	167	5.6	64
07-Aug-95	13:10	18.6	7.00	200	4.9	53
21-Aug-95	13:45	20.2	7.80	224	8.1	88
11-Sep-95	12:40	16.4	7.44	244	6.9	70
25-Sep-95	12:40	12.3	7.46	247	9.2	85

Little Hangman Creek

Sample Date	Sample Time	Water Temperature (^oC)	pH (Units)	Conductivity (µS)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (%)
10-Oct-94	13:05	11.3	8.15	316	13.2	NR
24-Oct-94	11:40	7.4	8.00	311	12.4	103
07-Nov-94	13:42	5.1	7.19	269	11.7	91
21-Nov-94	12:25	1.1	6.50	NM	11.0	78
01-Dec-94	16:45	1.7	NM	NM	NM	NM
05-Dec-94	12:15	0.6	6.57	193	NM	NM
18-Dec-94	13:30	1.6	NM	NM	NM	NM
19-Dec-94	13:43	0.4	7.02	133	NM	NM
09-Jan-95	11:35	1.1	7.48	151	NM	NM
23-Jan-95	13:06	NM	7.60	136	NM	NM
06-Feb-95	11:20	4.4	7.70	132	NM	NM
18-Feb-95	16:20	4.0	NM	NM	NM	NM
20-Feb-95	13:30	6.8	7.38	97.0	11.1	91
06-Mar-95	11:25	2.2	8.02	171	11.6	84
20-Mar-95	13:05	5.4	7.28	138	NR	82
03-Apr-95	11:20	7.1	7.28	173	10.1	83
17-Apr-95	12:15	9.1	7.70	166	10.4	90
01-May-95	12:32	11.8	7.71	205	9.9	91
15-May-95	12:40	15.1	7.49	181	8.2	81
30-May-95	12:00	19.2	7.49	236	5.6	61
12-Jun-95	11:40	17.8	7.38	218	5.0	53
26-Jun-95	13:06	20.6	7.38	229	5.6	62
10-Jul-95	12:20	21.9	7.36	259	3.7	42
24-Jul-95	11:10	20.2	7.46	286	4.7	20
07-Aug-95	12:00	18.5	6.91	301	3.5	37
21-Aug-95	12:30	17.4	7.57	306	7.2	75
11-Sep-95	11:20	15.6	7.29	307	6.0	60
25-Sep-95	11:25	12.1	7.51	298	8.0	74
01-Dec-95	4:45	1.7	NM	NM	NM	NM

Rattler Run Creek

Sample Date	Sample Time	Water Temperature (^oC)	pH (Units)	Conductivity (µS)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (%)
10-Oct-94	10:45	8.7	7.68	271	11.5	NR
24-Oct-94	10:47	5.5	7.75	532	12.0	95
07-Nov-94	10:36	4.2	7.49	502	12.1	93
21-Nov-94	10:40	0.2	6.60	NM	12.9	90
05-Dec-94	9:00	-0.6	6.49	529	NM	NM
19-Dec-94	11:47	1.9	7.64	311	NM	NM
09-Jan-95	10:35	0.9	7.90	260	NM	NM
23-Jan-95	11:10	NM	7.53	403	NM	NM
06-Feb-95	10:45	4.0	7.69	334	NM	NM
17-Feb-95	11:26	NM	7.40	119	NM	NM
20-Feb-95	11:24	7.3	7.45	245	11.0	92
06-Mar-95	13:30	0.2	8.08	340	12.8	88
09-Mar-95	13:02	6.5	NM	220	NM	NM
15-Mar-95	11:10	6.2	NM	213	NM	NM
20-Mar-95	11:40	5.5	7.52	278	10.7	85
03-Apr-95	10:30	6.0	8.05	376	11.8	95
09-Apr-95	13:02	6.5	NM	220	NM	NM
17-Apr-95	11:30	7.1	8.83	368	12.9	107
01-May-95	11:48	10.0	8.18	420	10.4	92
15-May-95	11:30	14.3	8.76	406	11.2	109
30-May-95	11:10	16.3	8.30	420	9.9	101
12-Jun-95	10:50	13.9	8.18	444	10.4	101
26-Jun-95	11:26	16.9	7.95	NM	9.5	98
07-Jul-95	13:20	17.6	NM	261	8.3	88
10-Jul-95	11:20	17.4	7.94	471	8.9	93
24-Jul-95	10:30	15.7	8.17	471	8.9	90
07-Aug-95	11:00	15.0	7.48	505	8.3	82
21-Aug-95	11:30	13.3	8.13	494	9.8	93
11-Sep-95	10:30	12.5	7.78	526	9.9	92
25-Sep-95	10:30	8.9	7.96	472	10.7	92
23-Oct-95	13:35	5.4	7.79	479	13.7	109
20-Nov-95	14:00	2.9	7.59	479	12.6	93
11-Dec-95	14:25	0.1	NM	154	NM	NM
14-Dec-95	11:45	2.7	NM	365	NM	NM
18-Dec-95	11:25	0.5	7.68	415	13.1	91
01-Jan-96	12:45	0.1	NM	228	NM	NM
08-Jan-96	13:00	1.8	NM	174	NM	NM
16-Jan-96	14:05	4.2	7.50	336	11.9	92
25-Jan-96	12:30	0.3	NM	NM	NM	NM

Sample Date	Sample Time	Water Temperature (^oC)	pH (Units)	Conductivity (µS)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (%)
07-Feb-96	10:50	0.0	NM	134	NM	NM
08-Feb-96	11:15	0.5	NM	120	NM	NM
09-Feb-96	10:35	3.3	NM	203	NM	NM
13-Feb-96	10:10	1.4	NM	311	NM	NM
21-Feb-96	10:40	2.8	7.64	272	12.9	95
09-Mar-96	11:00	3.2	NM	225	NM	NM
13-Mar-96	10:55	4.6	NM	NM	NM	NM
18-Mar-96	11:00	4.9	8.01	333	11.7	91
02-Apr-96	11:10	7.3	NM	323	NM	NM
15-Apr-96	11:20	9.6	8.79	374	11.4	100
20-May-96	13:33	13.2	8.26	377	9.3	90
04-Jun-96	12:23	18.0	8.29	407	10.0	106
18-Jun-96	12:15	12.1	8.84	410	12.0	112
02-Jul-96	9:45	16.4	8.28	NM	9.4	96
16-Jul-96	11:30	17.4	8.45	NM	10.0	104
05-Aug-96	11:10	13.6	NM	416	9.1	87
20-Aug-96	10:30	13.0	NM	442	10.2	97
17-Sep-96	11:25	8.6	8.32	482	8.4	72
22-Oct-96	12:10	5.2	8.20	476	11.4	90
18-Nov-96	11:10	2.5	8.10	430	12.0	88
08-Dec-96	11:00	0.9	NM	NM	NM	NM
16-Dec-96	11:30	0.0	NM	343	NM	NM
22-Jan-97	10:55	0.8	7.79	301	12.9	90
03-Feb-97	14:45	2.4	NM	289	NM	NM
19-Feb-97	10:35	2.6	7.34	150	7.6	61
13-Mar-97	10:30	1.1	NM	302	NM	NM
17-Mar-97	10:40	5.5	7.98	176	11.5	91
19-Mar-97	9:45	7.2	NM	234	NM	NM
22-Apr-97	11:00	8.3	8.55	355	12.2	106
20-May-97	11:15	13.8	8.68	373	10.5	101
02-Jun-97	12:00	16.0	8.18	389	9.5	96
17-Jun-97	11:15	17.6	8.48	390	8.9	96
07-Jul-97	10:45	16.3	8.33	406	8.4	86
21-Jul-97	11:30	19.3	8.21	410	8.6	93
04-Aug-97	11:20	17.4	8.19	425	10.4	108
18-Aug-97	11:30	15.0	NM	412	10.1	100
02-Sep-97	12:50	16.2	8.43	424	10.9	109
15-Sep-97	10:40	12.2	8.13	418	10.4	98

Hangman Creek at Bradshaw Road

Sample Date	Sample Time	Water Temperature (^oC)	pH (Units)	Conductivity (µS)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (%)
15-Sep-95	11:00	16.2	8.43	311	9.5	97
13-Mar-96	11:30	6.1	NM	122	NM	NM
18-Mar-96	11:30	6.8	7.74	140	11.0	91
02-Apr-96	11:20	7.4	NM	118	NM	NM
15-Apr-96	11:45	10.7	8.28	149	11.2	11
20-May-96	13:33	13.2	7.96	116	9.4	90
04-Jun-96	12:25	21.9	9.52	173	14.0	164
18-Jun-96	12:15	15.1	8.62	224	11.0	110
02-Jul-96	11:30	23.4	8.59	NM	10.6	124
16-Jul-96	11:30	23.1	8.54	NM	7.2	85
05-Aug-96	11:35	16.3	NM	319	6.2	63
20-Aug-96	10:45	18.3	NM	339	9.6	NR
17-Sep-96	11:40	12.8	8.41	333	8.1	77
22-Oct-96	11:55	5.7	8.05	309	11.2	88
18-Nov-96	11:40	2.8	8.18	279	11.9	88
08-Dec-96	11:30	0.9	NM	176	NM	NM
16-Dec-96	11:40	0.3	NM	155	NM	NM
01-Jan-97	11:45	1.4	NM	156	NM	NM
22-Jan-97	11:05	0.6	8.14	116	12.6	87
03-Feb-97	15:00	1.9	NM	106	NM	NM
19-Feb-97	10:45	3.5	7.53	110	8.1	NR
13-Mar-97	10:45	2.6	NM	114	NM	NM
17-Mar-97	11:15	4.8	7.73	106	11.5	90
19-Mar-97	10:00	6.5	NM	107	NM	NM
22-Apr-97	12:15	8.9	8.09	82.9	11.7	101
20-May-97	12:00	17.1	8.91	170	13.1	136
02-Jun-97	12:30	18.7	7.90	175	8.0	86
17-Jun-97	11:30	21.2	8.33	192	8.5	95
07-Jul-97	11:00	19.6	8.03	235	7.8	85
21-Jul-97	12:05	23.8	8.16	278	8.2	98
04-Aug-97	10:45	23.8	8.09	279	6.0	70
18-Aug-97	11:40	19.7	8.11	302	7.3	80
02-Sep-97	12:50	19.3	8.34	336	7.6	85

Rock Creek at Jackson Road

Sample Date	Sample Time	Water Temperature (^oC)	pH (Units)	Conductivity (µS)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (%)
10-Oct-94	9:30	8.8	8.02	357	10.9	94
24-Oct-94	9:35	5.1	7.25	316	8.3	65
07-Nov-94	10:35	4.1	6.83	328	11.0	84
21-Nov-94	9:45	0.4	NM	NM	12.6	86
01-Dec-94	13:06	0.9	7.58	191	12.8	90
01-Dec-94	14:15	2.9	NM	NM	NM	NM
05-Dec-94	9:00	-0.7	6.52	242	NM	NM
18-Dec-94	12:15	0.9	NM	NM	NM	NM
19-Dec-94	9:35	1.0	7.27	188	NM	NM
27-Dec-94	15:55	3.8	NM	NM	NM	NM
09-Jan-95	9:15	0.9	7.70	204	NM	NM
23-Jan-95	10:25	0.0	7.38	192	NM	NM
06-Feb-95	9:15	3.6	7.28	186	NM	NM
17-Feb-95	10:00	0.1	6.86	149	18.5	NR
20-Feb-95	11:20	5.1	7.19	132	11.8	93
06-Mar-95	9:20	0.9	7.58	191	12.8	90
09-Mar-95	12:10	4.5	NM	NM	NM	NM
09-Mar-95	16:50	5.3	NM	130	NM	NM
10-Mar-95	13:10	6.4	NM	158	NM	NM
20-Mar-95	10:40	5.3	7.34	180	10.5	85
03-Apr-95	9:20	6.3	6.80	199	11.3	92
15-Apr-95	12:00	6.9	NM	217	NM	NM
17-Apr-95	10:45	7.7	8.38	195	12.8	107
17-Apr-95	12:00	7.5	7.97	193	13.1	109
01-May-95	10:53	10.6	8.00	227	11.1	100
15-May-95	10:45	15.1	8.40	222	10.3	102
30-May-95	9:35	17.8	7.77	254	7.4	78
06-Jun-95	15:25	12.3	NM	NM	NM	NM
12-Jun-95	9:30	16.1	7.67	261	8.8	89
26-Jun-95	10:45	19.6	7.79	269	7.9	87
07-Jul-95	11:50	19.4	NM	260	7.0	76
10-Jul-95	10:00	21.1	7.68	263	7.4	83
21-Jul-95	10:20	16.7	7.89	318	9.7	99
24-Jul-95	9:30	19.7	8.22	295	9.6	104
07-Aug-95	9:30	18.3	7.30	297	6.7	71
21-Aug-95	10:20	16.7	7.89	318	9.7	99
11-Sep-95	9:30	15.1	7.49	324	7.8	77
25-Sep-95	9:20	9.6	7.64	336	11.1	97
23-Oct-95	9:15	5.2	7.42	336	10.5	85

Sample Date	Sample Time	Water Temperature (^oC)	pH (Units)	Conductivity (µS)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (%)
20-Nov-95	9:45	2.9	7.45	249	11.7	87
12-Dec-95	11:17	0.8	NM	101	NM	NM
13-Dec-95	9:30	2.4	NM	121	NM	NM
18-Dec-95	9:45	0.7	7.97	196	12.3	86
31-Dec-95	13:00	0.1	NM	125	NM	NM
01-Jan-96	12:00	0.2	NM	125	NM	NM
09-Jan-96	9:45	0.9	NM	137	NM	NM
10-Jan-96	13:15	1.6	NM	143	NM	NM
16-Jan-96	9:35	3.7	7.44	166	12.2	92
25-Jan-96	11:50	0.1	NM	176	NM	NM
08-Feb-96	10:05	1.1	NM	105	NM	NM
09-Feb-96	9:30	3.1	NM	107	NM	NM
10-Feb-96	11:00	0.8	NM	124	NM	NM
13-Feb-96	9:35	1.3	NM	169	NM	NM
21-Feb-96	9:45	3.5	7.42	148	11.9	90
09-Mar-96	10:05	4.0	NM	NM	NM	NM
10-Mar-96	10:50	1.7	NM	NM	NM	NM
11-Mar-96	15:10	4.9	NM	132	NM	NM
13-Mar-96	10:20	3.1	NM	152	NM	NM
18-Mar-96	9:40	4.2	7.79	174	11.9	92
05-Apr-96	10:05	7.2	8.08	178	10.5	87
15-Apr-96	9:50	9.6	8.57	200	11.2	98
20-May-96	14:35	14.3	8.17	175	9.6	94
04-Jun-96	10:15	18.8	7.81	203	10.3	110
18-Jun-96	10:30	14.6	8.67	247	10.3	103
02-Jul-96	14:15	24.7	8.70	NM	11.5	138
16-Jul-96	9:50	20.7	8.53	NM	10.6	124
05-Aug-96	9:30	15.3	NM	325	11.0	109
20-Aug-96	9:35	16.2	NM	328	8.8	89
17-Sep-96	9:30	11.5	8.49	344	8.5	79
22-Oct-96	10:25	5.3	7.56	344	11.3	89
18-Nov-96	9:50	3.2	7.91	284	11.8	88
08-Dec-96	10:00	0.8	NM	230	NM	NM
16-Dec-96	10:45	0.0	NM	227	NM	NM
22-Jan-97	9:50	0.2	8.13	139	13.2	91
19-Feb-97	8:45	1.6	7.76	109	8.9	63
10-Mar-97	10:35	2.1	7.75	127	13.6	99
17-Mar-97	9:05	3.4	7.74	94.6	12.0	90
19-Mar-97	9:00	5.4	NM	122	NM	NM
22-Apr-97	10:00	8.4	7.94	137	11.7	100
20-May-97	10:00	15.5	8.39	212	9.9	99

Sample Date	Sample Time	Water Temperature (^oC)	pH (Units)	Conductivity (µS)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (%)
02-Jun-97	10:20	15.9	7.82	238	9.9	100
17-Jun-97	10:20	19.8	8.32	254	9.5	106
07-Jul-97	10:00	19.2	7.99	291	8.2	89
21-Jul-97	9:40	22.3	8.21	308	8.7	101
04-Aug-97	9:45	21.6	8.26	322	7.9	90
18-Aug-97	10:20	19.0	7.79	348	8.1	87
02-Sep-97	10:35	18.3	8.10	348	10.1	108
15-Sep-97	9:20	14.6	7.80	354	8.0	78

Hangman Creek at Keevy Road

Sample Date	Sample Time	Water Temperature (^oC)	pH (Units)	Conductivity (µS)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (%)
20-Nov-95	11:25	4.2	8.31	199	13.0	100
11-Dec-95	15:26	NM	NM	NM	NM	NM
13-Dec-95	11:15	NM	NM	NM	NM	NM
14-Dec-95	10:00	2.5	NM	89.1	NM	NM
18-Dec-95	14:30	1.9	7.17	123	13.1	94
01-Jan-96	13:07	NM	NM	NM	NM	NM
08-Jan-96	15:55	2.3	NM	94.5	NM	NM
09-Jan-96	10:20	NM	NM	94.2	NM	NM
16-Jan-96	14:30	4.4	7.15	114	12.7	98
07-Feb-96	15:10	NM	NM	NM	NM	NM
09-Feb-96	11:15	NM	NM	NM	NM	NM
13-Feb-96	11:05	NM	NM	NM	NM	NM
21-Feb-96	11:15	4.5	7.33	108	12.9	95

LABORATORY CHEMISTRY DATA

Hangman Creek at the Idaho State Line

Date	Fecal Coliform (colonies per 100 ml)	Total Suspended Sediment (mg/l)	Turbidity (NTU)	Nitrate NO_3 (mg/l as N)	Nitrite $N0_2$ (mg/l as N)	Ammonia NH_3 (mg/l as N)	Total Phosphorus (mg/l)
10-Oct-94	83	6	5.1	0.05	<0.001	<0.01	0.044
24-Oct-94	67	2	2.6	0.14	<0.001	<0.01	0.058
07-Nov-94	27	7	23	2.63	0.015	0.01	0.131
21-Nov-94	60	5	20	4.78	0.011	0.03	0.116
01-Dec-94	NS	98	65	NS	NS	NS	NS
01-Dec-94	NS	105	50	NS	NS	NS	NS
05-Dec-94	180	3	17	5.68	0.01	0.04	0.131
18-Dec-94	NS	79	35	NS	NS	NS	NS
19-Dec-94	530	26	30	4.97	0.005	0.10	0.198
27-Dec-94	NS	333	101	NS	NS	NS	NS
09-Jan-95	420	140	125	2.57	0.013	0.08	0.592
23-Jan-95	36	13	23	3.19	0.001	0.02	0.116
06-Feb-95	20	19	22	2.40	0.001	0.03	0.134
06-Feb-95	NS	18	26	NS	NS	NS	NS
06-Feb-95	NS	19	24	NS	NS	NS	NS
18-Feb-95	NS	300	NM	NS	NS	NS	NS
19-Feb-95	160	330	120	2.61	0.005	0.05 (m)	0.804
19-Feb-95	NS	810	195	NS	NS	NS	NS
19-Feb-95	NS	740	190	NS	NS	NS	NS
20-Feb-95	NS	320	125	NS	NS	NS	NS
20-Feb-95	NS	350	118	NS	NS	NS	NS
06-Mar-95	20	7	11	3.07	0.003	0.03	0.093
15-Mar-95	NS	370	125	NS	NS	NS	NS
20-Mar-95	20	16	23	2.42	0.005	0.02	0.131
03-Apr-95	5	6	12	2.25	0.003	0.05	0.074
17-Apr-95	5	5	11	1.69	0.003	0.02	0.079
01-May-95	3	15	1.1	1.32	0.003	0.02	0.085
15-May-95	20	17	13	0.75	0.003	0.01	0.078
30-May-95	20	40	5.3	0.55	0.005	0.06	0.065
12-Jun-95	80	30	8.3	0.51	0.006	0.03	0.098
26-Jun-95	30	131	11	0.29	0.003	0.06	0.135
10-Jul-95	85	11	2.0	0.23	0.001	0.03	0.074
24-Jul-95	51	10	4.7	0.15	0.001	0.05	0.081
07-Aug-95	2400	12	5.2	0.25	0.001	0.02	0.093
21-Aug-95	110	43	6.2	0.15	0.001	0.01	0.095
11-Sep-95	30	24	10.3	0.07	0.001	0.01	0.099
25-Sep-95	290	76	6.6	0.09	<0.001	0.05	0.086

