WATER QUALITY STATUS REPORT ● REPORT NO. 73

PERRINE COULEE
Twin Falls County, Idaho
1986

Prepared by
William H. Clark

Department of Health & Welfare
Division of Environment
Boise, Idaho

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ABSTRACT

The Perrine Coulee System is a group of agricultural drains entering the Snake River, near Twin Falls, Idaho. During 1984 and 1985 water quality data was collected on a representative drain from the Perrine Coulee System. The objectives of the survey were to determine background water quality information for Perrine Coulee and quantify agriculturally related pollutants entering the Snake River via the drain selected for study. During the 1985 irrigation season (April 15-October 15), the Perrine Coulee drain contributed over 7,322 tons of sediment to the Snake River. Inorganic nitrogen and total phosphorus exceed recommended limits in Perrine Coulee, especially during June, July and August. Fecal coliform bacteria exceeded Idaho Water Quality Standards geometric mean limit 50/100 mL, on nearly all sample dates and the 500/100 mL limit several times. Bacterial levels were not as high as reported for other southern Idaho irrigation drains. Concentrations of suspended sediment, inorganic nitrogen, total phosphorus, dissolved ortho-phosphate, and fecal coliform bacteria increased substantially in the Perrine Coulee drain compared with the background levels found in the Twin Falls Main Canal. Any sediment retention practices applied to the farmland in the watershed would help prevent sediment, nutrients and bacteria from reaching the Snake River.

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INTRODUCTION

The Perrine Coulee System is located in northern Twin Falls County, Idaho, just south of the Snake River (Figure 1). The watershed drained by the coulee is located to the east and southeast of Twin Falls and includes the eastern and northeastern portion of the City. Kimberly is located near the center of the watershed.

OBJECTIVES

The study was conducted at the request of the USDA Soil Conservation Service. The objectives were to describe the sediment and nutrient concentrations and loadings of the coulee to provide background information for use in future potential agricultural water quality projects.

DESCRIPTION OF STUDY AREA

The Perrine Coulee System is located in Twin Falls County and flows northwards to the Snake River north and northeast of the City of Twin Falls (Figure 1) at Snake River Mile 612.7, approximately one river mile upstream from the Perrine Bridge (U. S. Highway 93)(Pacific Northwest River Basins Commission 1976). The area drains about 35 square miles of agricultural land in the Kimberly-Twin Falls areas. The Perrine Coulee System is a natural drainage which parallels and is east of Rock Creek. The drainage differs from Rock Creek in having a smaller watershed and not being in a deep, rocky canyon. The Perrine Coulee System began as a natural drainage course, but in the early 1900s the canal company began using portions of it. Water diverted into Perrine Coulee laterals may also flow into other natural drainage ways. The drainage system picks up irrigation return flows along its length as well as overland flow during periods of precipitation and snow melt.

Soils can be generally described as thin, light colored, medium textured surface soils and very strongly calcareous silty subsoils. These soils vary in total depth and are underlain by fractured basalt. The soils were formed under arid conditions and are low in organic material. They are highly productive and also highly erosive. The deeper soils (40-60 inches to bedrock) are termed Portneuf Series and the more shallow soils (10-20 inches to bedrock - commonly old shield volcanos which form much of the topography) are known as Trevino Series (Barker et al. 1983). The soils within the Perrine Coulee System are presently classed as "highly erodible" as defined by the 1985 Farm Bill (U. S. Department of Agriculture 1986). The main crops grown in the area are dry beans, grain, corn, alfalfa, sugar beets and potatoes.

The climate of the area is semi-arid with moderately cold winters and hot summers. Annual precipitation averages about 9 inches (Ralston and Young 1971) for the period of record and was 7.89 inches during 1985 (Table 2). The growing season is about 120 days.

In 1983 a hydroelectric plant was constructed near the mouth of Perrine Coulee (the middle drain of the present study) below the rim of the Snake Canyon. The facility is operated by K. W. Inc. and utilizes the drain water to produce hydropower.