Little Hangman Creek

Date	Fecal Coliform (colonies per 100 ml)	Total Suspended Sediment (mg/l)	Turbidity (NTU)	Nitrate NO_3 (mg/l as N)	Nitrite $N0_2$ (mg/l as N)	Ammonia NH_3 (mg/l as N)	Total Phosphorus (mg/l)
10-Oct-94	110	2	1.5	0.09	<0.001	<0.01	0.040
24-Oct-94	19	3	1.6	0.12	0.001	0.02	0.062
07-Nov-94	14	8	2.7	0.80	0.006	<0.01	0.117
21-Nov-94	100	2	7.5	13.4	0.098	0.04	0.087
01-Dec-94	NS	70	79	NS	NS	NS	NS
05-Dec-94	50	2	19	8.43	0.018	0.05	0.212
18-Dec-94	NS	98	52	NS	NS	NS	NS
18-Dec-94	NS	103	56	NS	NS	NS	NS
19-Dec-94	420	23	36	7.28	0.008	0.10	0.283
19-Dec-94	NS	29	40	NS	NS	NS	NS
27-Dec-94	NS	248	140	NS	NS	NS	NS
09-Jan-95	NS	55	55	NS	NS	NS	NS
09-Jan-95	90	28	20	3.15	0.011	0.10	0.176
11-Jan-95	NS	208	180	NS	NS	NS	NS
14-Jan-95	NS	365	190	NS	NS	NS	NS
23-Jan-95	13	17	32	4.80	0.005	0.06 (m)	0.182
23-Jan-95	NS	18	30	NS	NS	NS	NS
23-Jan-95	NS	18	29	NS	NS	NS	NS
30-Jan-95	NS	3170	48	NS	NS	NS	NS
31-Jan-95	NS	4640	31	NS	NS	NS	NS
31-Jan-95	NS	3560	52	NS	NS	NS	NS
31-Jan-95	NS	4360	40	NS	NS	NS	NS
06-Feb-95	NS	19	25	NS	NS	NS	NS
06-Feb-95	NS	16	25	NS	NS	NS	NS
06-Feb-95	22	21	30	4.39	0.006	0.06	0.210
18-Feb-95	NS	60	73	NS	NS	NS	NS
18-Feb-95	NS	250	90	NS	NS	NS	NS
19-Feb-95	NS	990	177	NS	NS	NS	NS
19-Feb-95	NS	1120	175	NS	NS	NS	NS
19-Feb-95	NS	2260	115	NS	NS	NS	NS
19-Feb-95	NS	1090	170	NS	NS	NS	NS
20-Feb-95	NS	410	125	NS	NS	NS	NS
20-Feb-95	NS	400	125	NS	NS	NS	NS
20-Feb-95	100	390	135	4.41	0.008	0.05	0.956
21-Feb-95	NS	120	65	NS	NS	NS	NS
06-Mar-95	5	14	3.4	5.13	0.008	0.09	0.203
09-Mar-95	NS	2270	240	NS	NS	NS	NS
09-Mar-95	NS	1010	160	NS	NS	NS	NS
11-Mar-95	NS	480	210	NS	NS	NS	NS

Date	Fecal Coliform (colonies per 100 ml)	Total Suspended Sediment (mg/l)	Turbidity (NTU)	Nitrate NO_3 (mg/l as N)	Nitrite $N0_2$ (mg/l as N)	Ammonia NH_3 (mg/l as N)	Total Phosphorus (mg/l)
15-Mar-95	NS	1870	130	NS	NS	NS	NS
20-Mar-95	11	21	35	3.53	0.005	0.03	0.208
03-Apr-95	21	11	19	3.36	0.008	0.08	0.139
03-Apr-95	NS	29	18	NS	NS	NS	NS
17-Apr-95	6	9	17	2.46	0.011	0.02	0.134
01-May-95	3	13	1.5	2.20	0.006	0.02	0.119
15-May-95	510	14	17	0.95	0.005	0.01	0.118
30-May-95	110	12	6.2	0.53	0.010	0.04	0.093
12-Jun-95	130	10	7.2	0.72	0.013	0.03	0.117
26-Jun-95	690	13	4.0	0.51	0.006	0.05	0.087
10-Jul-95	400	12	5.0	0.31	0.006	0.06	0.160
24-Jul-95	1400	4	2.8	0.11	<0.001	0.05	0.130
07-Aug-95	130	5	2.7	0.29	0.001	0.06	0.151
21-Aug-95	10	7	3.7	0.18	0.001	0.05	0.098
11-Sep-95	20	5	2.5	0.10	0.001	0.05	0.106
25-Sep-95	520	3	2.5	0.11	<0.001	0.02	0.068
12-Dec-95	NS	1005	410	NS	NS	NS	NS
13-Dec-95	NS	241	400	NS	NS	NS	NS
06-Feb-96	NS	181	100	NS	NS	NS	NS
07-Feb-96	NS	559	275	NS	NS	NS	NS
18-Feb-96	NS	254	175	NS	NS	NS	NS
19-Feb-96	NS	1975	390	NS	NS	NS	NS
01-Dec-96	NS	134	100	NS	NS	NS	NS
08-Dec-96	NS	1056	300	NS	NS	NS	NS
09-Dec-96	NS	640	155	NS	NS	NS	NS
01-Jan-97	NS	1938	160	NS	NS	NS	NS
01-Jan-97	NS	906	72	NS	NS	NS	NS
02-Jan-97	NS	658	105	NS	NS	NS	NS
30-Jan-97	NS	1372	160	NS	NS	NS	NS
30-Jan-97	NS	1522	160	NS	NS	NS	NS
01-Feb-97	NS	3785	450	NS	NS	NS	NS
14-Feb-97	NS	3896	775	NS	NS	NS	NS
19-Feb-97	NS	4635	750	NS	NS	NS	NS
19-Feb-97	NS	4575	900	NS	NS	NS	NS

Rattler Run Creek

Date	Fecal Coliform (colonies per 100 ml)	Total Suspended Sediment (mg/l)	Turbidity (NTU)	Nitrate NO_3 (mg/l as N)	Nitrite $N0_2$ (mg/l as N)	Ammonia NH_3 (mg/l as N)	Total Phosphorus (mg/l)
10-Oct-94	51	<2	1.4	0.52	0.001	<0.01	0.274
24-Oct-94	24	4	1.4	0.29	0.001	0.01	0.228
07-Nov-94	56	<2	3.0	4.65	0.022	3.03 (e)	1.00
21-Nov-94	21	<2	2.1	6.53	0.022	2.22 (e)	0.682
05-Dec-94	6	<2	2.1	9.25	0.024	1.07	0.554
19-Dec-94	140	4	31	10.9	0.020	0.87	0.547
09-Jan-95	NS	348	200	NS	NS	NS	NS
09-Jan-95	160	296	190	5.54	0.003	0.98	1.68
09-Jan-95	NS	332	190	NS	NS	NS	NS
23-Jan-95	8	8	8.0	15.1	0.033	0.57 (m)	0.265
31-Jan-95	NS	4290	18	NS	NS	NS	NS
06-Feb-95	11	26	16	15.5	0.029	0.23	0.286
17-Feb-95	NS	840	160	NS	NS	NS	NS
17-Feb-95	NS	870	160	NS	NS	NS	NS
17-Feb-95	NS	1820	120	NS	NS	NS	NS
17-Feb-95	NS	1770	125	NS	NS	NS	NS
17-Feb-95	NS	2770	120	NS	NS	NS	NS
17-Feb-95	NS	2640	110	NS	NS	NS	NS
18-Feb-95	NS	6290	15	NS	NS	NS	NS
18-Feb-95	NS	6310	25	NS	NS	NS	NS
19-Feb-95	NS	3010	165	NS	NS	NS	NS
20-Feb-95	300	820	130	13.6	0.020	0.05	1.42
06-Mar-95	<1	69	53	11.4	0.029	0.39	0.406
09-Mar-95	130	2320	85	12.2	0.013	0.19 (m)	2.88
09-Mar-95	NS	2460	95	NS	NS	NS	NS
15-Mar-95	NS	920	150	NS	NS	NS	NS
20-Mar-95	16	301	82	11.9	0.018	0.18	0.688
03-Apr-95	2	6	5.0	12.3	0.083	0.06	0.180
17-Apr-95	1	2	3.0	11.7	0.041	0.02	0.146
01-May-95	24	4	0.4	9.25	0.01	0.03	0.238
15-May-95	16	6	3.0	4.69	0.015	0.01	0.225
30-May-95	33	5	3.7	1.80	0.013	0.04	0.257
05-Jun-95	NS	8	3.5	NS	NS	NS	NS
05-Jun-95	NS	6	3.6	NS	NS	NS	NS
12-Jun-95	130	6	4.5	2.97	0.010	0.01	0.377
26-Jun-95	100	47	2.8	3.53	0.006	0.08	0.353
07-Jul-95	NS	74	97	NS	NS	NS	NS
10-Jul-95	3100	25	13	4.16	0.033	0.04	0.712
24-Jul-95	1300	3	3.4	0.27	0.001	0.05	0.568

Date	Fecal Coliform (colonies per 100 ml)	Total Suspended Sediment (mg/l)	Turbidity (NTU)	Nitrate NO_3 (mg/l as N)	Nitrite $N0_2$ (mg/l as N)	Ammonia NH_3 (mg/l as N)	Total Phosphorus (mg/l)
07-Aug-95	14300	3	2.9	1.10	0.006	0.05	0.703
21-Aug-95	1800	16	3.3	0.34	<0.001	0.04	0.441
11-Sep-95	600	<2	3.2	0.77	0.003	0.05	0.494
25-Sep-95	210	<2	2.6	0.55	0.001	0.04	0.361
23-Oct-95	57	<2	1.5	4.10	0.003	0.01	0.423
23-Oct-95	57	<2	3.0	4.10	0.003	0.01	0.423
20-Nov-95	24	3	1.5	1.08	0.003	0.02	0.503
11-Dec-95	NS	135	152	NS	NS	NS	NS
11-Dec-95	NS	122	153	NS	NS	NS	NS
14-Dec-95	NS	55	42	NS	NS	NS	NS
14-Dec-95	NS	45	43	NS	NS	NS	NS
18-Dec-95	41	15	16	6.78	0.026	0.93	0.412
01-Jan-96	NS	43	94	NS	NS	NS	NS
01-Jan-96	NS	47	94	NS	NS	NS	NS
08-Jan-96	NS	467	285	NS	NS	NS	NS
16-Jan-96	30	62	70	11.5	0.033	0.33	0.501
25-Jan-96	NS	14	8.0	NS	NS	NS	NS
07-Feb-96	NS	1029	275	NS	NS	NS	NS
08-Feb-96	NS	3709	600	NS	NS	NS	NS
13-Feb-96	NS	34	40	NS	NS	NS	NS
21-Feb-96	60	114	78	12.2	0.013	0.11	0.472
10-Mar-96	NS	2539	550	NS	NS	NS	NS
10-Mar-96	NS	2588	600	NS	NS	NS	NS
13-Mar-96	NS	147	65	NS	NS	NS	NS
13-Mar-96	NS	142	70	NS	NS	NS	NS
18-Mar-96	13	29	24	3.65	0.022	0.11	0.241
02-Apr-96	NS	45	38	NS	NS	NS	NS
15-Apr-96	1	6	4.0	5.45	0.061	0.02	0.181
20-May-96	20	23	14	6.42	0.024	NS	0.323
04-Jun-96	96	6	0.4	0.53	0.011	NS	0.264
18-Jun-96	20	6	3.4	3.22	0.003	0.02	0.273
02-Jul-96	2700	3	3.6	3.19	0.008	0.03	0.264
16-Jul-96	4500	5	2.0	1.72	0.006	0.04	0.518
05-Aug-96	280	2	1.4	1.33	NS	0.03 (m)	0.533
20-Aug-96	340	6	2.5	1.49	0.001	0.03 (m)	0.665
17-Sep-96	760	8	3.8	2.84	0.001	NS	0.462
10-Oct-96	NS	698	140	NS	NS	NS	NS
22-Oct-96	880	3	6.0	6.22	0.022	3.24 (e)	1.43
18-Nov-96	30	2	4.6	7.33	0.053	1.26 (e)	0.948
08-Dec-96	NS	77	43	NS	NS	NS	NS

Date	Fecal Coliform (colonies per 100 ml)	Total Suspended Sediment (mg/l)	Turbidity (NTU)	Nitrate NO_3 (mg/l as N)	Nitrite $N0_2$ (mg/l as N)	Ammonia NH_3 (mg/l as N)	Total Phosphorus (mg/l)
16-Dec-96	42	8	16	15.3	0.026	0.14 (m)	0.254
29-Dec-96	NS	1132	300	NS	NS	NS	NS
01-Jan-97	NS	604	250	NS	NS	NS	NS
02-Jan-97	NS	215	100	11.5	0.010	0.17 (m)	0.701
03-Jan-97	NS	125	97	NS	NS	NS	NS
22-Jan-97	110	44	36	13.3	0.019	0.16	0.303
01-Feb-97	NS	274	60	NS	NS	NS	NS
03-Feb-97	NS	134	14	NS	NS	NS	NS
19-Feb-97	110	10540	850	8.70	0.011	0.09	10.5
13-Mar-97	NS	24	23	NS	NS	NS	NS
17-Mar-97	120	1042	365	8.17	0.005	0.07	1.56
19-Mar-97	NS	272	89	NS	NS	NS	NS
22-Apr-97	2	7	5.3	9.89	0.041	0.04	0.244
25-Apr-97	NS	16	9.9	NS	NS	NS	NS
20-May-97	46	4	3.7	6.60	0.028	0.01	0.167
02-Jun-97	138	31	17	6.00	0.045	0.05	0.394
17-Jun-97	90	7	5.0	4.14	0.006	0.01	0.266
07-Jul-97	170	3	2.3	2.75	0.003	<0.01	0.332
21-Jul-97	123	3	2.1	2.00	0.005	0.03	0.387
04-Aug-97	350	6	1.7	1.54	0.001	0.01	0.450
18-Aug-97	390	4	1.9	1.17	0.001	0.01	0.393

Hangman Creek at Bradshaw Road

Date	Fecal Coliform (colonies per 100 ml)	Total Suspended Sediment (mg/l)	Turbidity (NTU)	Nitrate NO_3 (mg/l as N)	Nitrite $N0_2$ (mg/l as N)	Ammonia NH_3 (mg/l as N)	Total Phosphorus (mg/l)
09-Mar-96	NS	443	150	NS	NS	NS	NS
09-Mar-96	NS	441	150	NS	NS	NS	NS
13-Mar-96	NS	52	50	NS	NS	NS	NS
13-Mar-96	NS	49	50	NS	NS	NS	NS
18-Mar-96	8	19	32	3.51	0.003	0.04	0.165
02-Apr-96	NS	428	165	NS	NS	NS	NS
15-Apr-96	6	12	25	5.50	0.005	0.02	0.119
20-May-96	510	35	63	1.55	0.008	0.02	0.280
04-Jun-96	15	11	0.6	1.18	0.006	NS	0.053
18-Jun-96	7	10	3.7	0.89	0.005	0.01	0.061
02-Jul-96	66	3	2.2	0.84	0.008	0.01	0.042
16-Jul-96	3800	10	3.6	0.14	0.001	0.06	0.092
05-Aug-96	24	11	6.1	0.16	NS	0.02 (m)	0.099
20-Aug-96	26	13	5.0	0.17	0.001	0.02 (m)	0.140
17-Sep-96	36	2	2.4	0.15	0.001	NS	0.069
22-Oct-96	234	7	3.2	0.53	0.001	0.01	0.040
18-Nov-96	30	2	5.0	2.93	0.013	0.18	0.172
08-Dec-96	NS	59	36	NS	NS	NS	NS
08-Dec-96	NS	62	35	NS	NS	NS	NS
08-Dec-96	NS	70	40	NS	NS	NS	NS
09-Dec-96	NS	434	185	NS	NS	NS	NS
10-Dec-96	NS	80	79	NS	NS	NS	NS
16-Dec-96	92	9	44	5.76	0.005	0.05 (m)	0.230
29-Dec-96	NS	544	200	NS	NS	NS	NS
01-Jan-97	NS	2116	475	NS	NS	NS	NS
01-Jan-97	NS	1840	475	4.10	0.006	0.04 (m)	2.68
02-Jan-97	NS	335	125	4.54	0.010	0.03 (m)	0.788
03-Jan-97	NS	218	100	NS	NS	NS	NS
22-Jan-97	114	449	290	4.17	0.003	0.03	1.07
01-Feb-97	NS	430	47	NS	NS	NS	NS
03-Feb-97	NS	166	20	NS	NS	NS	NS
19-Feb-97	140	1924	450	4.09	0.005	0.04	2.45
13-Mar-97	NS	65	60	3.25	0.003	0.01 (m)	0.260
13-Mar-97	NS	63	59	NS	NS	NS	NS
17-Mar-97	500	3170	750	3.95	0.003	0.05	4.27
17-Mar-97	NS	2950	700	NS	NS	NS	NS
17-Mar-97	NS	2886	725	NS	NS	NS	NS

Date	Fecal Coliform (colonies per 100 ml)	Total Suspended Sediment (mg/l)	Turbidity (NTU)	Nitrate NO_3 (mg/l as N)	Nitrite $N0_2$ (mg/l as N)	Ammonia NH_3 (mg/l as N)	Total Phosphorus (mg/l)
19-Mar-97	NS	392	120	NS	NS	NS	NS
22-Apr-97	150	48	81	1.22	0.003	0.04	0.179
25-Apr-97	NS	163	7.7	NS	NS	NS	NS
20-May-97	25	11	7.7	1.55	0.005	<0.01	0.061
02-Jun-97	160	37	34	1.65	0.020	0.06	0.226
17-Jun-97	98	37	8.1	1.26	0.005	<0.01	0.088
07-Jul-97	160	8	4.2	0.94	0.006	<0.01	0.062
21-Jul-97	73	6	3.5	0.45	0.006	0.01	0.054
04-Aug-97	87	4	3.5	0.15	0.003	0.01	0.070
18-Aug-97	42	6	3.6	0.28	0.005	<0.01	0.070

Rock Creek at Jackson Road

Date	Fecal Coliform (colonies per 100 ml)	Total Suspended Sediment (mg/l)	Turbidity (NTU)	Nitrate NO_3 (mg/l as N)	Nitrite $N0_2$ (mg/l as N)	Ammonia NH_3 (mg/l as N)	Total Phosphorus (mg/l)
10-Oct-94	<1	16	6.9	0.08	<0.001	<0.01	0.205
24-Oct-94	23	9	4.2	0.15	<0.001	0.02	0.164
07-Nov-94	16	<2	1.6	1.19	0.003	<0.01	0.092
21-Nov-94	20	<2	2.0	2.97	0.006	0.01 (m)	0.068
01-Dec-94	NS	67	82	NS	NS	NS	NS
01-Dec-94	NS	51	63	NS	NS	NS	NS
05-Dec-94	270	2	11	11.0	0.028	0.18	0.155
18-Dec-94	NS	277	57	NS	NS	NS	NS
19-Dec-94	730	26	31	12.0	0.020	0.46	0.267
27-Dec-94	NS	222	125	NS	NS	NS	NS
09-Jan-95	680	58	40	5.14	0.013	0.21	0.344
09-Jan-95	NS	327	245	NS	NS	NS	NS
09-Jan-95	NS	72	60	NS	NS	NS	NS
10-Jan-95	NS	1410	105	NS	NS	NS	NS
10-Jan-95	NS	1844	110	NS	NS	NS	NS
10-Jan-95	NS	1223	170	NS	NS	NS	NS
11-Jan-95	NS	2315	170	NS	NS	NS	NS
23-Jan-95	NS	5	15	NS	NS	NS	NS
23-Jan-95	270	4	17	7.76	0.010	0.07	0.139
23-Jan-95	NS	6	16	NS	NS	NS	NS
31-Jan-95	NS	2620	97	NS	NS	NS	NS
31-Jan-95	NS	2640	80	NS	NS	NS	NS
02-Feb-95	NS	230	135	NS	NS	NS	NS
02-Feb-95	NS	170	120	NS	NS	NS	NS
02-Feb-95	NS	260	130	NS	NS	NS	NS
02-Feb-95	NS	550	170	NS	NS	NS	NS
06-Feb-95	NS	15	20	NS	NS	NS	NS
06-Feb-95	40	17	17	8.04	0.011	0.05	0.182
06-Feb-95	NS	15	20	NS	NS	NS	NS
17-Feb-95	100	1270	165	0.01	4.23	0.26	1.77
17-Feb-95	NS	430	110	NS	NS	NS	NS
17-Feb-95	NS	290	100	NS	NS	NS	NS
17-Feb-95	NS	1050	180	NS	NS	NS	NS
17-Feb-95	NS	1040	180	NS	NS	NS	NS
17-Feb-95	NS	1000	185	NS	NS	NS	NS
17-Feb-95	NS	1140	175	NS	NS	NS	NS
17-Feb-95	NS	1090	160	NS	NS	NS	NS
17-Feb-95	NS	1140	165	NS	NS	NS	NS
17-Feb-95	NS	460	100	NS	NS	NS	NS

Date	Fecal Coliform (colonies per 100 ml)	Total Suspended Sediment (mg/l)	Turbidity (NTU)	Nitrate NO_3 (mg/l as N)	Nitrite $N0_2$ (mg/l as N)	Ammonia NH_3 (mg/l as N)	Total Phosphorus (mg/l)
18-Feb-95	NS	1330	180	NS	NS	NS	NS
18-Feb-95	NS	110	93	NS	NS	NS	NS
18-Feb-95	NS	470	135	NS	NS	NS	NS
18-Feb-95	NS	490	130	NS	NS	NS	NS
18-Feb-95	NS	440	125	NS	NS	NS	NS
19-Feb-95	NS	2120	140	NS	NS	NS	NS
19-Feb-95	NS	1270	170	NS	NS	NS	NS
19-Feb-95	NS	1930	130	NS	NS	NS	NS
20-Feb-95	300	740	175	7.70	0.010	0.05	1.20
20-Feb-95	NS	630	165	NS	NS	NS	NS
21-Feb-95	NS	76	50	NS	NS	NS	NS
06-Mar-95	100	10	1.9	6.04	0.006	0.02	0.129
09-Mar-95	NS	1390	180	NS	NS	NS	NS
09-Mar-95	NS	2700	85	NS	NS	NS	NS
09-Mar-95	NS	4220	35	NS	NS	NS	NS
09-Mar-95	400	4460	83	5.10	0.006	0.12 (m)	3.62
09-Mar-95	NS	4190	50	NS	NS	NS	NS
09-Mar-95	NS	4260	53	NS	NS	NS	NS
10-Mar-95	NS	1030	160	NS	NS	NS	NS
10-Mar-95	NS	230	199	NS	NS	NS	NS
15-Mar-95	NS	560	175	NS	NS	NS	NS
15-Mar-95	NS	2050	150	NS	NS	NS	NS
20-Mar-95	40	42	39	6.65	0.006	0.03	0.219
03-Apr-95	15	13	7.0	4.26	0.010	0.05	0.065
03-Apr-95	NS	<2	6.0	NS	NS	NS	NS
15-Apr-95	NS	4	5.0	NS	NS	NS	NS
15-Apr-95	NS	4	5.0	NS	NS	NS	NS
15-Apr-95	NS	12	7.0	NS	NS	NS	NS
17-Apr-95	5	2	6.0	2.71	0.013	0.02	0.056
01-May-95	<1	3	0.4	1.77	0.018	0.02	0.050
15-May-95	10	4	4.0	0.68	0.008	<0.01	0.049
30-May-95	23	5	5.0	0.83	0.013	0.06	0.078
05-Jun-95	380	NS	NS	NS	NS	NS	NS
05-Jun-95	NS	8	3.6	NS	NS	NS	NS
05-Jun-95	NS	13	3.6	NS	NS	NS	NS
06-Jun-95	NS	10	4.5	NS	NS	NS	NS
12-Jun-95	34	4	3.0	0.64	0.005	0.01	0.056
26-Jun-95	8	NS	NS	NS	NS	NS	NS
26-Jun-95	17	3	2.3	0.52	0.010	0.10	0.064
07-Jul-95	NS	41	28	NS	NS	NS	NS

Date	Fecal Coliform (colonies per 100 ml)	Total Suspended Sediment (mg/l)	Turbidity (NTU)	Nitrate NO_3 (mg/l as N)	Nitrite $N0_2$ (mg/l as N)	Ammonia NH_3 (mg/l as N)	Total Phosphorus (mg/l)
10-Jul-95	340	14	5.0	0.39	0.006	0.02	0.136
24-Jul-95	20	14	4.0	0.12	0.001	0.06	0.866
07-Aug-95	1700	8	3.8	0.30	0.003	0.04	0.154
21-Aug-95	20	5	2.4	0.71	0.008	0.04	0.069
11-Sep-95	50	3	3.8	0.74	0.010	0.05	0.086
25-Sep-95	50	3	2.0	0.72	0.005	0.02	0.057
25-Sep-95	<1	NS	NS	NS	NS	NS	NS
23-Oct-95	12	2	2.4	1.58	0.028	0.03	0.133
20-Nov-95	24	<2	4.1	1.08	0.001	0.02	0.050
11-Dec-95	NS	152	89	NS	NS	NS	NS
11-Dec-95	NS	156	93	NS	NS	NS	NS
12-Dec-95	NS	3486	885	NS	NS	NS	NS
12-Dec-95	NS	3123	875	NS	NS	NS	NS
13-Dec-95	NS	271	345	NS	NS	NS	NS
13-Dec-95	NS	272	335	NS	NS	NS	NS
18-Dec-95	610	8	46	5.97	0.015	0.16	0.224
01-Jan-96	NS	88	31	NS	NS	NS	NS
01-Jan-96	NS	35	70	NS	NS	NS	NS
01-Jan-96	NS	35	67	NS	NS	NS	NS
08-Jan-96	NS	1000	550	NS	NS	NS	NS
09-Jan-96	NS	90	116	NS	NS	NS	NS
10-Jan-96	NS	81	120	NS	NS	NS	NS
16-Jan-96	NS	106	155	NS	NS	NS	NS
16-Jan-96	250	111	150	7.40	<0.001	0.13	0.650
06-Feb-96	NS	1691	450	NS	NS	NS	NS
07-Feb-96	NS	1057	325	NS	NS	NS	NS
07-Feb-96	NS	1584	400	NS	NS	NS	NS
08-Feb-96	NS	1488	400	NS	NS	NS	NS
08-Feb-96	NS	1432	400	NS	NS	NS	NS
09-Feb-96	NS	650	250	NS	NS	NS	NS
09-Feb-96	NS	591	300	NS	NS	NS	NS
09-Feb-96	NS	604	325	NS	NS	NS	NS
09-Feb-96	NS	483	250	NS	NS	NS	NS
09-Feb-96	NS	644	300	NS	NS	NS	NS
10-Feb-96	NS	90	75	NS	NS	NS	NS
10-Feb-96	NS	465	225	NS	NS	NS	NS
10-Feb-96	NS	84	70	NS	NS	NS	NS
13-Feb-96	NS	31	60	NS	NS	NS	NS
21-Feb-96	40	48	67	5.63	0.005	0.04	0.289
09-Mar-96	NS	2020	500	NS	NS	NS	NS

Date	Fecal Coliform (colonies per 100 ml)	Total Suspended Sediment (mg/l)	Turbidity (NTU)	Nitrate NO_3 (mg/l as N)	Nitrite $N0_2$ (mg/l as N)	Ammonia NH_3 (mg/l as N)	Total Phosphorus (mg/l)
09-Mar-96	NS	1876	475	NS	NS	NS	NS
09-Mar-96	NS	123	80	NS	NS	NS	NS
09-Mar-96	NS	133	80	NS	NS	NS	NS
10-Mar-96	NS	169	95	NS	NS	NS	NS
11-Mar-96	NS	573	225	NS	NS	NS	NS
11-Mar-96	NS	594	250	NS	NS	NS	NS
13-Mar-96	NS	82	70	NS	NS	NS	NS
18-Mar-96	11	9	31	4.83	0.005	0.06	0.165
05-Apr-96	NS	8	25	NS	NS	NS	NS
15-Apr-96	<1	3	11	5.71	0.008	<0.01	0.070
15-May-96	NS	48	44	NS	NS	NS	NS
20-May-96	16	23	53	1.70	0.010	0.01	0.240
04-Jun-96	17	5	0.3	0.47	0.005	NS	0.039
18-Jun-96	23	5	4.3	0.74	0.003	0.01	0.059
02-Jul-96	90	5	3.2	0.65	0.005	0.03	0.051
16-Jul-96	230	7	2.5	0.70	0.019	0.06	0.097
05-Aug-96	64	6	2.5	1.09	0.001	0.03 (m)	0.096
20-Aug-96	3	3	2.9	0.85	0.015	0.07 (m)	0.085
17-Sep-96	61	9	3.9	1.61	0.008	NS	0.098
22-Oct-96	115	2	3.3	1.65	0.008	0.04	0.087
18-Nov-96	37	<2	2.8	1.53	0.001	0.04	0.043
08-Dec-96	NS	56	27	NS	NS	NS	NS
08-Dec-96	NS	59	27	NS	NS	NS	NS
09-Dec-96	NS	131	86	NS	NS	NS	NS
10-Dec-96	NS	461	120	NS	NS	NS	NS
16-Dec-96	42	4	22	10.4	0.013	0.09 (m)	0.160
31-Dec-96	NS	1060	275	NS	NS	NS	NS
31-Dec-96	NS	1128	250	NS	NS	NS	NS
01-Jan-97	NS	708	250	NS	NS	NS	NS
01-Jan-97	NS	1400	405	6.50	0.006	0.09 (m)	2.28
02-Jan-97	NS	260	85	NS	NS	NS	NS
02-Jan-97	NS	265	102	7.68	0.005	NS	0.691
03-Jan-97	NS	238	110	NS	NS	NS	NS
08-Jan-97	NS	40	58	NS	NS	NS	NS
08-Jan-97	NS	57	59	NS	NS	NS	NS
22-Jan-97	300	218	285	5.45	0.011	0.11	0.844
31-Jan-97	NS	851	185	NS	NS	NS	NS
01-Feb-97	NS	151	92	NS	NS	NS	NS
01-Feb-97	NS	121	26	NS	NS	NS	NS
03-Feb-97	NS	96	17	NS	NS	NS	NS

Date	Fecal Coliform (colonies per 100 ml)	Total Suspended Sediment (mg/l)	Turbidity (NTU)	Nitrate NO_3 (mg/l as N)	Nitrite $N0_2$ (mg/l as N)	Ammonia NH_3 (mg/l as N)	Total Phosphorus (mg/l)
19-Feb-97	NS	7565	875	NS	NS	NS	NS
19-Feb-97	230	4973	850	5.12	0.008	0.09	5.70
10-Mar-97	150	170	96	5.29	0.003	0.05	0.394
10-Mar-97	NS	135	86	NS	NS	NS	NS
10-Mar-97	NS	155	94	NS	NS	NS	NS
13-Mar-97	NS	41	67	NS	NS	NS	NS
17-Mar-97	NS	1873	650	NS	NS	NS	NS
17-Mar-97	240	2272	650	4.51	0.003	0.07	3.10
18-Mar-97	NS	119	75	NS	NS	NS	NS
19-Mar-97	NS	200	105	NS	NS	NS	NS
22-Apr-97	30	15	34	2.06	0.005	0.03	0.153
25-Apr-97	NS	26	37	NS	NS	NS	NS
20-May-97	63	7	5.8	1.25	0.010	0.01	0.062
02-Jun-97	400	121	120	1.69	0.026	0.11	0.515
17-Jun-97	50	7	4.4	0.97	0.005	0.01	0.067
07-Jul-97	58	8	4.2	1.32	0.008	0.01	0.098
21-Jul-97	80	9	3.9	1.41	0.010	0.02	0.106
04-Aug-97	290	6	2.2	1.67	0.015	0.03	0.113
18-Aug-97	51	4	1.9	2.10	0.015	0.02	0.112

Hangman Creek at Keevy Road

Date	Fecal Coliform (colonies per 100 ml)	Total Suspended Sediment (mg/l)	Turbidity (NTU)	Nitrate NO_3 (mg/l as N)	Nitrite $N0_2$ (mg/l as N)	Ammonia NH_3 (mg/l as N)	Total Phosphorus (mg/l)
23-Oct-95	10	<2	0.6	0.13	0.001	0.01	0.012
20-Nov-95	4	3	1.9	0.40	0.001	0.02	0.053
11-Dec-95	NS	12	50	NS	NS	NS	NS
11-Dec-95	NS	9	53	NS	NS	NS	NS
13-Dec-95	NS	915	405	NS	NS	NS	NS
13-Dec-95	NS	1151	410	NS	NS	NS	NS
14-Dec-95	NS	100	93	NS	NS	NS	NS
14-Dec-95	NS	98	94	NS	NS	NS	NS
18-Dec-95	60	13	61	3.48	0.008	0.09	0.258
01-Jan-96	NS	138	131	NS	NS	NS	NS
01-Jan-96	NS	107	130	NS	NS	NS	NS
08-Jan-96	NS	2342	785	NS	NS	NS	NS
09-Jan-96	NS	316	165	NS	NS	NS	NS
16-Jan-96	140	212	180	4.04	<0.001	0.07	0.939
07-Feb-96	NS	1960	500	NS	NS	NS	NS
08-Feb-96	NS	1662	400	NS	NS	NS	NS
13-Feb-96	NS	52	60	NS	NS	NS	NS
21-Feb-96	20	84	87	3.73	0.005	0.02	0.371

DISCHARGE DATA - All Stations

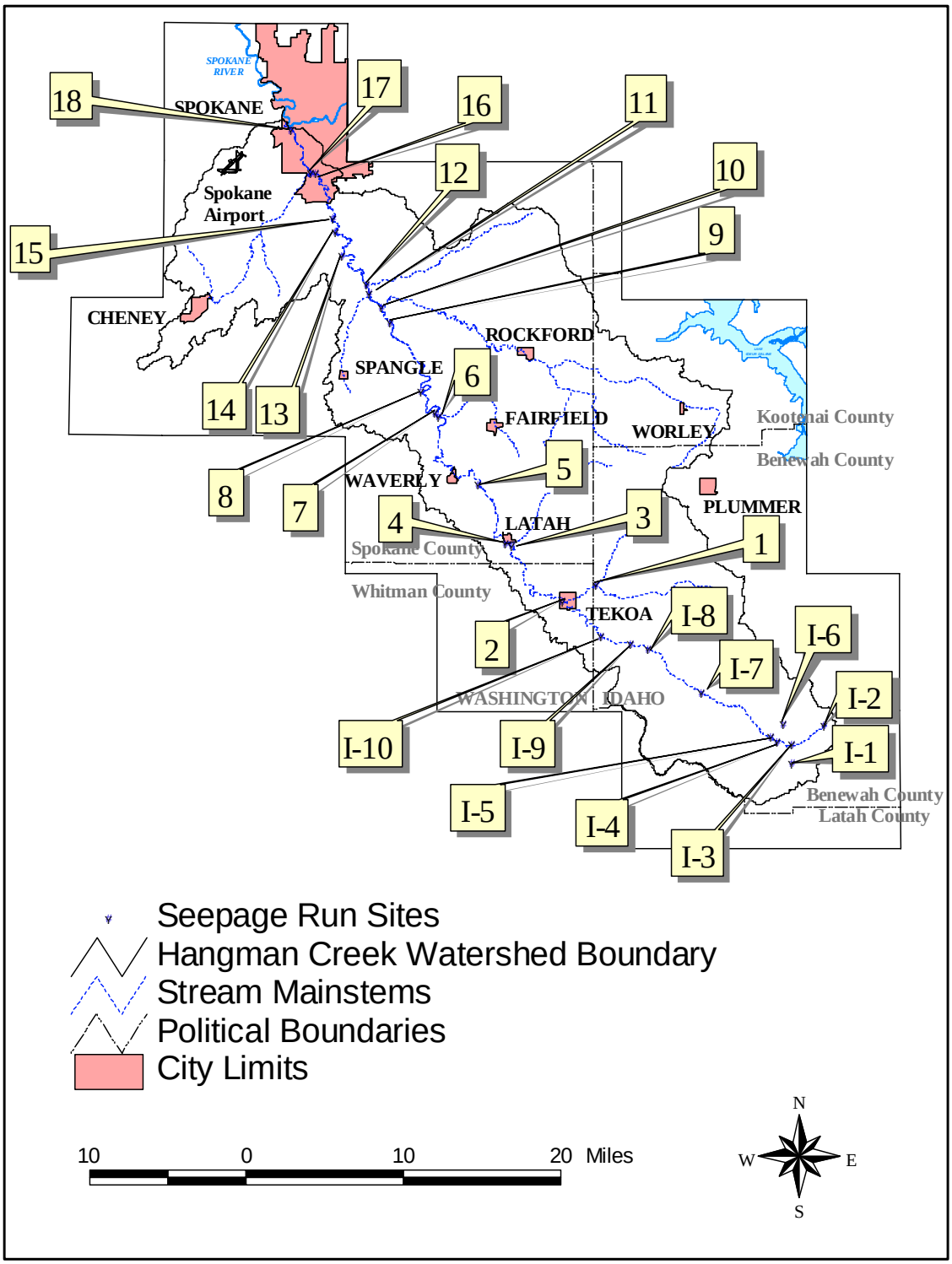
Date	Discharge (cfs)					Stage (Feet)
	Hangman Creek at the Idaho State Line	Little Hangman Creek	Rattler Run Creek	Hangman Creek at Bradshaw Road	Rock Creek at Jackson Road	Hangman Creek at Keevy Road
11-Oct-94	0.13 (MD)	0.10 (MD)	0.02 (MD)	NM	0 (MD)	NM
24-Oct-94	0.20 (MD)	0.18 (MD)	0.06 (MD)	NM	0.01 (MD)	NM
07-Nov-94	2.53 (MD)	0.45 (MD)	0.34 (MD)	NM	2.76 (MD)	NM
21-Nov-94	24.1 (MD)	2.67 (MD)	0.53 (MD)	NM	4.60 (MD)	NM
01-Dec-94	387	183	NM	NM	309 (MD)	NM
02-Dec-94	NM	58.3 (MD)	1.78 (MD)	NM	NM	NM
05-Dec-94	33.8 (MD)	0.98	NM	NM	20.0	NM
18-Dec-94	410	275	NM	NM	781	NM
19-Dec-94	243 (MD)	162 (MD)	3.92 (MD)	NM	337 (MD)	NM
27-Dec-94	949	617	NM	NM	729	NM
09-Jan-95	97.7	45.4	15.8 (MD)	NM	88.5 (9:15)	NM
09-Jan-95	NM	NM	NM	NM	826 (15:10)	NM
10-Jan-95	NM	NM	NM	NM	830	NM
15-Jan-95	425 (MD)	209 (MD)	12.9 (MD)	NM	360 (MD)	NM
23-Jan-95	62.2	28.8	NM	NM	82.9	NM
31-Jan-95	NM	1430 (14:32)	NM	NM	2320	NM
31-Jan-95	NM	1390 (15:09)	NM	NM	NM	NM
02-Feb-95	NM	NM	NM	NM	777	NM
06-Feb-95	144	31.8	NM	NM	243	NM
17-Feb-95	NM	NM	NM	NM	202 (10:00)	NM
17-Feb-95	NM	NM	NM	NM	241 (10:25)	NM
17-Feb-95	NM	NM	NM	NM	265 (10:41)	NM
17-Feb-95	NM	NM	NM	NM	280 (11:06)	NM
17-Feb-95	NM	NM	NM	NM	905 (13:10)	NM
17-Feb-95	NM	NM	NM	NM	1020 (13:28)	NM
17-Feb-95	NM	NM	NM	NM	1040 (14:05)	NM
17-Feb-95	NM	NM	NM	NM	983 (14:29)	NM
17-Feb-95	NM	NM	NM	NM	1080 (16:17)	NM
18-Feb-95	304	81.4 (13:00)	NM	NM	388 (13:46)	NM
18-Feb-95	NM	184 (16:20)	NM	NM	658 (17:33)	NM
19-Feb-95	NM	851 (10:45)	NM	NM	983 (11:27)	NM
19-Feb-95	NM	681 (13:30)	NM	NM	998 (12:05)	NM
19-Feb-95	NM	599 (14:51)	NM	NM	998 (12:20)	NM
19-Feb-95	NM	578 (15:06)	NM	NM	973 (15:50)	NM
20-Feb-95	2030	586	NM	NM	1370 (10:40)	NM
20-Feb-95	NM	NM	NM	NM	1310 (11:20)	NM
06-Mar-95	45.6	8.06	NM	NM	97.3	NM