Background water quality data on the Perrine Coulee System is minimal. The U. S. Environmental Protection Agency (EPA) conducted a water quality survey of the Snake River and its tributaries Perrine Coulee and Rock Creek during November 1971 (U. S. Environmental Protection Agency (1973). EPA studied the drain that passes through Twin Falls and forms the western portion of the Perrine Coulee system. Several field (physical), chemical, and bacteriological parameters were reported for Perrine Coulee. The conclusion reached by EPA was that the effect of Perrine Coulee on the quality of the Snake River could not be measured a short distance downstream (U. S. Environmental Protection Agency 1973). U. S. Environmental Protection Agency (1978) published survey results of agricultural nonpoint sources for the middle and upper Snake River basins. They showed photographs of two of the three drains (at Snake River miles 612 and 614) which form the Perrine Coulee System and presented some water quality data (turbidity and suspended solids only) for several collection dates between 1974 and 1977. The U. S. Geological Survey (USGS) placed a flow monitoring station near the mouth (and just above our station P2) of Perrine Coulee April 10, 1985. The station will be maintained and monitored by the USGS until April 29, 1987. The purpose of the station is to monitor the quantity of water available for the hydroelectric project.

MATERIALS AND METHODS

The water quality survey was designed to follow that of the Rock Creek Rural Clean Water Program (RCWP) which was conducted on Rock Creek to the west of the Perrine Coulee System (Clark 1985b and 1986). Idaho Department of Health and Welfare, Division of Environment, survey design and sample procedures were followed during the survey.

SAMPLE STATIONS

A representative drain for water quality monitoring was selected in the Perrine Coulee System watershed (Figure 1). The western branch of Perrine Coulee was not selected for study since much of it flows through Twin Falls and has a potential for urban pollution which would interfere with the assessment of agricultural pollution. Two sample stations were chosen to characterize the water quality of the coulee. Factors used in the selection of the two stations included: funding, time, the small size of the study watershed, and the objective of the survey to obtain background water quality data. An upstream station (P1) was selected at Shoshone Falls Road near its junction with Highway 30 (T10S, R17E, Section 30). The lower or "near mouth" station (P2) was located at the point where the coulee drops over the rim towards the Snake River (T9S,

R17E, Section 35). This station is approximately 3.3 river miles below station P1. Data from these sample stations are compared with that from the Twin Falls Main Canal which feeds the irrigation system. Canal water was sampled in the early part of the Rock Creek project and is used here assuming no recent significant changes.

FLOW

Flow was measured at the mouth station using standard techniques (Leupold and Stevens 1978; and U. S. Bureau of Reclamation 1967). Flow (discharge in cubic feet per second) was measured with a Marsh-McBirney Model 201 portable water current meter. Flow was also monitored by the U.S. Geological Survey near the mouth of Perrine Coulee beginning April 10, 1985.

WATER CHEMISTRY

Since this project is primarily concerned with total phosphorus, dissolved ortho-phosphate, and suspended sediment, the methods for their specific chemical analyses are given:

Total phosphorus (mg/L) - All of the phosphorus present in the sample regardless of form, as measured by the persulfate digestion procedure (EPA STORET #09665). The digested sample is then analyzed by direct colorimetry: Ammonia molybdate and antimony potassium tartrate react in an acid medium with dilute solutions of phosphorus to form an antimony-phosphomolybdate complex. This complex is reduced to a blue colored complex by ascorbic acid. The color is proportional to the phosphorus concentration. Only ortho-phosphate forms a blue color in this test.

Dissolved ortho-phosphate (mg/L) - All of the phosphorus present in the filtrate of a sample filtered through phosphorus-free 0.45 micron membrane filters (EPA STORET #00671). Schleicher and Schuell® filters were used. Some phosphorus contamination was discovered by the State Laboratory on random new filters. The field sampling of this parameter was changed in June 1985 to allow for field filtration.

Suspended sediment (mg/L) - The suspended sediment is measured as nonfilterable residue. A well mixed sample is filtered through a glass fiber filter, and the residue retained on the filter is dried to constant weight at 103-105°C.

All chemical analyses are performed in accordance with U.S. EPA (1979) and American Public Health Association (1985). Both field and laboratory quality assurance procedures are followed and are described later in this section.

Parameters measured include flow, total phosphorus, dissolved ortho-phosphate, suspended sediment, and fecal coliform bacteria. Biweekly samples (May-August) also included nitrate + nitrite and total Kjeldahl nitrogen.

Water quality sampling procedures followed Ralston and Browne (1976); U.S. Department of the Interior (1977); and U. S. Environmental Protection Agency (1977, 1982b). All chemical samples were collected as grab samples or with DH-48 or DH-59 suspended sediment samplers (U.S. Interagency Committee on Water Resources 1963). Composite samples were collected into a churn splitter (Pickering 1978). Sub-samples were then dispensed into new one liter cubitainers. One liter was preserved with two mL of concentrated H_2SO_4 for analysis of nutrients (except for dissolved ortho-phosphate). Water for dissolved ortho-phosphate analysis was field filtered (after June 1985) with the use of polypropylene syringes, Gelman® Delrin™ syringe-type membrane filter holders and 0.45 micron membrane filters as mentioned above. The sample was then filtered into Corning™ 16 x 125 mm polystyrene disposable culture tubes. On sample runs where metals were examined, a liter cubitainer was preserved with 10 mL (later in the survey 2 ml) of 1:1 redistilled HNO_3. All samples were stored and transported to the laboratory on ice to reduce the sample temperature to 4°C. Most data analysis was done on STORET (U. S. Environmental Protection Agency 1982a).

QUALITY ASSURANCE

Quality assurance (quality control) involves the use of standard operating procedures in the laboratory and the field portions of the study. Quality assurance for the field work is outlined above and follows U.S. Environmental Protection Agency (1985), Bauer (1986), and Bauer et al. (1986) guidelines. Outliers in the data were excluded using Dixon's "Criterion for Rejection of Outlying Measurements" (Youden and Steiner 1975). Laboratory quality assurance follows Idaho Department of Health and Welfare (1984) and U.S. Environmental Protection Agency (1983) guidelines. The quality assurance data for Rock Creek will be referenced in this report since the Perrine Coulee samples were collected the same day, and we assume that the factors that influence quality assurance in Rock Creek are the same as in Perrine Coulee.

Two specific quality assurance methods are outlined below:

Precision

Duplicate (split) samples are taken at Rock Creek subbasin station 7-4 on each survey date. Chemical samples are divided with the churn splitter. Duplicate bacterial grab samples are taken as close together (in time and space) in the stream as possible. These data are then treated following guidelines to determine the relative range of the precision of the duplicate samples (U.S. Environmental Protection Agency 1983).

Accuracy

Field spiked samples were collected for the first time during 1985. Three sets of spiked samples were collected for all Rock Creek and for most of the subbasin stations (n=26). Chemical spikes in Rock Creek samples for the following parameters examined in the Perrine Coulee portion of the survey (ortho-phosphate, total phosphorus, nitrate, and total Kjeldahl nitrogen) were prepared in the laboratory and were sealed in Kimble™ 10 mL borosilicate glass ampules. Celite was used for suspended sediment spiking and was contained in polypropylene vials. The spike containers were placed into cubitainers containing 900 mL of sample water. The glass ampules were rinsed in sample water before opening. Percent recovery is calculated according to the known amount of the material in the spike by subtracting the "background" values determined by the analysis of split unspiked samples.

MISCELLANEOUS

Color photographs were taken of each sample station during each survey for comparison with other sample dates. The photographs make a permanent record of visual water quality, riparian conditions, sediment deposits, and other important features.

Complete water quality data for this survey are on file with the U.S. Environmental Protection Agency (STORET) and the Idaho Department of Health and Welfare, Division of Environment, 450 W. State Street, Boise Idaho 83720.

RESULTS AND DISCUSSION

FLOW

The mean flow at the mouth of the middle Perrine Coulee drain was 35 cfs (n=20) for 1985 (Table 2). Flows taken from May through October, 1985, had a range of 11 to 66 cfs (Figure 8 and Table 2). Flows on any given sample date depend on specific irrigation practices in the watershed.

SEDIMENT

Suspended sediment consists of solid material (mineral or organic) that is in suspension and is being transported by water 3 inch (7.5 cm) above the stream bottom to the top of the water column. Suspended sediment is used as an indicator or key parameter for water quality studies involving agricultural return flows (Clark and Bauer 1982 and 1983) and is important to land management agencies, landowners, and the State's Division of Environment. Soil retained on the land will benefit both the landowner and water quality.