Date	Discharge (cfs)					Stage (Feet)
	Hangman Creek at the Idaho State Line	Little Hangman Creek	Rattler Run Creek	Hangman Creek at Bradshaw Road	Rock Creek at Jackson Road	Hangman Creek at Keevy Road
09-Mar-95	NM	NM	NM	NM	939 (12:10)	NM
09-Mar-95	NM	NM	NM	NM	750 (16:50)	NM
09-Mar-95	NM	NM	NM	NM	746 (17:10)	NM
10-Mar-95	NM	NM	NM	NM	638 (7:37)	NM
10-Mar-95	NM	NM	NM	NM	525 (13:10)	NM
15-Mar-95	NM	NM	NM	NM	1300	NM
20-Mar-95	164	44.0	NM	NM	419	NM
03-Apr-95	29.9	6.30	NM	NM	91.4	NM
15-Apr-95	NM	NM	NM	NM	153 (12:00)	NM
15-Apr-95	NM	NM	NM	NM	213 (15:07)	NM
17-Apr-95	29.4	6.97	NM	NM	89.9	NM
01-May-95	4.64	3.03	NM	NM	35.0	NM
15-May-95	2.53	3.97	NM	NM	31.5	NM
30-May-95	NM	1.86	NM	NM	8.82	NM
05-Jun-95	NM	NM	NM	NM	7.53	NM
06-Jun-95	NM	NM	NM	NM	19.4	NM
12-Jun-95	NM	1.99	NM	NM	1.11	NM
07-Jul-95	NM	NM	NM	NM	1.33	NM
10-Jul-95	NM	1.50	0.73	NM	18.1	NM
24-Jul-95	NM	0.46	0.23	NM	1.57	NM
07-Aug-95	NM	0.67	0.25	NM	1.74	NM
21-Aug-95	NM	0.46	0.00	NM	1.18	NM
11-Sep-95	NM	NM	0.19	NM	3.79	NM
25-Sep-95	NM	0.20	0.35	NM	2.24	NM
23-Oct-95	NM	NM	0.28 (MD)	NM	2.46 (MD)	0.16
20-Nov-95	NM	NM	0.38 (MD)	NM	4.81 (MD)	0.38
11-Dec-95	NM	NM	5.14 (MD)	NM	189	1.55
12-Dec-95	NM	NM	NM	NM	808	NM
13-Dec-95	NM	NM	NM	NM	458	5.29
14-Dec-95	NM	NM	2.12 (MD)	NM	NM	2.73
18-Dec-95	NM	NM	1.25 (MD)	NM	123	1.74
31-Dec-95	NM	NM	NM	NM	139 (MD)	NM
01-Jan-96	NM	NM	19.1	NM	87.1	2.15
08-Jan-96	NM	NM	31.9 (MD)	NM	1390	5.05
09-Jan-96	NM	NM	NM	NM	354	3.80
10-Jan-96	NM	NM	NM	NM	346	NM
16-Jan-96	NM	NM	35.0	NM	258 (MD)	3.42
25-Jan-96	NM	NM	18.0	NM	55.2	NM

Date	Discharge (cfs)					Stage (Feet)
	Hangman Creek at the Idaho State Line	Little Hangman Creek	Rattler Run Creek	Hangman Creek at Bradshaw Road	Rock Creek at Jackson Road	Hangman Creek at Keevy Road
06-Feb-96	NM	NM	NM	NM	905	NM
07-Feb-96	NM	NM	174 (MD)	NM	6200 (9:40)	8.83
07-Feb-96	NM	NM	NM	NM	3750 (16:10)	NM
08-Feb-96	NM	NM	644	NM	4420	NM
09-Feb-96	NM	NM	NM	NM	2470 (9:30)	8.33
09-Feb-96	NM	NM	NM	NM	2080 (10:35)	NM
09-Feb-96	NM	NM	NM	NM	1900 (12:35)	NM
09-Feb-96	NM	NM	NM	NM	1700 (13:06)	NM
09-Feb-96	NM	NM	NM	NM	1540 (MD) (13:06)	NM
10-Feb-96	NM	NM	NM	NM	463 (MD)	NM
13-Feb-96	NM	NM	33.2	NM	246	8.33
21-Feb-96	NM	NM	16.5	NM	445	3.95
09-Mar-96	NM	NM	45.7 (MD)	816	349 (10:05)	NM
09-Mar-96	NM	NM	NM	NM	514 (13:15)	NM
10-Mar-96	NM	NM	NM	NM	550	NM
11-Mar-96	NM	NM	NM	NM	1120	NM
13-Mar-96	NM	NM	9.29	552	431 (MD)	NM
18-Mar-96	NM	NM	3.10	232	202	NM
02-Apr-96	NM	NM	4.41	529	NM	NM
05-Apr-96	NM	NM	NM	NM	163	NM
15-Apr-96	NM	NM	1.35	122	80.1	NM
15-May-96	NM	NM	NM	NM	157	NM
20-May-96	NM	NM	2.34	356	135	NM
04-Jun-96	NM	NM	1.10 (MD)	51.1	12.1 (MD)	NM
18-Jun-96	NM	NM	0.46	18.8	2.20	NM
02-Jul-96	NM	NM	0.55 (MD)	9.10 (MD)	2.22	NM
05-Jul-96	NM	NM	NM	NM	1.81 (MD)	NM
06-Jul-96	NM	NM	NM	NM	0.64 (MD)	NM
16-Jul-96	NM	NM	0.32	2.72	0.34	NM
05-Aug-96	NM	NM	0.32	2.70 (MD)	0.20 (MD)	NM
20-Aug-96	NM	NM	0.30	1.37	0.92	NM
17-Sep-96	NM	NM	0.41	2.82 (MD)	0.21 (MD)	NM
22-Oct-96	NM	NM	0.64	12.7	3.65	NM
08-Nov-96	NM	NM	NM	NM	3.08 (MD)	NM
18-Nov-96	NM	NM	0.89 (MD)	32.8	7.80	NM
08-Dec-96	NM	NM	20.3	538 (MD)	590	NM
09-Dec-96	NM	NM	NM	2290	1750	NM
10-Dec-96	NM	NM	112	1510	1950	NM

Date	Discharge (cfs)					Stage (Feet)
	Hangman Creek at the Idaho State Line	Little Hangman Creek	Rattler Run Creek	Hangman Creek at Bradshaw Road	Rock Creek at Jackson Road	Hangman Creek at Keevy Road
16-Dec-96	NM	NM	6.99	262	45.0	NM
01-Jan-97	NM	NM	44.2	9030 (11:45)	9600	NM
01-Jan-97	NM	NM	NM	11600 (15:06)	NM	NM
02-Jan-97	NM	NM	NM	3810 (MD)	2750	NM
03-Jan-97	NM	NM	NM	2870	1650	NM
08-Jan-97	NM	NM	NM	NM	556 (MD)	NM
22-Jan-97	NM	NM	10.1 (MD)	408	335	NM
31-Jan-97	NM	NM	NM	NM	1550	NM
01-Feb-97	NM	NM	NM	1360	434 (MD) (11:06)	NM
01-Feb-97	NM	NM	NM	NM	650 (12:35)	NM
03-Feb-97	NM	NM	NM	909	355	NM
19-Feb-97	NM	NM	NM	1920	2250	NM
10-Mar-97	NM	NM	NM	NM	619 (MD)	NM
13-Mar-97	NM	NM	1.19	441 (MD)	128	NM
17-Mar-97	NM	NM	25.2	2100 (11:15)	2600	NM
17-Mar-97	NM	NM	NM	2060 (11:50)	NM	NM
17-Mar-97	NM	NM	NM	2030 (12:00)	NM	NM
19-Mar-97	NM	NM	16.2	1040	920	NM
22-Apr-97	NM	NM	0.67	352	81.0	NM
25-Apr-97	NM	NM	3.20	745	142	NM
20-May-97	NM	NM	1.30 (MD)	52.4	1.15	NM
02-Jun-97	NM	NM	2.12	97.2	22.9 (MD)	NM
17-Jun-97	NM	NM	1.11 (MD)	31.8	1.25	NM
07-Jul-97	NM	NM	0.42	9.84	10.9	NM
21-Jul-97	NM	NM	0.28 (MD)	6.51	1.04 (MD)	NM
04-Aug-97	NM	NM	0.15	5.98 (MD)	1.00	NM
18-Aug-97	NM	NM	0.10 (MD)	1.98	0.98	NM
02-Sep-97	NM	NM	NM	NM	0.84	NM
15-Sep-97	NM	NM	NM	NM	1.05	NM

Appendix E
Hangman Creek Seepage Run and Low Flow Data



Seepage Run Site Location Map

Site 1 **Stateline Little Hangman** V notch weir located in Little Hangman Creek approximately 50 feet above the bridge at the Washington Idaho State Line, State Route 274, one and one quarter mile east of Tekoa, WA.

Site 2 **HC at Tekoa** Modified cross-section located in Hangman Creek approximately 300 feet below the confluence of Little Hangman and Hangman Creeks, Tekoa, WA.

Site 3 **HC at Marsh Rd** Modified cross-section located in Hangman Creek approximately 100 feet above Marsh Rd., Latah WA.

Site 4 **Cove Creek** V notch weir located in Cove Creek approximately 20 feet above the confluence of Hangman and Cove Creeks, Latah, WA.

Site 5 **HC at Roberts Rd** Modified cross-section located in Hangman Creek approximately 200 feet above the intersection of State Route 27 and Roberts Rd., one and on-half miles south east of Waverly, WA.

Site 6 **Rattler Run Creek** V notch weir located in Rattlers Run Creek approximately 50 feet above the confluence of Hangman and Rattlers Run Creeks, West Bradshaw Rd., three and one quarter miles west of Fairfield, WA.

Site 7 **HC at Bradshaw Rd** Modified cross-section located in Hangman Creek approximately 700 feet below the confluence of Hangman and Rattlers Run Creeks, West Bradshaw Rd., three and one quarter miles west of Fairfield, WA.

Site 8 **HC at Keevy Rd** Modified cross-section located in Hangman Creek approximately 300 feet above Keevy Rd., four and one-half miles north-east of Fairfield WA.

Site 9 **HC U//S Rock Creek** Modified cross-section located in Hangman Creek approximately one mile above the confluence of Rock and Hangman Creeks.

Site 10 **Rock Creek** Modified cross-section located in Rock Creek approximately 300 feet above Valley Chapel Rd., one half mile east of the intersection of Latah and Valley Chapel Rd., four miles north west of Mt. Hope, WA.

Site 11 **HC U/S Calif Ck** Modified cross-section located in Hangman Creek approximately one half mile south of Elder Rd. on Valley Chapel Rd.

Site 12 **California Creek** V notch weir located in California Creek approximately 20 feet down stream of the intersection of Elder Rd. and Valley Chapel Rd.

Site 13 **HC D/S Golf Course** Modified cross-section located in Hangman Creek approximately 200 feet down stream of the tenth green of the Hangman Valley Golf Course.

Site 14 **HC 2 miles S Hatch Rd** Modified cross-section located in Hangman Creek approximately 200 feet downstream of the downstream most property line at 9412 S. Hangman Valley Rd. This residence is approximately two miles south of Hatch Rd.

Site 15 **HC at Yellowstone** Modified cross-section located in Hangman Creek at the Yellowstone pipeline crossing, approximately one-half mile south of the intersection of Hangman Valley and Hatch Rd.

Site 16 **HC U/S Marshall Ck** Modified cross-sections located in Hangman Creek approximately 300 feet upstream of the confluence of Hangman and Marshall Creeks.

Site 17 **Marshall Ck** V notch weir located in Marshall Creek at downstream side of the box culvert that crosses U.S. Route 195 at the confluence of Hangman and Marshall Creeks.

Site 18 **USGS Gage site** USGS gaging station located in Hangman Creek at High Bridge Park, Spokane, WA approximately one-quarter mile from the confluence of Hangman Creek and the Spokane River.

Seepage Run Water Quality Results, September 6, 2001

Site Name	River Mile	Discharge (cfs)	Ca (mg/l)	Mg (mg/l)	Cl (mg/l)	SO_4 (mg/l)	CO_3 + HCO_3 (mg/l)	NO_3 (mg/l)	NO_2 (mg/l)
Stateline Little Hangman	Trib.	0.228	28.9	7.34	1.84	10.1	123	0.14	<0.001
HC at Tekoa	54.8	0.287	26.2	8.36	2.85	8.58	124	<0.01	<0.001
HC at Marsh Rd	47.3	0.547	26.8	5.98	6.20	9.32	120	<0.01	<0.001
Cove Creek	Trib.	0.069	34.8	8.02	3.41	14.0	136	1.07	<0.001
HC at Roberts Rd	41.5	0.622	24.0	7.00	4.54	10.5	114	0.01	<0.001
Rattler Run Creek	Trib.	0.082	41.0	9.43	27.7	11.2	166	0.02	<0.001
HC at Bradshaw Rd	32.8	0.591	26.6	6.32	8.58	8.83	120	0.01	<0.001
HC at Keevy Rd	29.4	0.352	26.4	5.69	7.58	7.92	115	0.09	<0.001
HC U/S Rock Ck	21	1.62	23.8	7.48	3.09	5.17	125	0.01	<0.001
Rock Creek	Trib.	0.414	27.4	5.35	3.06	4.10	119	0.01	<0.001
HC U/S Calif Ck	18.8	1.77	25.8	5.73	3.16	4.75	121	0.01	<0.001
California Ck	Trib.	0.042	36.2	6.85	4.27	8.82	138	0.11	<0.001
HC D/S Golf Course	13.5	1.45	27.5	9.33	4.63	9.55	130	<0.01	<0.001
HC 2 miles S Hatch Rd	10.2	1.33	29.0	9.67	8.07	12.7	133	0.03	<0.001
HC at Yellowstone	8.8	1.33	21.1	12.0	8.58	12.3	124	<0.01	<0.001
HC U/S Marshall Ck	4.6	1.20	71.2	7.39	15.2	22.8	200	0.98	<0.001
Marshall Ck	Trib.	0.601	30.9	5.59	6.21	9.82	110	0.42	<0.001
USGS Gage site	0.8	5.10	61.9	8.75	15.8	21.0	185	1.08	<0.001

Site Name	NH_3 (mg/l)	TKN (mg/l)	TP (μg/l)	Fecal Coliform (#/100 ml)	Enterococcus (#/100 ml)	pH (units)	Cond (ms/cm)	DO (mg/l)
Stateline Little Hangman	0.01	0.29	63	59	110	7.21	263	7.14
HC at Tekoa	<0.01	0.33	79	28	85	7.94	271	11.49
HC at Marsh Rd	0.01	0.42	64	46	25	7.70	273	10.05
Cove Creek	0.04	0.28	100	190	180	7.65	316	10.32
HC at Roberts Rd	0.01	0.45	77	16	200	7.86	259	9.41
Rattler Run Creek	0.01	0.45	256	310	200	7.81	426	9.24
HC at Bradshaw Rd	0.02	0.56	97	16	21	8.00	277	7.61
HC at Keevy Rd	0.03	0.57	58	2	41	8.64	261	11.55
HC U/S Rock Ck	0.01	0.37	72	7	5	9.23	251	16.64
Rock Creek	<0.01	0.35	35	790	8	9.15	236	8.37
HC U/S Calif Ck	0.01	0.46	74	4	2	8.93	250	10.21
California Ck	0.01	0.19	95	290	440	8.34	291	10.23
HC D/S Golf Course	<0.01	0.37	32	19	5	8.52	276	13.9
HC 2 miles S Hatch Rd	0.01	0.33	41	17	31	8.18	292	10.86
HC at Yellowstone	0.01	0.34	29	3	22	8.29	284	10.75
HC U/S Marshall Ck	0.01	0.2	32	2	14	7.83	313	10.58
Marshall Ck	0.05	0.24	65	1600	1040	7.56	261	7.56
USGS Gage site	0.02	0.23	22	65	80	8.17	433	12.56

Appendix F
Hangman Creek Suspended Sediment and Flow Data

Hangman Creek at Marne Bridge Total Sediment Discharge Data

Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)	Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)
10/1/97	3	0.32	0	0.32	11/1/97	42	6.9	0	6.9
10/2/97	5	0.61	0	0.61	11/2/97	41	6.5	0	6.5
10/3/97	5	0.61	0	0.61	11/3/97	50	9.1	0	9.1
10/4/97	5	0.62	0	0.62	11/4/97	43	7.8	0	7.8
10/5/97	5	0.62	0	0.62	11/5/97	36	6.0	0	6.0
10/6/97	5	0.63	0	0.63	11/6/97	28	4.3	0	4.3
10/7/97	5	0.63	0	0.63	11/7/97	18	2.8	0	2.8
10/8/97	5	0.62	0	0.62	11/8/97	16	2.6	0	2.6
10/9/97	9	1.2	0	1.2	11/9/97	23	4.0	0	4.0
10/10/97	9	1.2	0	1.2	11/10/97	29	4.9	0	4.9
10/11/97	9	1.2	0	1.2	11/11/97	28	4.7	0	4.7
10/12/97	9	1.2	0	1.2	11/12/97	24	4.3	0	4.3
10/13/97	9	1.2	0	1.2	11/13/97	19	3.2	0	3.2
10/14/97	9	1.2	0	1.2	11/14/97	16	2.5	0	2.5
10/15/97	9	1.2	0	1.2	11/15/97	16	2.3	0	2.3
10/16/97	9	1.2	0	1.2	11/16/97	15	2.2	0	2.2
10/17/97	9	1.2	0	1.2	11/17/97	15	2.3	0	2.3
10/18/97	9	1.2	0	1.2	11/18/97	13	2.1	0	2.1
10/19/97	9	1.2	0	1.2	11/19/97	10	1.6	0	1.6
10/20/97	9	1.2	0	1.2	11/20/97	9	1.8	0	1.8
10/21/97	9	1.2	0	1.2	11/21/97	14	3.0	0	3.0
10/22/97	9	1.2	0	1.2	11/22/97	41	18	100	118
10/23/97	9	1.2	0	1.2	11/23/97	24	8.9	98	107
10/24/97	9	1.2	0	1.2	11/24/97	13	3.7	96	100
10/25/97	9	1.2	0	1.2	11/25/97	12	3.2	0	3.2
10/26/97	9	1.2	0	1.2	11/26/97	12	3.0	0	3.0
10/27/97	9	1.2	0	1.2	11/27/97	11	3.0	0	3.0
10/28/97	10	1.3	0	1.3	11/28/97	12	3.3	96	99
10/29/97	38	5.4	0	5.4	11/29/97	14	3.4	0	3.4
10/30/97	44	7.0	0	7.0	11/30/97	13	2.9	0	2.9
10/31/97	43	7.2	0	7.2					

Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)	Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)
12/1/97	11	2.5	0	2.5	1/1/98	753	360	102	462
12/2/97	13	2.6	0	2.6	1/2/98	380	154	100	254
12/3/97	15	2.9	0	2.9	1/3/98	401	150	99	249
12/4/97	14	2.6	0	2.6	1/4/98	382	175	101	276
12/5/97	11	2.0	0	2.0	1/5/98	305	110	98	208
12/6/97	12	1.9	0	1.9	1/6/98	204	69	98	167
12/7/97	13	2.1	0	2.1	1/7/98	99	31	97	128
12/8/97	13	2.3	0	2.3	1/8/98	59	18	97	115
12/9/97	13	2.2	0	2.2	1/9/98	50	13	0	13
12/10/97	13	2.2	0	2.2	1/10/98	42	10	0	10
12/11/97	13	2.2	0	2.2	1/11/98	36	9.1	0	9.1
12/12/97	16	2.7	0	2.7	1/12/98	30	7.2	0	7.2
12/13/97	19	3.2	0	3.2	1/13/98	24	4.2	0	4.2
12/14/97	20	3.4	0	3.4	1/14/98	20	4.2	0	4.2
12/15/97	20	3.5	0	3.5	1/15/98	16	4.2	0	4.2
12/16/97	24	3.7	0	3.7	1/16/98	19	6.1	97	104
12/17/97	31	5.3	0	5.3	1/17/98	77	51	106	157
12/18/97	363	871	111	982	1/18/98	493	1010	140	1150
12/19/97	2360	990	105	1095	1/19/98	514	1010	144	1154
12/20/97	1560	390	101	491	1/20/98	945	3550	193	3743
12/21/97	963	180	98	278	1/21/98	665	1730	158	1888
12/22/97	521	120	96	216	1/22/98	210	301	129	430
12/23/97	333	82	0	82	1/23/98	96	116	123	239
12/24/97	286	71	0	71	1/24/98	359	980	157	1137
12/25/97	208	46	0	46	1/25/98	517	1380	164	1544
12/26/97	253	57	0	57	1/26/98	164	348	149	497
12/27/97	280	59	0	59	1/27/98	217	919	166	1085
12/28/97	296	62	0	62	1/28/98	1480	8540	241	8781
12/29/97	291	64	0	64	1/29/98	290	778	161	939
12/30/97	926	320	97	417	1/30/98	77	140	140	280
12/31/97	1940	1060	103	1163	1/31/98	50	72	130	202

Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)	Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)
2/1/98	40	47	122	169	3/1/98	21	15	109	124
2/2/98	31	32	118	150	3/2/98	28	25	113	138
2/3/98	37	48	125	173	3/3/98	66	101	131	232
2/4/98	33	35	119	154	3/4/98	53	78	129	207
2/5/98	34	33	116	149	3/5/98	32	34	119	153
2/6/98	26	23	114	137	3/6/98	26	25	115	140
2/7/98	22	18	112	130	3/7/98	23	18	111	129
2/8/98	21	17	110	127	3/8/98	22	16	109	125
2/9/98	21	16	110	126	3/9/98	20	14	108	122
2/10/98	22	15	108	123	3/10/98	114	207	130	337
2/11/98	23	14	106	120	3/11/98	212	338	134	472
2/12/98	30	22	109	131	3/12/98	178	215	123	338
2/13/98	177	303	133	436	3/13/98	87	88	117	205
2/14/98	93	163	137	300	3/14/98	52	44	113	157
2/15/98	60	94	132	226	3/15/98	45	35	110	145
2/16/98	105	241	154	395	3/16/98	40	29	109	138
2/17/98	67	119	138	257	3/17/98	36	26	109	135
2/18/98	43	56	125	181	3/18/98	33	25	110	135
2/19/98	29	30	118	148	3/19/98	30	21	108	129
2/20/98	23	21	114	135	3/20/98	28	18	106	124
2/21/98	34	37	115	152	3/21/98	26	15	105	120
2/22/98	378	940	158	1098	3/22/98	25	14	104	118
2/23/98	191	298	132	430	3/23/98	27	16	105	121
2/24/98	80	95	122	217	3/24/98	175	345	133	478
2/25/98	38	41	119	160	3/25/98	240	360	131	491
2/26/98	24	22	115	137	3/26/98	145	167	121	288
2/27/98	18	16	113	129	3/27/98	79	80	117	197
2/28/98	19	15	111	126	3/28/98	48	46	115	161
					3/29/98	38	30	111	141
					3/30/98	30	20	108	128
					3/31/98	24	15	105	120

Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)	Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)
4/1/98	21	12	104	116	5/1/98	14	3.7	0	3.7
4/2/98	21	11	103	114	5/2/98	13	3.3	0	3.3
4/3/98	21	10	102	112	5/3/98	12	2.8	0	2.8
4/4/98	22	10	102	112	5/4/98	9	2.0	0	2.0
4/5/98	25	11	102	113	5/5/98	9	2.1	0	2.1
4/6/98	32	17	106	123	5/6/98	17	3.8	0	3.8
4/7/98	36	32	113	145	5/7/98	20	4.3	0	4.3
4/8/98	32	22	108	130	5/8/98	11	2.4	0	2.4
4/9/98	28	16	105	121	5/9/98	8	1.8	0	1.8
4/10/98	25	13	103	116	5/10/98	9	2.0	0	2.0
4/11/98	24	13	104	117	5/11/98	10	2.0	0	2.0
4/12/98	42	34	112	146	5/12/98	9	1.7	0	1.7
4/13/98	37	25	107	132	5/13/98	8	1.6	0	1.6
4/14/98	32	18	104	122	5/14/98	8	1.6	0	1.6
4/15/98	27	13	102	115	5/15/98	9	1.9	0	1.9
4/16/98	23	11	101	112	5/16/98	12	2.6	0	2.6
4/17/98	20	8.2	100	108	5/17/98	15	3.5	0	3.5
4/18/98	16	6.3	99	106	5/18/98	16	4.1	0	4.1
4/19/98	14	5.1	99	104	5/19/98	22	9.4	99	109
4/20/98	13	4.7	98	103	5/20/98	27	13	102	115
4/21/98	13	4.3	98	102	5/21/98	23	7.9	98	106
4/22/98	12	4.0	97	101	5/22/98	25	7.4	96	104
4/23/98	12	3.6	97	100	5/23/98	30	8.4	96	105
4/24/98	11	3.4	97	100	5/24/98	132	210	132	342
4/25/98	14	4.5	97	102	5/25/98	97	90	115	205
4/26/98	30	10	98	108	5/26/98	79	61	110	171
4/27/98	40	12	97	109	5/27/98	260	920	164	1084
4/28/98	23	6.8	97	103	5/28/98	306	999	177	1176
4/29/98	16	4.7	96	101	5/29/98	117	192	134	326
4/30/98	15	4.1	96	100	5/30/98	65	69	119	188
					5/31/98	51	43	112	155

Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)	Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)
6/1/98	43	29	107	136	7/1/98	12	1.4	0	1.4
6/2/98	37	21	104	125	7/2/98	11	1.2	0	1.2
6/3/98	34	16	102	118	7/3/98	12	1.4	0	1.4
6/4/98	34	14	100	114	7/4/98	10	1.2	0	1.2
6/5/98	31	11	99	110	7/5/98	10	1.2	0	1.2
6/6/98	24	8.4	98	106	7/6/98	9	0.99	0	0.99
6/7/98	21	7.5	98	106	7/7/98	9	0.89	0	0.89
6/8/98	20	6.7	98	105	7/8/98	8	0.78	0	0.78
6/9/98	17	5.3	97	102	7/9/98	8	0.69	0	0.69
6/10/98	14	3.8	96	100	7/10/98	9	0.85	0	0.85
6/11/98	12	3.0	0	3.0	7/11/98	15	1.4	0	1.4
6/12/98	13	2.9	0	2.9	7/12/98	15	1.3	0	1.3
6/13/98	13	2.7	0	2.7	7/13/98	15	1.3	0	1.3
6/14/98	12	2.4	0	2.4	7/14/98	15	1.3	0	1.3
6/15/98	11	2.1	0	2.1	7/15/98	15	1.3	0	1.3
6/16/98	10	1.9	0	1.9	7/16/98	14	1.3	0	1.3
6/17/98	10	1.8	0	1.8	7/17/98	14	1.3	0	1.3
6/18/98	9	1.7	0	1.7	7/18/98	14	1.2	0	1.2
6/19/98	10	1.7	0	1.7	7/19/98	13	1.1	0	1.1
6/20/98	10	1.8	0	1.8	7/20/98	10	0.81	0	0.81
6/21/98	10	1.7	0	1.7	7/21/98	8	0.62	0	0.62
6/22/98	9	1.5	0	1.5	7/22/98	6	0.48	0	0.48
6/23/98	8	1.3	0	1.3	7/23/98	5	0.37	0	0.37
6/24/98	7	1.1	0	1.1	7/24/98	5	0.33	0	0.33
6/25/98	6	0.90	0	0.90	7/25/98	6	0.38	0	0.38
6/26/98	6	0.80	0	0.80	7/26/98	6	0.32	0	0.32
6/27/98	5	0.70	0	0.70	7/27/98	6	0.32	0	0.32
6/28/98	6	0.70	0	0.70	7/28/98	6	0.31	0	0.31
6/29/98	8	0.90	0	0.90	7/29/98	6	0.30	0	0.30
6/30/98	10	1.3	0	1.3	7/30/98	6	0.29	0	0.29
					7/31/98	6	0.29	0	0.29

Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)	Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)
8/1/98	6	0.29	0	0.29	9/1/98	5	0.19	0	0.19
8/2/98	6	0.29	0	0.29	9/2/98	5	0.18	0	0.18
8/3/98	6	0.29	0	0.29	9/3/98	4	0.17	0	0.17
8/4/98	6	0.28	0	0.28	9/4/98	4	0.16	0	0.16
8/5/98	6	0.27	0	0.27	9/5/98	4	0.16	0	0.16
8/6/98	6	0.27	0	0.27	9/6/98	4	0.15	0	0.15
8/7/98	6	0.26	0	0.26	9/7/98	4	0.14	0	0.14
8/8/98	6	0.26	0	0.26	9/8/98	3	0.13	0	0.13
8/9/98	6	0.26	0	0.26	9/9/98	3	0.13	0	0.13
8/10/98	6	0.26	0	0.26	9/10/98	3	0.12	0	0.12
8/11/98	6	0.25	0	0.25	9/11/98	3	0.12	0	0.12
8/12/98	6	0.25	0	0.25	9/12/98	3	0.12	0	0.12
8/13/98	6	0.24	0	0.24	9/13/98	3	0.12	0	0.12
8/14/98	6	0.23	0	0.23	9/14/98	3	0.13	0	0.13
8/15/98	5	0.22	0	0.22	9/15/98	3	0.13	0	0.13
8/16/98	5	0.20	0	0.20	9/16/98	3	0.13	0	0.13
8/17/98	5	0.19	0	0.19	9/17/98	3	0.13	0	0.13
8/18/98	4	0.16	0	0.16	9/18/98	3	0.13	0	0.13
8/19/98	3	0.14	0	0.14	9/19/98	3	0.13	0	0.13
8/20/98	3	0.11	0	0.11	9/20/98	3	0.14	0	0.14
8/21/98	2	0.09	0	0.09	9/21/98	3	0.14	0	0.14
8/22/98	2	0.08	0	0.08	9/22/98	3	0.15	0	0.15
8/23/98	2	0.08	0	0.08	9/23/98	3	0.16	0	0.16
8/24/98	2	0.08	0	0.08	9/24/98	4	0.17	0	0.17
8/25/98	2	0.08	0	0.08	9/25/98	4	0.18	0	0.18
8/26/98	2	0.09	0	0.09	9/26/98	4	0.18	0	0.18
8/27/98	2	0.08	0	0.08	9/27/98	3	0.16	0	0.16
8/28/98	2	0.08	0	0.08	9/28/98	3	0.14	0	0.14
8/29/98	3	0.10	0	0.10	9/29/98	2	0.12	0	0.12
8/30/98	3	0.13	0	0.13	9/30/98	2	0.10	0	0.10
8/31/98	4	0.17	0	0.17					

Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)	Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)
10/1/98	2	0.10	0	0.10	11/1/98	6	0.34	0	0.34
10/2/98	2	0.10	0	0.10	11/2/98	6	0.36	0	0.36
10/3/98	2	0.10	0	0.10	11/3/98	6	0.34	0	0.34
10/4/98	2	0.12	0	0.12	11/4/98	5	0.33	0	0.33
10/5/98	3	0.13	0	0.13	11/5/98	5	0.33	0	0.33
10/6/98	3	0.14	0	0.14	11/6/98	5	0.35	0	0.35
10/7/98	3	0.15	0	0.15	11/7/98	6	0.38	0	0.38
10/8/98	3	0.14	0	0.14	11/8/98	5	0.35	0	0.35
10/9/98	3	0.13	0	0.13	11/9/98	4	0.25	0	0.25
10/10/98	2	0.12	0	0.12	11/10/98	3	0.19	0	0.19
10/11/98	2	0.11	0	0.11	11/11/98	3	0.19	0	0.19
10/12/98	2	0.11	0	0.11	11/12/98	3	0.22	0	0.22
10/13/98	2	0.09	0	0.09	11/13/98	5	0.30	0	0.30
10/14/98	2	0.08	0	0.08	11/14/98	5	0.36	0	0.36
10/15/98	1	0.07	0	0.07	11/15/98	6	0.44	0	0.44
10/16/98	1	0.06	0	0.06	11/16/98	7	0.49	0	0.49
10/17/98	1	0.06	0	0.06	11/17/98	8	0.53	0	0.53
10/18/98	1	0.06	0	0.06	11/18/98	8	0.57	0	0.57
10/19/98	1	0.06	0	0.06	11/19/98	8	0.66	0	0.66
10/20/98	1	0.06	0	0.06	11/20/98	9	0.80	0	0.80
10/21/98	1	0.06	0	0.06	11/21/98	9	0.87	0	0.87
10/22/98	1	0.06	0	0.06	11/22/98	9	0.88	0	0.88
10/23/98	2	0.10	0	0.10	11/23/98	11	1.7	0	1.7
10/24/98	3	0.15	0	0.15	11/24/98	21	4.8	0	4.8
10/25/98	4	0.20	0	0.20	11/25/98	14	2.5	0	2.5
10/26/98	5	0.28	0	0.28	11/26/98	14	2.1	0	2.1
10/27/98	6	0.33	0	0.33	11/27/98	29	9.1	96	106
10/28/98	5	0.29	0	0.29	11/28/98	31	7.1	0	7.1
10/29/98	4	0.25	0	0.25	11/29/98	27	4.8	0	4.8
10/30/98	4	0.24	0	0.24	11/30/98	22	3.5	0	3.5
10/31/98	5	0.28	0	0.28					

Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)	Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)
12/1/98	19	3.6	0	3.6	1/1/99	196	278	128	406
12/2/98	85	96	105	201	1/2/99	94	92	116	208
12/3/98	458	1570	186	1756	1/3/99	69	52	110	162
12/4/98	262	452	131	583	1/4/99	50	31	106	137
12/5/98	65	46	108	154	1/5/99	32	19	105	124
12/6/98	39	19	102	121	1/6/99	19	10	104	114
12/7/98	38	15	100	115	1/7/99	15	7.9	104	112
12/8/98	36	12	98	110	1/8/99	15	8.5	104	112
12/9/98	33	10	97	107	1/9/99	20	11	104	115
12/10/98	28	8.0	96	104	1/10/99	76	420	133	553
12/11/98	21	5.9	96	102	1/11/99	1340	9220	276	9496
12/12/98	26	12	100	112	1/12/99	477	1250	159	1409
12/13/98	69	170	154	324	1/13/99	154	318	147	465
12/14/98	113	288	161	449	1/14/99	195	533	155	688
12/15/98	93	139	131	270	1/15/99	854	4220	230	4450
12/16/98	73	61	112	173	1/16/99	482	1620	176	1796
12/17/98	53	33	106	139	1/17/99	171	398	154	552
12/18/98	37	20	104	124	1/18/99	913	5230	212	5442
12/19/98	NM	8.4	97	106	1/19/99	1010	4790	206	4996
12/20/98	NM	4.1	0	4.1	1/20/99	161	399	159	558
12/21/98	NM	2.4	0	2.4	1/21/99	111	272	158	430
12/22/98	NM	1.9	0	1.9	1/22/99	179	685	198	883
12/23/98	NM	1.9	0	1.9	1/23/99	128	403	175	578
12/24/98	NM	1.8	0	1.8	1/24/99	67	131	143	274
12/25/98	NM	2.1	0	2.1	1/25/99	41	69	136	205
12/26/98	15	2.8	0	2.8	1/26/99	29	40	127	167
12/27/98	20	3.9	0	3.9	1/27/99	23	26	120	146
12/28/98	1460	19400	349	19749	1/28/99	18	18	116	134
12/29/98	1430	13000	346	13346	1/29/99	9	12	122	134
12/30/98	836	4410	234	4644	1/30/99	24	42	138	180
12/31/98	456	1020	150	1170	1/31/99	27	35	126	161

Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)	Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)
2/1/99	24	25	118	143	3/1/99	1040	9550	335	9885
2/2/99	17	15	113	128	3/2/99	423	2080	226	2306
2/3/99	27	26	116	142	3/3/99	204	752	193	945
2/4/99	38	47	123	170	3/4/99	117	303	161	464
2/5/99	63	92	130	222	3/5/99	75	163	150	313
2/6/99	257	911	142	1053	3/6/99	68	125	140	265
2/7/99	3090	22900	297	23197	3/7/99	57	94	135	229
2/8/99	1950	9400	215	9615	3/8/99	52	77	131	208
2/9/99	286	649	149	798	3/9/99	47	65	128	193
2/10/99	93	153	134	287	3/10/99	40	54	127	181
2/11/99	46	54	121	175	3/11/99	41	49	123	172
2/12/99	39	42	118	160	3/12/99	33	36	119	155
2/13/99	30	29	116	145	3/13/99	29	30	118	148
2/14/99	22	22	116	138	3/14/99	29	31	118	149
2/15/99	42	49	121	170	3/15/99	36	43	122	165
2/16/99	61	82	126	208	3/16/99	51	73	129	202
2/17/99	134	294	150	444	3/17/99	67	107	134	241
2/18/99	165	347	147	494	3/18/99	38	51	126	177
2/19/99	237	916	177	1093	3/19/99	27	32	122	154
2/20/99	486	1950	192	2142	3/20/99	26	30	121	151
2/21/99	123	302	159	461	3/21/99	37	49	126	175
2/22/99	64	156	156	312	3/22/99	45	75	135	210
2/23/99	122	521	189	710	3/23/99	39	62	133	195
2/24/99	1660	20700	415	21115	3/24/99	32	44	128	172
2/25/99	1190	15400	447	15847	3/25/99	28	35	125	160
2/26/99	271	2010	288	2298	3/26/99	37	53	129	182
2/27/99	93	420	208	628	3/27/99	39	62	133	195
2/28/99	1580	23800	510	24310	3/28/99	28	36	125	161
					3/29/99	22	26	121	147
					3/30/99	21	26	123	149
					3/31/99	22	25	120	145

Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)	Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)
4/1/99	21	21	116	137	5/1/99	11	4.9	101	105
4/2/99	21	17	112	129	5/2/99	10	4.2	100	104
4/3/99	19	15	111	126	5/3/99	10	4.4	101	105
4/4/99	22	20	114	134	5/4/99	10	5.6	104	110
4/5/99	22	21	116	137	5/5/99	15	9.2	106	115
4/6/99	17	16	114	130	5/6/99	13	6.6	103	110
4/7/99	17	14	112	126	5/7/99	12	5.4	102	107
4/8/99	16	12	110	122	5/8/99	11	4.7	101	105
4/9/99	22	21	114	135	5/9/99	10	4.4	100	105
4/10/99	29	30	117	147	5/10/99	9	3.8	100	104
4/11/99	26	23	114	137	5/11/99	8	3.1	100	103
4/12/99	18	14	111	125	5/12/99	7	2.8	99	102
4/13/99	18	13	109	122	5/13/99	8	2.8	98	101
4/14/99	22	15	108	123	5/14/99	8	2.7	98	101
4/15/99	23	15	107	122	5/15/99	7	2.4	98	100
4/16/99	24	15	106	121	5/16/99	7	2.2	97	99
4/17/99	23	14	106	120	5/17/99	7	2.2	97	99
4/18/99	22	13	106	119	5/18/99	7	2.0	97	99
4/19/99	21	13	106	119	5/19/99	6	1.6	96	98
4/20/99	24	17	109	126	5/20/99	5	1.5	96	98
4/21/99	27	21	110	131	5/21/99	6	1.8	96	98
4/22/99	25	18	109	127	5/22/99	7	1.8	96	98
4/23/99	24	15	107	122	5/23/99	6	1.7	0	1.7
4/24/99	26	15	105	120	5/24/99	6	1.6	0	1.6
4/25/99	23	12	104	116	5/25/99	7	1.6	0	1.6
4/26/99	19	10	103	113	5/26/99	7	1.6	0	1.6
4/27/99	16	8.3	103	111	5/27/99	7	1.5	0	1.5
4/28/99	14	7.3	103	110	5/28/99	7	1.5	0	1.5
4/29/99	15	7.1	102	109	5/29/99	7	1.4	0	1.4
4/30/99	14	6.3	101	108	5/30/99	7	1.4	0	1.4
					5/31/99	7	1.3	0	1.3

Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)	Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)
6/1/99	7	1.3	0	1.3	7/1/99	11	1.3	0	1.3
6/2/99	7	1.3	0	1.3	7/2/99	11	1.2	0	1.2
6/3/99	7	1.4	0	1.4	7/3/99	10	1.1	0	1.1
6/4/99	7	1.5	0	1.5	7/4/99	11	1.1	0	1.1
6/5/99	8	1.6	0	1.6	7/5/99	13	1.3	0	1.3
6/6/99	10	2.2	0	2.2	7/6/99	13	1.3	0	1.3
6/7/99	14	2.6	0	2.6	7/7/99	10	0.90	0	0.90
6/8/99	16	3.0	0	3.0	7/8/99	9	0.80	0	0.80
6/9/99	16	2.9	0	2.9	7/9/99	9	0.80	0	0.80
6/10/99	16	2.7	0	2.7	7/10/99	9	0.70	0	0.70
6/11/99	16	2.6	0	2.6	7/11/99	9	0.70	0	0.70
6/12/99	16	2.5	0	2.5	7/12/99	8	0.60	0	0.60
6/13/99	15	2.3	0	2.3	7/13/99	8	0.60	0	0.60
6/14/99	15	2.1	0	2.1	7/14/99	10	0.80	0	0.80
6/15/99	14	1.9	0	1.9	7/15/99	12	0.90	0	0.90
6/16/99	14	1.8	0	1.8	7/16/99	13	1.0	0	1.0
6/17/99	13	1.7	0	1.7	7/17/99	13	1.0	0	1.0
6/18/99	13	1.5	0	1.5	7/18/99	13	1.0	0	1.0
6/19/99	13	1.4	0	1.4	7/19/99	14	1.1	0	1.1
6/20/99	12	1.4	0	1.4	7/20/99	14	0.99	0	0.99
6/21/99	12	1.3	0	1.3	7/21/99	11	0.75	0	0.75
6/22/99	11	1.3	0	1.3	7/22/99	8	0.57	0	0.57
6/23/99	12	1.4	0	1.4	7/23/99	6	0.43	0	0.43
6/24/99	14	1.5	0	1.5	7/24/99	5	0.35	0	0.35
6/25/99	13	1.8	0	1.8	7/25/99	5	0.35	0	0.35
6/26/99	12	1.6	0	1.6	7/26/99	6	0.36	0	0.36
6/27/99	11	1.6	0	1.6	7/27/99	6	0.40	0	0.40
6/28/99	11	1.5	0	1.5	7/28/99	6	0.37	0	0.37
6/29/99	11	1.5	0	1.5	7/29/99	6	0.32	0	0.32
6/30/99	11	1.5	0	1.5	7/30/99	6	0.32	0	0.32
					7/31/99	6	0.29	0	0.29

Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)	Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)
8/1/99	6	0.31	0	0.31	9/1/99	2	0.10	0	0.10
8/2/99	6	0.32	0	0.32	9/2/99	2	0.11	0	0.11
8/3/99	6	0.31	0	0.31	9/3/99	2	0.11	0	0.11
8/4/99	6	0.29	0	0.29	9/4/99	2	0.11	0	0.11
8/5/99	7	0.31	0	0.31	9/5/99	2	0.11	0	0.11
8/6/99	7	0.36	0	0.36	9/6/99	2	0.11	0	0.11
8/7/99	8	0.50	0	0.50	9/7/99	2	0.11	0	0.11
8/8/99	9	0.56	0	0.56	9/8/99	2	0.11	0	0.11
8/9/99	10	0.57	0	0.57	9/9/99	2	0.11	0	0.11
8/10/99	11	0.59	0	0.59	9/10/99	2	0.11	0	0.11
8/11/99	9	0.49	0	0.49	9/11/99	2	0.11	0	0.11
8/12/99	7	0.37	0	0.37	9/12/99	2	0.11	0	0.11
8/13/99	5	0.27	0	0.27	9/13/99	2	0.11	0	0.11
8/14/99	4	0.25	0	0.25	9/14/99	2	0.11	0	0.11
8/15/99	3	0.19	0	0.19	9/15/99	2	0.11	0	0.11
8/16/99	3	0.18	0	0.18	9/16/99	2	0.11	0	0.11
8/17/99	2	0.12	0	0.12	9/17/99	2	0.10	0	0.10
8/18/99	2	0.12	0	0.12	9/18/99	2	0.10	0	0.10
8/19/99	2	0.12	0	0.12	9/19/99	2	0.10	0	0.10
8/20/99	2	0.12	0	0.12	9/20/99	2	0.10	0	0.10
8/21/99	1	0.06	0	0.06	9/21/99	2	0.09	0	0.09
8/22/99	1	0.06	0	0.06	9/22/99	2	0.09	0	0.09
8/23/99	1	0.06	0	0.06	9/23/99	2	0.08	0	0.08
8/24/99	1	0.05	0	0.05	9/24/99	1	0.08	0	0.08
8/25/99	1	0.05	0	0.05	9/25/99	1	0.07	0	0.07
8/26/99	1	0.05	0	0.05	9/26/99	1	0.07	0	0.07
8/27/99	1	0.05	0	0.05	9/27/99	1	0.06	0	0.06
8/28/99	1	0.05	0	0.05	9/28/99	1	0.06	0	0.06
8/29/99	1	0.08	0	0.08	9/29/99	1	0.06	0	0.06
8/30/99	2	0.09	0	0.09	9/30/99	1	0.06	0	0.06
8/31/99	2	0.10	0	0.10					

Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)	Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)
10/1/99	1	0.05	0	0.05	11/1/99	1	0.13	0	0.13
10/2/99	1	0.06	0	0.06	11/2/99	2	0.14	0	0.14
10/3/99	1	0.06	0	0.06	11/3/99	2	0.19	0	0.19
10/4/99	1	0.06	0	0.06	11/4/99	2	0.22	0	0.22
10/5/99	1	0.06	0	0.06	11/5/99	3	0.25	0	0.25
10/6/99	1	0.06	0	0.06	11/6/99	3	0.30	0	0.30
10/7/99	1	0.06	0	0.06	11/7/99	3	0.34	0	0.34
10/8/99	1	0.06	0	0.06	11/8/99	3	0.36	0	0.36
10/9/99	1	0.07	0	0.07	11/9/99	4	0.38	0	0.38
10/10/99	1	0.07	0	0.07	11/10/99	4	0.41	0	0.41
10/11/99	1	0.07	0	0.07	11/11/99	3	0.35	0	0.35
10/12/99	1	0.07	0	0.07	11/12/99	3	0.29	0	0.29
10/13/99	1	0.07	0	0.07	11/13/99	2	0.24	0	0.24
10/14/99	1	0.08	0	0.08	11/14/99	2	0.21	0	0.21
10/15/99	1	0.09	0	0.09	11/15/99	2	0.16	0	0.16
10/16/99	2	0.11	0	0.11	11/16/99	1	0.13	0	0.13
10/17/99	2	0.14	0	0.14	11/17/99	1	0.11	0	0.11
10/18/99	2	0.16	0	0.16	11/18/99	1	0.10	0	0.10
10/19/99	3	0.20	0	0.20	11/19/99	1	0.11	0	0.11
10/20/99	3	0.23	0	0.23	11/20/99	1	0.11	0	0.11
10/21/99	4	0.27	0	0.27	11/21/99	1	0.11	0	0.11
10/22/99	5	0.33	0	0.33	11/22/99	1	0.11	0	0.11
10/23/99	5	0.32	0	0.32	11/23/99	1	0.11	0	0.11
10/24/99	5	0.31	0	0.31	11/24/99	1	0.13	0	0.13
10/25/99	5	0.33	0	0.33	11/25/99	2	0.24	0	0.24
10/26/99	4	0.35	0	0.35	11/26/99	3	0.48	0	0.48
10/27/99	4	0.37	0	0.37	11/27/99	6	1.2	0	1.2
10/28/99	4	0.39	0	0.39	11/28/99	10	3.0	0	3.0
10/29/99	4	0.39	0	0.39	11/29/99	16	5.7	0	5.7
10/30/99	3	0.28	0	0.28	11/30/99	9	2.3	0	2.3
10/31/99	2	0.19	0	0.19					

Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)	Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)
12/1/99	6	1.2	0	1.2	1/1/00	6	1.1	0	1.1
12/2/99	8	1.7	0	1.7	1/2/00	6	1.2	0	1.2
12/3/99	12	3.2	0	3.2	1/3/00	6	1.2	0	1.2
12/4/99	15	5.0	0	5.0	1/4/00	7	1.4	0	1.4
12/5/99	21	8.8	0	8.8	1/5/00	7	1.6	0	1.6
12/6/99	13	3.8	0	3.8	1/6/00	6	1.4	0	1.4
12/7/99	8	2.0	0	2.0	1/7/00	10	3.4	0	3.4
12/8/99	7	1.5	0	1.5	1/8/00	8	2.6	0	2.6
12/9/99	6	1.3	0	1.3	1/9/00	11	4.2	0	4.2
12/10/99	9	2.2	0	2.2	1/10/00	20	9.8	0	9.8
12/11/99	9	2.1	0	2.1	1/11/00	30	17	0	17
12/12/99	9	2.1	0	2.1	1/12/00	23	11	0	11
12/13/99	32	20	0	20	1/13/00	25	10	0	10
12/14/99	168	256	77	333	1/14/00	26	10	0	10
12/15/99	116	89	14	103	1/15/00	62	97	42	139
12/16/99	361	1050	139	1189	1/16/00	119	239	117	356
12/17/99	364	962	160	1122	1/17/00	183	554	192	746
12/18/99	106	152	66	218	1/18/00	164	330	114	444
12/19/99	94	154	92	246	1/19/00	131	172	61	233
12/20/99	289	292	33	325	1/20/00	127	116	28	144
12/21/99	87	61	8	69	1/21/00	123	94	15	109
12/22/99	49	27	0	27	1/22/00	115	76	7	83
12/23/99	34	16	0	16	1/23/00	73	43	0	43
12/24/99	23	9.2	0	9.2	1/24/00	28	15	0	15
12/25/99	22	7.6	0	7.6	1/25/00	20	9.8	0	9.8
12/26/99	20	6.0	0	6.0	1/26/00	20	9.8	0	9.8
12/27/99	12	3.4	0	3.4	1/27/00	17	8.1	0	8.1
12/28/99	8	2.1	0	2.1	1/28/00	19	8.1	0	8.1
12/29/99	7	1.6	0	1.6	1/29/00	14	5.2	0	5.2
12/30/99	5	1.2	0	1.2	1/30/00	10	3.6	0	3.6
12/31/99	4	0.87	0	0.87	1/31/00	14	4.9	0	4.9

Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)	Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)
2/1/00	48	24	0	24	3/1/00	146	437	201	638
2/2/00	1460	19600	457	20057	3/2/00	207	520	162	6812
2/3/00	1000	12300	447	12747	3/3/00	140	342	154	496
2/4/00	250	1180	338	1518	3/4/00	119	306	161	467
2/5/00	147	415	183	598	3/5/00	250	1010	284	1294
2/6/00	94	233	157	390	3/6/00	146	538	255	793
2/7/00	83	201	152	353	3/7/00	116	361	215	576
2/8/00	132	376	188	564	3/8/00	94	221	145	366
2/9/00	182	694	269	963	3/9/00	83	169	121	290
2/10/00	157	480	206	686	3/10/00	137	234	94	328
2/11/00	112	245	134	379	3/11/00	136	243	103	346
2/12/00	179	296	89	385	3/12/00	84	170	116	286
2/13/00	156	237	78	315	3/13/00	93	142	80	222
2/14/00	130	197	77	274	3/14/00	102	177	94	271
2/15/00	119	242	119	361	3/15/00	80	141	96	237
2/16/00	122	277	141	418	3/16/00	45	64	71	135
2/17/00	132	247	108	355	3/17/00	72	154	128	282
2/18/00	134	191	70	261	3/18/00	41	78	112	190
2/19/00	148	173	49	222	3/19/00	35	65	108	173
2/20/00	129	133	37	170	3/20/00	49	77	83	160
2/21/00	128	142	43	185	3/21/00	67	89	63	152
2/22/00	338	1170	197	1367	3/22/00	82	105	58	163
2/23/00	658	4550	408	4958	3/23/00	178	453	129	582
2/24/00	417	2550	398	2948	3/24/00	432	1180	171	1351
2/25/00	193	641	221	862	3/25/00	184	351	110	461
2/26/00	126	357	188	545	3/26/00	142	217	78	295
2/27/00	244	1200	320	1520	3/27/00	121	159	61	2201
2/28/00	332	1860	392	2252	3/28/00	119	153	59	212
2/29/00	155	597	269	866	3/29/00	113	139	54	193
					3/30/00	100	113	45	158
					3/31/00	88	91	37	128

Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)	Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)
4/1/00	78	73	29	102	5/1/00	11	5.8	0	5.8
4/2/00	76	68	26	94	5/2/00	6	3.1	0	3.1
4/3/00	90	73	19	92	5/3/00	9	5.7	5	11
4/4/00	108	86	17	103	5/4/00	7	4.7	5	9.7
4/5/00	119	97	19	116	5/5/00	3	1.9	0	1.9
4/6/00	115	91	17	108	5/6/00	2	0.94	0	0.94
4/7/00	111	87	16	103	5/7/00	1	0.62	0	0.62
4/8/00	107	77	11	88	5/8/00	1	0.47	0	0.47
4/9/00	106	69	6	75	5/9/00	1	0.43	0	0.43
4/10/00	108	65	1	66	5/10/00	1	0.47	0	0.47
4/11/00	110	63	0	63	5/11/00	1	0.56	0	0.56
4/12/00	111	59	0	59	5/12/00	5	7.1	42	49
4/13/00	116	67	0	67	5/13/00	7	8.0	45	53
4/14/00	1090	7690	334	8024	5/14/00	4	3.1	19	22
4/15/00	1090	7000	399	7399	5/15/00	3	2.2	7	9.3
4/16/00	387	1180	199	1379	5/16/00	3	1.8	1	2.6
4/17/00	208	478	143	621	5/17/00	3	1.6	0	1.6
4/18/00	197	346	97	443	5/18/00	3	1.3	0	1.3
4/19/00	180	249	66	315	5/19/00	2	0.99	0	0.99
4/20/00	153	172	45	217	5/20/00	2	0.81	0	0.81
4/21/00	135	132	33	165	5/21/00	2	0.77	0	0.77
4/22/00	126	113	26	139	5/22/00	2	0.72	0	0.72
4/23/00	102	85	21	106	5/23/00	2	0.66	0	0.66
4/24/00	65	49	14	63	5/24/00	2	0.61	0	0.61
4/25/00	52	35	8	43	5/25/00	2	0.57	0	0.57
4/26/00	60	39	6	45	5/26/00	2	0.54	0	0.54
4/27/00	53	36	7	43	5/27/00	2	0.52	0	0.52
4/28/00	31	20	4	24	5/28/00	2	0.52	0	0.52
4/29/00	21	13	1	14	5/29/00	2	0.50	0	0.50
4/30/00	19	11	0	11	5/30/00	2	0.52	0	0.52
					5/31/00	2	0.62	0	0.62

Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)	Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)
6/1/00	2	0.75	0	0.75	7/1/00	3	0.31	0	0.31
6/2/00	4	1.9	0	1.9	7/2/00	3	0.31	0	0.31
6/3/00	4	1.4	0	1.4	7/3/00	3	0.35	0	0.35
6/4/00	3	0.88	0	0.88	7/4/00	4	0.41	0	0.41
6/5/00	2	0.59	0	0.59	7/5/00	4	0.47	0	0.47
6/6/00	2	0.41	0	0.41	7/6/00	4	0.47	0	0.47
6/7/00	1	0.28	0	0.28	7/7/00	4	0.48	0	0.48
6/8/00	1	0.22	0	0.22	7/8/00	4	0.47	0	0.47
6/9/00	1	0.22	0	0.22	7/9/00	4	0.43	0	0.43
6/10/00	1	0.23	0	0.23	7/10/00	4	0.40	0	0.40
6/11/00	1	0.22	0	0.22	7/11/00	4	0.39	0	0.39
6/12/00	1	0.34	0	0.34	7/12/00	4	0.36	0	0.36
6/13/00	2	0.66	0	0.66	7/13/00	4	0.34	0	0.34
6/14/00	3	1.1	0	1.1	7/14/00	3	0.28	0	0.28
6/15/00	4	1.5	0	1.5	7/15/00	3	0.22	0	0.22
6/16/00	3	1.0	0	1.0	7/16/00	2	0.17	0	0.17
6/17/00	3	0.79	0	0.79	7/17/00	2	0.14	0	0.14
6/18/00	3	0.63	0	0.63	7/18/00	1	0.11	0	0.11
6/19/00	2	0.51	0	0.51	7/19/00	1	0.09	0	0.09
6/20/00	2	0.43	0	0.43	7/20/00	1	0.07	0	0.07
6/21/00	2	0.39	0	0.39	7/21/00	1	0.08	0	0.08
6/22/00	2	0.36	0	0.36	7/22/00	1	0.08	0	0.08
6/23/00	2	0.34	0	0.34	7/23/00	1	0.09	0	0.09
6/24/00	2	0.32	0	0.32	7/24/00	2	0.10	0	0.10
6/25/00	2	0.31	0	0.31	7/25/00	2	0.11	0	0.11
6/26/00	2	0.30	0	0.30	7/26/00	2	0.12	0	0.12
6/27/00	2	0.28	0	0.28	7/27/00	2	0.11	0	0.11
6/28/00	2	0.26	0	0.26	7/28/00	2	0.10	0	0.10
6/29/00	2	0.25	0	0.25	7/29/00	1	0.09	0	0.09
6/30/00	2	0.27	0	0.27	7/30/00	1	0.08	0	0.08
					7/31/00	1	0.07	0	0.07

Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)	Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)
8/1/00	1	0.06	0	0.06	9/1/00	2	0.07	0	0.07
8/2/00	1	0.06	0	0.06	9/2/00	2	0.08	0	0.08
8/3/00	1	0.06	0	0.06	9/3/00	2	0.09	0	0.09
8/4/00	2	0.08	0	0.08	9/4/00	2	0.09	0	0.09
8/5/00	2	0.10	0	0.10	9/5/00	2	0.09	0	0.09
8/6/00	2	0.11	0	0.11	9/6/00	2	0.09	0	0.09
8/7/00	3	0.14	0	0.14	9/7/00	2	0.09	0	0.09
8/8/00	3	0.14	0	0.14	9/8/00	2	0.09	0	0.09
8/9/00	3	0.13	0	0.13	9/9/00	2	0.09	0	0.09
8/10/00	3	0.12	0	0.12	9/10/00	2	0.13	0	0.13
8/11/00	3	0.11	0	0.11	9/11/00	3	0.16	0	0.16
8/12/00	2	0.10	0	0.10	9/12/00	3	0.20	0	0.20
8/13/00	2	0.10	0	0.10	9/13/00	3	0.18	0	0.18
8/14/00	2	0.10	0	0.10	9/14/00	3	0.17	0	0.17
8/15/00	2	0.09	0	0.09	9/15/00	3	0.17	0	0.17
8/16/00	2	0.09	0	0.09	9/16/00	3	0.16	0	0.16
8/17/00	2	0.10	0	0.10	9/17/00	3	0.15	0	0.15
8/18/00	2	0.10	0	0.10	9/18/00	3	0.15	0	0.15
8/19/00	3	0.11	0	0.11	9/19/00	3	0.14	0	0.14
8/20/00	3	0.12	0	0.12	9/20/00	3	0.14	0	0.14
8/21/00	3	0.13	0	0.13	9/21/00	3	0.16	0	0.16
8/22/00	3	0.12	0	0.12	9/22/00	3	0.15	0	0.15
8/23/00	3	0.12	0	0.12	9/23/00	3	0.16	0	0.16
8/24/00	3	0.11	0	0.11	9/24/00	3	0.16	0	0.16
8/25/00	3	0.10	0	0.10	9/25/00	3	0.16	0	0.16
8/26/00	2	0.09	0	0.09	9/26/00	2	0.09	0	0.09
8/27/00	2	0.09	0	0.09	9/27/00	1	0.05	0	0.05
8/28/00	2	0.08	0	0.08	9/28/00	1	0.05	0	0.05
8/29/00	2	0.08	0	0.08	9/29/00	1	0.05	0	0.05
8/30/00	2	0.08	0	0.08	9/30/00	1	0.05	0	0.05
8/31/00	2	0.07	0	0.07					

Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)	Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)
10/1/00	2	0.12	0	0.12	11/1/00	41	3.0	0	3.0
10/2/00	2	0.13	0	0.13	11/2/00	38	2.8	0	2.8
10/3/00	2	0.12	0	0.12	11/3/00	35	2.6	0	2.6
10/4/00	2	0.12	0	0.12	11/4/00	32	2.5	0	2.5
10/5/00	2	0.12	0	0.12	11/5/00	29	2.5	0	2.5
10/6/00	2	0.11	0	0.11	11/6/00	26	2.3	0	2.3
10/7/00	2	0.11	0	0.11	11/7/00	23	1.9	0	1.9
10/8/00	2	0.11	0	0.11	11/8/00	20	1.8	0	1.8
10/9/00	2	0.12	0	0.12	11/9/00	17	1.6	0	1.6
10/10/00	2	0.12	0	0.12	11/10/00	15	1.4	0	1.4
10/11/00	2	0.11	0	0.11	11/11/00	13	1.1	0	1.1
10/12/00	2	0.11	0	0.11	11/12/00	11	0.79	0	0.79
10/13/00	2	0.12	0	0.12	11/13/00	9	0.74	0	0.74
10/14/00	2	0.12	0	0.12	11/14/00	6	0.48	0	0.48
10/15/00	2	0.12	0	0.12	11/15/00	4	0.31	0	0.31
10/16/00	2	0.12	0	0.12	11/16/00	3	0.27	0	0.27
10/17/00	2	0.13	0	0.13	11/17/00	10	0.76	0	0.76
10/18/00	2	0.13	0	0.13	11/18/00	18	1.3	0	1.3
10/19/00	2	0.12	0	0.12	11/19/00	25	1.8	0	1.8
10/20/00	5	0.34	0	0.34	11/20/00	33	2.1	0	2.1
10/21/00	13	0.94	0	0.94	11/21/00	41	2.8	0	2.8
10/22/00	22	1.7	0	1.7	11/22/00	54	3.6	0	3.6
10/23/00	31	2.3	0	2.3	11/23/00	58	3.9	0	3.9
10/24/00	40	2.9	0	2.9	11/24/00	57	4.1	0	4.1
10/25/00	49	3.5	0	3.5	11/25/00	56	4.0	0	4.0
10/26/00	56	4.0	0	4.0	11/26/00	54	4.3	0	4.3
10/27/00	55	3.9	0	3.9	11/27/00	53	4.7	0	4.7
10/28/00	52	3.8	0	3.8	11/28/00	51	4.7	0	4.7
10/29/00	49	3.8	0	3.8	11/29/00	50	4.4	0	4.4
10/30/00	46	3.5	0	3.5	11/30/00	49	5.3	0	5.3
10/31/00	44	3.2	0	3.2					

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12/1/00	47	5.2	0	5.2	1/1/01	2	0.16	0	0.16
12/2/00	46	5.1	0	5.1	1/2/01	1	0.06	0	0.06
12/3/00	44	5.1	0	5.1	1/3/01	1	0.06	0	0.06
12/4/00	43	4.9	0	4.9	1/4/01	3	0.29	0	0.29
12/5/00	42	4.6	0	4.6	1/5/01	4	0.45	0	0.45
12/6/00	40	4.3	0	4.3	1/6/01	5	0.61	0	0.61
12/7/00	37	3.8	0	3.8	1/7/01	NS	0.41	0	0.41
12/8/00	31	3.1	0	3.1	1/8/01	2	0.26	0	0.26
12/9/00	25	2.5	0	2.5	1/9/01	NS	0.45	0	0.45
12/10/00	20	1.8	0	1.8	1/10/01	NS	0.61	0	0.61
12/11/00	NS	1.0	0	1.0	1/11/01	7	1.0	0	1.0
12/12/00	NS	0.56	0	0.56	1/12/01	6	0.99	0	0.99
12/13/00	3	0.20	0	0.20	1/13/01	7	1.1	0	1.1
12/14/00	2	0.19	0	0.19	1/14/01	8	1.2	0	1.2
12/15/00	2	0.21	0	0.21	1/15/01	7	1.0	0	1.0
12/16/00	NS	0.20	0	0.20	1/16/01	7	0.81	0	0.81
12/17/00	NS	0.19	0	0.19	1/17/01	NS	0.60	0	0.60
12/18/00	NS	0.17	0	0.17	1/18/01	NS	0.50	0	0.50
12/19/00	2	0.15	0	0.15	1/19/01	NS	0.48	0	0.48
12/20/00	NS	0.13	0	0.13	1/20/01	4	0.50	0	0.50
12/21/00	1	0.11	0	0.11	1/21/01	4	0.49	0	0.49
12/22/00	2	0.14	0	0.14	1/22/01	5	0.63	0	0.63
12/23/00	2	0.16	0	0.16	1/23/01	5	0.71	0	0.71
12/24/00	2	0.17	0	0.17	1/24/01	5	0.66	0	0.66
12/25/00	2	0.17	0	0.17	1/25/01	6	1.1	0	1.1
12/26/00	2	0.19	0	0.19	1/26/01	3	0.55	0	0.55
12/27/00	2	0.25	0	0.25	1/27/01	4	0.62	0	0.62
12/28/00	4	0.45	0	0.45	1/28/01	NS	0.47	0	0.47
12/29/00	4	0.53	0	0.53	1/29/01	NS	0.22	0	0.22
12/30/00	4	0.43	0	0.43	1/30/01	1	0.13	0	0.13
12/31/00	3	0.31	0	0.31	1/31/01	1	0.13	0	0.13

Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)	Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)
2/1/01	2	0.20	0	0.20	3/1/01	13	4.7	0	4.7
2/2/01	1	0.16	0	0.16	3/2/01	13	4.7	0	4.7
2/3/01	2	0.23	0	0.23	3/3/01	18	7.4	0	7.4
2/4/01	2	0.30	0	0.30	3/4/01	30	17	0	17
2/5/01	5	0.97	0	0.97	3/5/01	30	16	0	16
2/6/01	97	93	14	107	3/6/01	53	48	25	73
2/7/01	49	42	17	59	3/7/01	97	111	69	180
2/8/01	14	7.9	0	7.9	3/8/01	100	157	82	239
2/9/01	11	5.0	0	5.0	3/9/01	110	200	102	302
2/10/01	10	3.6	0	3.6	3/10/01	96	174	100	274
2/11/01	9	2.7	0	2.7	3/11/01	59	91	79	170
2/12/01	6	1.5	0	1.5	3/12/01	36	46	58	104
2/13/01	5	1.1	0	1.1	3/13/01	73	117	81	198
2/14/01	3	0.66	0	0.66	3/14/01	200	390	113	503
2/15/01	3	0.60	0	0.60	3/15/01	120	141	48	189
2/16/01	3	0.53	0	0.53	3/16/01	73	64	24	88
2/17/01	3	0.43	0	0.43	3/17/01	64	55	23	78
2/18/01	3	0.56	0	0.56	3/18/01	42	30	11	41
2/19/01	3	0.48	0	0.48	3/19/01	24	17	10	27
2/20/01	3	0.53	0	0.53	3/20/01	54	59	37	96
2/21/01	6	1.5	0	1.5	3/21/01	57	49	22	71
2/22/01	6	1.6	0	1.6	3/22/01	48	30	4	34
2/23/01	7	2.8	0	2.8	3/23/01	45	24	0	24
2/24/01	19	13	6	19	3/24/01	28	13	0	13
2/25/01	18	11	2	13	3/25/01	30	13	0	13
2/26/01	19	11	1	12	3/26/01	27	15	0	15
2/27/01	19	9.7	0	9.7	3/27/01	20	12	0	12
2/28/01	16	6.9	0	6.9	3/28/01	13	7.0	0	7.0
					3/29/01	14	8.4	2	10
					3/30/01	11	6.4	0	6.4
					3/31/01	14	6.8	0	6.8

Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)	Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)
4/1/01	10	5.1	0	5.1	5/1/01	135	342	104	446
4/2/01	16	11	10	21	5/2/01	137	241	86	327
4/3/01	21	13	2	15	5/3/01	26	25	33	58
4/4/01	23	16	11	27	5/4/01	40	30	13	43
4/5/01	30	21	9	30	5/5/01	30	18	2	20
4/6/01	19	12	1	13	5/6/01	21	11	0	11
4/7/01	22	15	8	23	5/7/01	16	6.8	0	6.8
4/8/01	22	16	11	27	5/8/01	14	5.3	0	5.3
4/9/01	17	12	11	23	5/9/01	12	4.1	0	4.1
4/10/01	22	14	5	19	5/10/01	9	2.8	0	2.8
4/11/01	16	9.6	0	9.6	5/11/01	9	2.4	0	2.4
4/12/01	28	26	26	52	5/12/01	9	2.2	0	2.2
4/13/01	29	27	28	55	5/13/01	10	2.3	0	2.3
4/14/01	28	22	17	39	5/14/01	10	2.2	0	2.2
4/15/01	26	17	5	22	5/15/01	6	1.5	0	1.5
4/16/01	19	11	0	11	5/16/01	9	4.7	0	4.7
4/17/01	16	7.6	0	7.6	5/17/01	21	11	0	11
4/18/01	17	7.4	0	7.4	5/18/01	20	7.7	0	7.7
4/19/01	14	6.3	0	6.3	5/19/01	18	5.4	0	5.4
4/20/01	19	11	0	11	5/20/01	15	4.0	0	4.0
4/21/01	21	11	0	11	5/21/01	12	2.8	0	2.8
4/22/01	16	7.1	0	7.1	5/22/01	11	2.2	0	2.2
4/23/01	18	7.2	0	7.2	5/23/01	8	1.5	0	1.5
4/24/01	12	4.4	0	4.4	5/24/01	6	0.90	0	0.90
4/25/01	10	3.6	0	3.6	5/25/01	5	0.70	0	0.70
4/26/01	14	4.7	0	4.7	5/26/01	4	0.59	0	0.59
4/27/01	19	6.4	0	6.4	5/27/01	4	0.47	0	0.47
4/28/01	21	6.9	0	6.9	5/28/01	4	0.47	0	0.47
4/29/01	12	4.9	0	4.9	5/29/01	4	0.41	0	0.41
4/30/01	15	9.0	2	11	5/30/01	3	0.36	0	0.36
					5/31/01	3	0.27	0	0.27

Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)	Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)
6/1/01	4	0.34	0	0.34	7/1/01	3	0.20	0	0.20
6/2/01	4	0.35	0	0.35	7/2/01	4	0.32	0	0.32
6/3/01	4	0.33	0	0.33	7/3/01	5	0.34	0	0.34
6/4/01	4	0.34	0	0.34	7/4/01	6	0.34	0	0.34
6/5/01	4	0.39	0	0.39	7/5/01	6	0.30	0	0.30
6/6/01	4	0.43	0	0.43	7/6/01	4	0.21	0	0.21
6/7/01	4	0.43	0	0.43	7/7/01	3	0.14	0	0.14
6/8/01	4	0.43	0	0.43	7/8/01	2	0.10	0	0.10
6/9/01	4	0.46	0	0.46	7/9/01	3	0.11	0	0.11
6/10/01	4	0.43	0	0.43	7/10/01	3	0.11	0	0.11
6/11/01	4	0.39	0	0.39	7/11/01	3	0.11	0	0.11
6/12/01	4	0.36	0	0.36	7/12/01	3	0.11	0	0.11
6/13/01	3	0.35	0	0.35	7/13/01	3	0.12	0	0.12
6/14/01	3	0.32	0	0.32	7/14/01	3	0.11	0	0.11
6/15/01	3	0.27	0	0.27	7/15/01	3	0.11	0	0.11
6/16/01	3	0.25	0	0.25	7/16/01	3	0.12	0	0.12
6/17/01	3	0.22	0	0.22	7/17/01	3	0.10	0	0.10
6/18/01	2	0.20	0	0.20	7/18/01	2	0.09	0	0.09
6/19/01	2	0.16	0	0.16	7/19/01	2	0.09	0	0.09
6/20/01	2	0.13	0	0.13	7/20/01	2	0.09	0	0.09
6/21/01	2	0.12	0	0.12	7/21/01	3	0.10	0	0.10
6/22/01	2	0.10	0	0.10	7/22/01	3	0.11	0	0.11
6/23/01	2	0.10	0	0.10	7/23/01	3	0.11	0	0.11
6/24/01	3	0.13	0	0.13	7/24/01	3	0.11	0	0.11
6/25/01	4	0.17	0	0.17	7/25/01	3	0.09	0	0.09
6/26/01	4	0.19	0	0.19	7/26/01	3	0.08	0	0.08
6/27/01	4	0.22	0	0.22	7/27/01	3	0.08	0	0.08
6/28/01	3	0.20	0	0.20	7/28/01	3	0.08	0	0.08
6/29/01	2	0.15	0	0.15	7/29/01	3	0.08	0	0.08
6/30/01	2	0.17	0	0.17	7/30/01	3	0.08	0	0.08
					7/31/01	3	0.08	0	0.08

Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)	Date	Suspended Sediment (mg/l)	Sediment Discharge (tons/day)	Estimated Bedload (tons/day)	Total Sediment (tons/day)
8/1/01	3	0.08	0	0.08	9/1/01	6	0.08	0	0.08
8/2/01	3	0.07	0	0.07	9/2/01	5	0.07	0	0.07
8/3/01	3	0.06	0	0.06	9/3/01	5	0.07	0	0.07
8/4/01	3	0.05	0	0.05	9/4/01	5	0.06	0	0.06
8/5/01	2	0.05	0	0.05	9/5/01	4	0.06	0	0.06
8/6/01	2	0.04	0	0.04	9/6/01	4	0.05	0	0.05
8/7/01	2	0.04	0	0.04	9/7/01	4	0.05	0	0.05
8/8/01	2	0.04	0	0.04	9/8/01	4	0.04	0	0.04
8/9/01	2	0.03	0	0.03	9/9/01	3	0.04	0	0.04
8/10/01	2	0.03	0	0.03	9/10/01	3	0.03	0	0.03
8/11/01	2	0.03	0	0.03	9/11/01	3	0.03	0	0.03
8/12/01	2	0.04	0	0.04	9/12/01	3	0.03	0	0.03
8/13/01	3	0.04	0	0.04	9/13/01	2	0.02	0	0.02
8/14/01	3	0.04	0	0.04	9/14/01	2	0.02	0	0.02
8/15/01	3	0.04	0	0.04	9/15/01	2	0.02	0	0.02
8/16/01	3	0.04	0	0.04	9/16/01	2	0.03	0	0.03
8/17/01	3	0.04	0	0.04	9/17/01	2	0.03	0	0.03
8/18/01	4	0.05	0	0.05	9/18/01	3	0.02	0	0.02
8/19/01	4	0.07	0	0.07	9/19/01	3	0.03	0	0.03
8/20/01	4	0.07	0	0.07	9/20/01	3	0.03	0	0.03
8/21/01	4	0.07	0	0.07	9/21/01	3	0.03	0	0.03
8/22/01	4	0.07	0	0.07	9/22/01	4	0.04	0	0.04
8/23/01	4	0.08	0	0.08	9/23/01	4	0.05	0	0.05
8/24/01	4	0.07	0	0.07	9/24/01	5	0.06	0	0.06
8/25/01	4	0.09	0	0.09	9/25/01	5	0.06	0	0.06
8/26/01	5	0.09	0	0.09	9/26/01	6	0.08	0	0.08
8/27/01	5	0.08	0	0.08	9/27/01	6	0.08	0	0.08
8/28/01	5	0.08	0	0.08	9/28/01	7	0.10	0	0.10
8/29/01	6	0.08	0	0.08	9/29/01	6	0.09	0	0.09
8/30/01	6	0.09	0	0.09	9/30/01	6	0.08	0	0.08
8/31/01	6	0.08	0	0.08					

Discharge Data

Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge
10/1/97	45	11/1/97	61	12/1/97	81	1/1/98	175
10/2/97	45	11/2/97	59	12/2/97	77	1/2/98	151
10/3/97	45	11/3/97	66	12/3/97	73	1/3/98	140
10/4/97	46	11/4/97	67	12/4/97	68	1/4/98	169
10/5/97	46	11/5/97	61	12/5/97	62	1/5/98	134
10/6/97	46	11/6/97	57	12/6/97	58	1/6/98	125
10/7/97	47	11/7/97	58	12/7/97	61	1/7/98	115
10/8/97	46	11/8/97	60	12/8/97	65	1/8/98	111
10/9/97	49	11/9/97	64	12/9/97	64	1/9/98	93
10/10/97	49	11/10/97	63	12/10/97	64	1/10/98	88
10/11/97	49	11/11/97	62	12/11/97	64	1/11/98	84
10/12/97	48	11/12/97	65	12/12/97	64	1/12/98	72
10/13/97	48	11/13/97	63	12/13/97	62	1/13/98	64
10/14/97	48	11/14/97	59	12/14/97	65	1/14/98	79
10/15/97	48	11/15/97	55	12/15/97	64	1/15/98	95
10/16/97	48	11/16/97	53	12/16/97	73	1/16/98	120
10/17/97	48	11/17/97	57	12/17/97	98	1/17/98	232
10/18/97	48	11/18/97	60	12/18/97	296	1/18/98	669
10/19/97	48	11/19/97	64	12/19/97	222	1/19/98	722
10/20/97	48	11/20/97	70	12/20/97	167	1/20/98	1350
10/21/97	48	11/21/97	81	12/21/97	127	1/21/98	907
10/22/97	48	11/22/97	147	12/22/97	106	1/22/98	526
10/23/97	47	11/23/97	133	12/23/97	93	1/23/98	447
10/24/97	48	11/24/97	108	12/24/97	93	1/24/98	886
10/25/97	47	11/25/97	97	12/25/97	83	1/25/98	978
10/26/97	48	11/26/97	96	12/26/97	79	1/26/98	780
10/27/97	48	11/27/97	99	12/27/97	77	1/27/98	1000
10/28/97	48	11/28/97	101	12/28/97	77	1/28/98	1970
10/29/97	53	11/29/97	94	12/29/97	82	1/29/98	936
10/30/97	60	11/30/97	87	12/30/97	113	1/30/98	668
10/31/97	62			12/31/97	197	1/31/98	536

Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge
2/1/98	439	3/1/98	275	4/1/98	208	5/1/98	98
2/2/98	389	3/2/98	323	4/2/98	194	5/2/98	93
2/3/98	473	3/3/98	549	4/3/98	181	5/3/98	90
2/4/98	397	3/4/98	530	4/4/98	173	5/4/98	88
2/5/98	354	3/5/98	398	4/5/98	177	5/5/98	86
2/6/98	332	3/6/98	352	4/6/98	226	5/6/98	85
2/7/98	305	3/7/98	300	4/7/98	324	5/7/98	81
2/8/98	287	3/8/98	271	4/8/98	255	5/8/98	79
2/9/98	279	3/9/98	261	4/9/98	212	5/9/98	78
2/10/98	259	3/10/98	542	4/10/98	195	5/10/98	78
2/11/98	235	3/11/98	596	4/11/98	199	5/11/98	76
2/12/98	264	3/12/98	444	4/12/98	302	5/12/98	74
2/13/98	580	3/13/98	371	4/13/98	248	5/13/98	75
2/14/98	632	3/14/98	318	4/14/98	205	5/14/98	76
2/15/98	568	3/15/98	286	4/15/98	183	5/15/98	76
2/16/98	850	3/16/98	274	4/16/98	168	5/16/98	76
2/17/98	649	3/17/98	272	4/17/98	156	5/17/98	84
2/18/98	481	3/18/98	279	4/18/98	145	5/18/98	96
2/19/98	384	3/19/98	252	4/19/98	137	5/19/98	142
2/20/98	330	3/20/98	230	4/20/98	130	5/20/98	178
2/21/98	350	3/21/98	216	4/21/98	124	5/21/98	128
2/22/98	896	3/22/98	206	4/22/98	119	5/22/98	108
2/23/98	562	3/23/98	215	4/23/98	110	5/23/98	105
2/24/98	442	3/24/98	584	4/24/98	115	5/24/98	567
2/25/98	397	3/25/98	548	4/25/98	120	5/25/98	344
2/26/98	341	3/26/98	425	4/26/98	125	5/26/98	287
2/27/98	323	3/27/98	376	4/27/98	110	5/2 7/98	977
2/28/98	294	3/28/98	349	4/28/98	110	5/28/98	1150
		3/29/98	292	4/29/98	106	5/29/98	586
		3/30/98	251	4/30/98	101	5/30/98	394
		3/31/98	224			5/31/98	308

Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge
6/1/98	245	7/1/98	44	8/1/98	18	9/1/98	14
6/2/98	204	7/2/98	42	8/2/98	18	9/2/98	14
6/3/98	173	7/3/98	44	8/3/98	18	9/3/98	14
6/4/98	148	7/4/98	44	8/4/98	17	9/4/98	14
6/5/98	136	7/5/98	44	8/5/98	17	9/5/98	14
6/6/98	128	7/6/98	40	8/6/98	16	9/6/98	14
6/7/98	134	7/7/98	38	8/7/98	16	9/7/98	14
6/8/98	126	7/8/98	36	8/8/98	16	9/8/98	14
6/9/98	113	7/9/98	34	8/9/98	16	9/9/98	14
6/10/98	102	7/10/98	34	8/10/98	16	9/10/98	15
6/11/98	92	7/11/98	34	8/11/98	15	9/11/98	15
6/12/98	85	7/12/98	33	8/12/98	16	9/12/98	15
6/13/98	80	7/13/98	33	8/13/98	15	9/13/98	15
6/14/98	75	7/14/98	33	8/14/98	15	9/14/98	16
6/15/98	71	7/15/98	33	8/15/98	15	9/15/98	16
6/16/98	69	7/16/98	34	8/16/98	15	9/16/98	16
6/17/98	68	7/17/98	33	8/17/98	14	9/17/98	16
6/18/98	66	7/18/98	32	8/18/98	14	9/18/98	16
6/19/98	66	7/19/98	31	8/19/98	15	9/19/98	16
6/20/98	68	7/20/98	30	8/20/98	15	9/20/98	17
6/21/98	67	7/21/98	29	8/21/98	14	9/21/98	17
6/22/98	64	7/22/98	28	8/22/98	15	9/22/98	17
6/23/98	61	7/23/98	27	8/23/98	15	9/23/98	17
6/24/98	58	7/24/98	27	8/24/98	15	9/24/98	17
6/25/98	55	7/25/98	23	8/25/98	15	9/25/98	17
6/26/98	53	7/26/98	20	8/26/98	16	9/26/98	17
6/27/98	51	7/27/98	19	8/27/98	15	9/27/98	17
6/28/98	49	7/28/98	19	8/28/98	15	9/28/98	18
6/29/98	47	7/29/98	19	8/29/98	15	9/29/98	18
6/30/98	46	7/30/98	18	8/30/98	15	9/30/98	18
		7/31/98	18	8/31/98	14		

Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge
10/1/98	18	11/1/98	23	12/1/98	69	1/1/99	515
10/2/98	18	11/2/98	23	12/2/98	222	1/2/99	358
10/3/98	18	11/3/98	23	12/3/98	1260	1/3/99	279
10/4/98	19	11/4/98	23	12/4/98	554	1/4/99	229
10/5/98	19	11/5/98	24	12/5/98	253	1/5/99	220
10/6/98	19	11/6/98	24	12/6/98	184	1/6/99	201
10/7/98	19	11/7/98	24	12/7/98	148	1/7/99	200
10/8/98	19	11/8/98	24	12/8/98	129	1/8/99	204
10/9/98	20	11/9/98	23	12/9/98	116	1/9/99	206
10/10/98	19	11/10/98	23	12/10/98	107	1/10/99	575
10/11/98	19	11/11/98	23	12/11/98	106	1/11/99	2420
10/12/98	20	11/12/98	24	12/12/98	159	1/12/99	909
10/13/98	20	11/13/98	24	12/13/98	852	1/13/99	764
10/14/98	20	11/14/98	25	12/14/98	942	1/14/99	864
10/15/98	20	11/15/98	26	12/15/98	547	1/15/99	1830
10/16/98	21	11/16/98	26	12/16/98	307	1/16/99	1130
10/17/98	21	11/17/98	26	12/17/98	232	1/17/99	856
10/18/98	21	11/18/98	26	12/18/98	199	1/18/99	1600
10/19/98	21	11/19/98	29	12/19/98	120	1/19/99	1520
10/20/98	21	11/20/98	34	12/20/98	84	1/20/99	913
10/21/98	21	11/21/98	36	12/21/98	69	1/21/99	898
10/22/98	21	11/22/98	36	12/22/98	64	1/22/99	1420
10/23/98	21	11/23/98	50	12/23/98	65	1/23/99	1120
10/24/98	21	11/24/98	82	12/24/98	66	1/24/99	710
10/25/98	21	11/25/98	63	12/25/98	66	1/25/99	624
10/26/98	21	11/26/98	56	12/26/98	67	1/26/99	501
10/27/98	21	11/27/98	108	12/27/98	72	1/27/99	414
10/28/98	21	11/28/98	84	12/28/98	3360	1/28/99	360
10/29/98	21	11/29/98	66	12/29/98	3330	1/29/99	441
10/30/98	21	11/30/98	59	12/30/98	1880	1/30/99	647
10/31/98	21			12/31/98	799	1/31/99	489

Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge
2/1/99	386	3/1/99	3190	4/1/99	365	5/1/99	160
2/2/99	323	3/2/99	1780	4/2/99	314	5/2/99	156
2/3/99	363	3/3/99	1350	4/3/99	292	5/3/99	163
2/4/99	456	3/4/99	945	4/4/99	338	5/4/99	204
2/5/99	536	3/5/99	801	4/5/99	360	5/5/99	225
2/6/99	690	3/6/99	673	4/6/99	339	5/6/99	194
2/7/99	2690	3/7/99	610	4/7/99	306	5/7/99	173
2/8/99	1640	3/8/99	549	4/8/99	282	5/8/99	161
2/9/99	786	3/9/99	511	4/9/99	335	5/9/99	157
2/10/99	594	3/10/99	503	4/10/99	374	5/10/99	152
2/11/99	430	3/11/99	450	4/11/99	330	5/11/99	147
2/12/99	388	3/12/99	403	4/12/99	292	5/12/99	142
2/13/99	357	3/13/99	384	4/13/99	270	5/13/99	134
2/14/99	358	3/14/99	386	4/14/99	253	5/14/99	129
2/15/99	430	3/15/99	438	4/15/99	239	5/15/99	123
2/16/99	492	3/16/99	527	4/16/99	232	5/16/99	118
2/17/99	796	3/17/99	590	4/17/99	228	5/17/99	114
2/18/99	763	3/18/99	487	4/18/99	226	5/18/99	112
2/19/99	1150	3/19/99	441	4/19/99	232	5/19/99	108
2/20/99	1340	3/20/99	424	4/20/99	265	5/20/99	105
2/21/99	919	3/21/99	486	4/21/99	284	5/21/99	104
2/22/99	872	3/22/99	608	4/22/99	264	5/22/99	100
2/23/99	1300	3/23/99	580	4/23/99	240	5/23/99	97
2/24/99	4220	3/24/99	516	4/24/99	216	5/24/99	93
2/25/99	4630	3/25/99	474	4/25/99	201	5/25/99	88
2/26/99	2580	3/26/99	524	4/26/99	194	5/26/99	84
2/27/99	1540	3/27/99	585	4/27/99	192	5/27/99	80
2/28/99	5440	3/28/99	481	4/28/99	190	5/28/99	77
		3/29/99	426	4/29/99	180	5/29/99	74
		3/30/99	454	4/30/99	169	5/30/99	71
		3/31/99	416			5/31/99	70

Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge
6/1/99	68	7/1/99	45	8/1/99	19	9/1/99	20
6/2/99	70	7/2/99	41	8/2/99	20	9/2/99	20
6/3/99	75	7/3/99	40	8/3/99	19	9/3/99	20
6/4/99	80	7/4/99	39	8/4/99	18	9/4/99	20
6/5/99	76	7/5/99	38	8/5/99	17	9/5/99	20
6/6/99	78	7/6/99	36	8/6/99	19	9/6/99	20
6/7/99	72	7/7/99	35	8/7/99	23	9/7/99	20
6/8/99	68	7/8/99	34	8/8/99	23	9/8/99	20
6/9/99	66	7/9/99	33	8/9/99	21	9/9/99	20
6/10/99	63	7/10/99	32	8/10/99	20	9/10/99	20
6/11/99	60	7/11/99	31	8/11/99	20	9/11/99	20
6/12/99	58	7/12/99	30	8/12/99	19	9/12/99	20
6/13/99	56	7/13/99	29	8/13/99	20	9/13/99	20
6/14/99	53	7/14/99	29	8/14/99	23	9/14/99	20
6/15/99	50	7/15/99	28	8/15/99	23	9/15/99	20
6/16/99	48	7/16/99	29	8/16/99	22	9/16/99	20
6/17/99	46	7/17/99	29	8/17/99	22	9/17/99	19
6/18/99	44	7/18/99	28	8/18/99	22	9/18/99	19
6/19/99	42	7/19/99	28	8/19/99	23	9/19/99	19
6/20/99	41	7/20/99	27	8/20/99	22	9/20/99	19
6/21/99	42	7/21/99	26	8/21/99	22	9/21/99	18
6/22/99	43	7/22/99	25	8/22/99	21	9/22/99	19
6/23/99	43	7/23/99	25	8/23/99	21	9/23/99	19
6/24/99	42	7/24/99	25	8/24/99	20	9/24/99	20
6/25/99	51	7/25/99	24	8/25/99	20	9/25/99	19
6/26/99	51	7/26/99	24	8/26/99	20	9/26/99	20
6/27/99	51	7/27/99	25	8/27/99	19	9/27/99	20
6/28/99	49	7/28/99	23	8/28/99	19	9/28/99	20
6/29/99	51	7/29/99	20	8/29/99	20	9/29/99	21
6/30/99	49	7/30/99	20	8/30/99	20	9/30/99	21
		7/31/99	18	8/31/99	21		

Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge
10/1/99	20	11/1/99	34	12/1/99	77	1/1/00	72
10/2/99	21	11/2/99	33	12/2/99	83	1/2/00	74
10/3/99	22	11/3/99	33	12/3/99	101	1/3/00	71
10/4/99	21	11/4/99	35	12/4/99	123	1/4/00	79
10/5/99	22	11/5/99	35	12/5/99	155	1/5/00	86
10/6/99	22	11/6/99	40	12/6/99	109	1/6/00	83
10/7/99	23	11/7/99	41	12/7/99	87	1/7/00	116
10/8/99	24	11/8/99	40	12/8/99	77	1/8/00	118
10/9/99	25	11/9/99	39	12/9/99	77	1/9/00	135
10/10/99	25	11/10/99	39	12/10/99	90	1/10/00	183
10/11/99	25	11/11/99	38	12/11/99	89	1/11/00	215
10/12/99	25	11/12/99	39	12/12/99	89	1/12/00	185
10/13/99	25	11/13/99	40	12/13/99	162	1/13/00	154
10/14/99	25	11/14/99	41	12/14/99	560	1/14/00	150
10/15/99	24	11/15/99	39	12/15/99	279	1/15/00	403
10/16/99	24	11/16/99	38	12/16/99	835	1/16/00	736
10/17/99	25	11/17/99	39	12/17/99	927	1/17/00	1070
10/18/99	25	11/18/99	38	12/18/99	510	1/18/00	723
10/19/99	25	11/19/99	39	12/19/99	624	1/19/00	486
10/20/99	25	11/20/99	39	12/20/99	362	1/20/00	340
10/21/99	24	11/21/99	39	12/21/99	253	1/21/00	283
10/22/99	25	11/22/99	39	12/22/99	206	1/22/00	246
10/23/99	24	11/23/99	39	12/23/99	175	1/23/00	216
10/24/99	25	11/24/99	44	12/24/99	148	1/24/00	196
10/25/99	27	11/25/99	50	12/25/99	127	1/25/00	177
10/26/99	30	11/26/99	56	12/26/99	111	1/26/00	178
10/27/99	32	11/27/99	72	12/27/99	102	1/27/00	174
10/28/99	35	11/28/99	95	12/28/99	92	1/28/00	161
10/29/99	38	11/29/99	129	12/29/99	86	1/29/00	140
10/30/99	37	11/30/99	92	12/30/99	79	1/30/00	131
10/31/99	35			12/31/99	73	1/31/00	130

Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge
2/1/00	172	3/1/00	1110	4/1/00	347	5/1/00	190
2/2/00	4370	3/2/00	935	4/2/00	334	5/2/00	195
2/3/00	4000	3/3/00	902	4/3/00	299	5/3/00	240
2/4/00	1720	3/4/00	932	4/4/00	292	5/4/00	238
2/5/00	1030	3/5/00	1480	4/5/00	301	5/5/00	206
2/6/00	913	3/6/00	1350	4/6/00	293	5/6/00	197
2/7/00	891	3/7/00	1170	4/7/00	288	5/7/00	185
2/8/00	1050	3/8/00	859	4/8/00	265	5/8/00	172
2/9/00	1410	3/9/00	755	4/9/00	241	5/9/00	160
2/10/00	1130	3/10/00	636	4/10/00	221	5/10/00	175
2/11/00	814	3/11/00	675	4/11/00	211	5/11/00	206
2/12/00	613	3/12/00	733	4/12/00	198	5/12/00	404
2/13/00	562	3/13/00	570	4/13/00	214	5/13/00	418
2/14/00	558	3/14/00	635	4/14/00	1700	5/14/00	301
2/15/00	745	3/15/00	644	4/15/00	2210	5/15/00	248
2/16/00	841	3/16/00	534	4/16/00	1100	5/16/00	220
2/17/00	695	3/17/00	787	4/17/00	852	5/17/00	197
2/18/00	528	3/18/00	716	4/18/00	649	5/18/00	178
2/19/00	432	3/19/00	696	4/19/00	510	5/19/00	161
2/20/00	382	3/20/00	587	4/20/00	416	5/20/00	150
2/21/00	409	3/21/00	498	4/21/00	364	5/21/00	142
2/22/00	1090	3/22/00	473	4/22/00	332	5/22/00	133
2/23/00	2550	3/23/00	788	4/23/00	308	5/23/00	122
2/24/00	2200	3/24/00	977	4/24/00	277	5/24/00	112
2/25/00	1200	3/25/00	704	4/25/00	250	5/25/00	105
2/26/00	1050	3/26/00	565	4/26/00	245	5/26/00	100
2/27/00	1640	3/27/00	488	4/27/00	249	5/2 7/00	97
2/28/00	1960	3/28/00	477	4/28/00	233	5/28/00	96
2/29/00	1410	3/29/00	458	4/29/00	219	5/29/00	93
		3/30/00	418	4/30/00	203	5/30/00	97
		3/31/00	381			5/31/00	114

Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge
6/1/00	114	7/1/00	46	8/1/00	20	9/1/00	14
6/2/00	155	7/2/00	40	8/2/00	19	9/2/00	16
6/3/00	139	7/3/00	40	8/3/00	19	9/3/00	16
6/4/00	113	7/4/00	43	8/4/00	19	9/4/00	17
6/5/00	98	7/5/00	45	8/5/00	18	9/5/00	17
6/6/00	89	7/6/00	43	8/6/00	17	9/6/00	16
6/7/00	81	7/7/00	45	8/7/00	18	9/7/00	16
6/8/00	79	7/8/00	43	8/8/00	17	9/8/00	17
6/9/00	83	7/9/00	40	8/9/00	17	9/9/00	16
6/10/00	84	7/10/00	37	8/10/00	17	9/10/00	21
6/11/00	82	7/11/00	36	8/11/00	17	9/11/00	22
6/12/00	93	7/12/00	34	8/12/00	16	9/12/00	24
6/13/00	117	7/13/00	33	8/13/00	16	9/13/00	22
6/14/00	130	7/14/00	31	8/14/00	17	9/14/00	20
6/15/00	147	7/15/00	30	8/15/00	16	9/15/00	20
6/16/00	113	7/16/00	28	8/16/00	17	9/16/00	19
6/17/00	99	7/17/00	28	8/17/00	16	9/17/00	19
6/18/00	90	7/18/00	27	8/18/00	16	9/18/00	19
6/19/00	82	7/19/00	26	8/19/00	16	9/19/00	17
6/20/00	78	7/20/00	26	8/20/00	16	9/20/00	17
6/21/00	73	7/21/00	25	8/21/00	16	9/21/00	20
6/22/00	67	7/22/00	25	8/22/00	16	9/22/00	19
6/23/00	63	7/23/00	23	8/23/00	15	9/23/00	19
6/24/00	60	7/24/00	23	8/24/00	15	9/24/00	19
6/25/00	58	7/25/00	22	8/25/00	15	9/25/00	19
6/26/00	55	7/26/00	23	8/26/00	14	9/26/00	19
6/27/00	51	7/27/00	22	8/27/00	14	9/27/00	19
6/28/00	49	7/28/00	22	8/28/00	14	9/28/00	19
6/29/00	47	7/29/00	21	8/29/00	14	9/29/00	18
6/30/00	45	7/30/00	21	8/30/00	15	9/30/00	20
		7/31/00	20	8/31/00	14		

Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge
10/1/00	20	11/1/00	27	12/1/00	41	1/1/01	41
10/2/00	22	11/2/00	27	12/2/00	41	1/2/01	39
10/3/00	21	11/3/00	27	12/3/00	43	1/3/01	38
10/4/00	20	11/4/00	29	12/4/00	42	1/4/01	37
10/5/00	20	11/5/00	31	12/5/00	41	1/5/01	40
10/6/00	20	11/6/00	32	12/6/00	40	1/6/01	42
10/7/00	20	11/7/00	31	12/7/00	38	1/7/01	44
10/8/00	20	11/8/00	32	12/8/00	37	1/8/01	47
10/9/00	21	11/9/00	35	12/9/00	36	1/9/01	50
10/10/00	21	11/10/00	35	12/10/00	34	1/10/01	54
10/11/00	21	11/11/00	31	12/11/00	28	1/11/01	59
10/12/00	21	11/12/00	27	12/12/00	26	1/12/01	58
10/13/00	22	11/13/00	32	12/13/00	26	1/13/01	56
10/14/00	22	11/14/00	28	12/14/00	32	1/14/01	57
10/15/00	22	11/15/00	27	12/15/00	36	1/15/01	52
10/16/00	22	11/16/00	30	12/16/00	35	1/16/01	45
10/17/00	23	11/17/00	29	12/17/00	34	1/17/01	43
10/18/00	23	11/18/00	28	12/18/00	33	1/18/01	42
10/19/00	22	11/19/00	27	12/19/00	32	1/19/01	42
10/20/00	26	11/20/00	23	12/20/00	32	1/20/01	43
10/21/00	26	11/21/00	25	12/21/00	32	1/21/01	42
10/22/00	28	11/22/00	25	12/22/00	33	1/22/01	48
10/23/00	27	11/23/00	25	12/23/00	35	1/23/01	46
10/24/00	27	11/24/00	26	12/24/00	38	1/24/01	46
10/25/00	27	11/25/00	27	12/25/00	40	1/25/01	64
10/26/00	26	11/26/00	29	12/26/00	40	1/26/01	62
10/27/00	26	11/27/00	33	12/27/00	43	1/27/01	54
10/28/00	27	11/28/00	34	12/28/00	44	1/28/01	50
10/29/00	28	11/29/00	33	12/29/00	43	1/29/01	50
10/30/00	28	11/30/00	40	12/30/00	42	1/30/01	49
10/31/00	27			12/31/00	41	1/31/01	50

Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge
2/1/01	47	3/1/01	134	4/1/01	181	5/1/01	677
2/2/01	48	3/2/01	137	4/2/01	259	5/2/01	599
2/3/01	51	3/3/01	153	4/3/01	226	5/3/01	361
2/4/01	56	3/4/01	203	4/4/01	267	5/4/01	274
2/5/01	76	3/5/01	200	4/5/01	258	5/5/01	225
2/6/01	278	3/6/01	326	4/6/01	222	5/6/01	187
2/7/01	291	3/7/01	522	4/7/01	250	5/7/01	159
2/8/01	205	3/8/01	581	4/8/01	267	5/8/01	140
2/9/01	169	3/9/01	670	4/9/01	267	5/9/01	125
2/10/01	131	3/10/01	659	4/10/01	237	5/10/01	112
2/11/01	113	3/11/01	569	4/11/01	217	5/11/01	100
2/12/01	88	3/12/01	476	4/12/01	330	5/12/01	92
2/13/01	84	3/13/01	576	4/13/01	343	5/13/01	84
2/14/01	73	3/14/01	717	4/14/01	293	5/14/01	83
2/15/01	71	3/15/01	429	4/15/01	239	5/15/01	103
2/16/01	65	3/16/01	324	4/16/01	203	5/16/01	183
2/17/01	51	3/17/01	317	4/17/01	177	5/17/01	197
2/18/01	66	3/18/01	264	4/18/01	164	5/18/01	142
2/19/01	63	3/19/01	260	4/19/01	168	5/19/01	114
2/20/01	58	3/20/01	379	4/20/01	201	5/20/01	96
2/21/01	83	3/21/01	313	4/21/01	191	5/21/01	83
2/22/01	97	3/22/01	233	4/22/01	166	5/22/01	74
2/23/01	136	3/23/01	192	4/23/01	148	5/23/01	66
2/24/01	244	3/24/01	167	4/24/01	135	5/24/01	60
2/25/01	227	3/25/01	159	4/25/01	129	5/25/01	55
2/26/01	221	3/26/01	213	4/26/01	123	5/26/01	50
2/27/01	192	3/27/01	214	4/27/01	120	5/27/01	46
2/28/01	161	3/28/01	197	4/28/01	123	5/28/01	42
		3/29/01	226	4/29/01	156	5/29/01	42
		3/30/01	206	4/30/01	226	5/30/01	40
		3/31/01	173			5/31/01	38

Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge	Date	USGS Daily Average Discharge
6/1/01	36	7/1/01	26	8/1/01	10	9/1/01	5.5
6/2/01	35	7/2/01	33	8/2/01	8.6	9/2/01	5.1
6/3/01	34	7/3/01	27	8/3/01	7.9	9/3/01	4.8
6/4/01	35	7/4/01	23	8/4/01	7.5	9/4/01	4.8
6/5/01	38	7/5/01	20	8/5/01	7.6	9/5/01	4.6
6/6/01	41	7/6/01	17	8/6/01	6.6	9/6/01	4.3
6/7/01	40	7/7/01	17	8/7/01	6.3	9/7/01	4.5
6/8/01	39	7/8/01	15	8/8/01	6.4	9/8/01	4.4
6/9/01	43	7/9/01	16	8/9/01	6.0	9/9/01	3.9
6/10/01	41	7/10/01	14	8/10/01	5.6	9/10/01	4.1
6/11/01	38	7/11/01	14	8/11/01	5.5	9/11/01	4.4
6/12/01	37	7/12/01	15	8/12/01	5.5	9/12/01	4.0
6/13/01	39	7/13/01	15	8/13/01	5.6	9/13/01	3.8
6/14/01	39	7/14/01	14	8/14/01	5.4	9/14/01	3.6
6/15/01	36	7/15/01	14	8/15/01	5.4	9/15/01	4.0
6/16/01	34	7/16/01	14	8/16/01	4.9	9/16/01	4.3
6/17/01	31	7/17/01	14	8/17/01	4.8	9/17/01	3.8
6/18/01	29	7/18/01	15	8/18/01	5.1	9/18/01	3.5
6/19/01	28	7/19/01	15	8/19/01	6.7	9/19/01	3.5
6/20/01	25	7/20/01	13	8/20/01	6.7	9/20/01	3.9
6/21/01	23	7/21/01	13	8/21/01	6.2	9/21/01	3.7
6/22/01	21	7/22/01	14	8/22/01	6.8	9/22/01	3.8
6/23/01	19	7/23/01	13	8/23/01	7.1	9/23/01	4.4
6/24/01	18	7/24/01	13	8/24/01	6.7	9/24/01	4.3
6/25/01	18	7/25/01	11	8/25/01	7.3	9/25/01	4.2
6/26/01	18	7/26/01	11	8/26/01	7.1	9/26/01	5.1
6/27/01	21	7/27/01	11	8/27/01	6.1	9/27/01	4.7
6/28/01	24	7/28/01	10	8/28/01	5.9	9/28/01	5.4
6/29/01	30	7/29/01	10	8/29/01	5.3	9/29/01	5.1
6/30/01	28	7/30/01	9.7	8/30/01	5.5	9/30/01	5.2
		7/31/01	9.7	8/31/01	5.2		