Suspended sediment concentrations had a wider range at the upper sample station (P1)(24-2105 mg/L) as compared with the station near the mouth of the drain (P2)(14-1722 mg/L) (Table 3). However, the mean concentration at P1 (448.4 mg/L) was lower than that at P2 (525.2 mg/L) (n=21) (Table 3). Concentrations varied over the irrigation season and peaked during July (Table 3). By September and October the suspended sediment concentrations were substantially less due to the reduction in crop irrigation at that time of year. Suspended sediment concentrations fall within the ranges reported for most of the subbasins sampled in the nearby Rock Creek watershed (Clark 1985b). The mean suspended sediment concentration for the Twin Falls Main Canal (here considered the background sample) was 44.7 mg/L for the period 1980-1982 (Table 7). This comparison of background data to the drain data shows a substantial increase in sediment concentration as the irrigation water passes through the Perrine Coulee System (Figure 5).

Suspended sediment loadings were only calculated for the lower station (near mouth, P2) to determine the amount of sediment lost from the watershed during the 1985 irrigation season (Table 3). The highest monthly loadings occurred during May, June, and July (Table 3). The total suspended sediment load for the Perrine Coulee drain measured was 7,322 tons (Table 3). If the contribution from April was known the value would be slightly higher. This loading value is higher than any reported for the Rock Creek subbasin stations by Clark (1985b and 1986) which is, in part, a function of the generally higher flows in Perrine Coulee.

NUTRIENTS

Nutrients are a major concern when examining the water quality of a stream. An excess supply of nutrients may cause an over-abundance of plant and animal biomass, especially of undesirable species or communities. The nutrients examined during this survey are phosphorus and nitrogen.

Nitrogen

Excess nitrogen in inorganic or organic forms is considered a pollutant. The major source of inorganic nitrogen (nitrate) is from the production (and eventual plowout) of alfalfa (*Medicago sativa* L.) in this area (Robbins and Carter 1980). At least 50 percent of the nitrate present in groundwater is the result of plowout of alfalfa (Robbins and Carter 1980). Carter (pers. comm. 1985) believes that up to 70 percent of the nitrate in the groundwater of the Rock Creek watershed is attributable to alfalfa and other leguminous crop plowout. Carter and Bondurant (1973) have shown that the mean concentration of nitrate nitrogen in the subsurface water Twin Falls irrigation tract is 3.24 mg/L. In contrast, organic nitrogen (total Kjeldahl nitrogen) is mostly associated with the sediment. Sediment reduction will, therefore, reduce the organic nitrogen. Significant reductions of organic nitrogen in Rock Creek but inorganic nitrogen is not significantly reduced by best management practices (BMPs) (Clark and Bauer 1982, 1983; Martin 1983, 1984; and Clark 1985b, 1986).

Inorganic Nitrogen

A concentration of total inorganic nitrogen (nitrate, nitrite and ammonia) of 0.3 mg/L is considered the limit for preventing the development of biological nuisances and the acceleration of cultural eutrophication (IDHW 1980). Nitrate usually comprises the major portion of total inorganic nitrogen and is often the only form of nitrogen considered when evaluating the 0.3 mg/L limit. Agricultural return flows often exceed the 0.3 mg/L limit.

Inorganic nitrogen concentrations significantly exceeded the suggested 0.3 mg/L limit in all but two samples at the lower station (P2) (Table 4). The two samples that did not exceed the limit occurred during April and early May before intensive irrigation had begun. The mean concentration at this station was 1.78 mg/L (n=12) with a range of 0.01 to 3.52 mg/L during the irrigation season (Table 4). At the upper station (P1) there was a greater range in values (0.02 to 4.54 mg/L) but a lower mean value (0.69 mg/L). The greater range of concentrations at the upper station is due to the variation in irrigation practices on individual fields on those sample dates while the higher values at the lower station are a composite of practices for the entire watershed. The mean values for inorganic nitrogen in Perrine Coulee were significantly higher than the mean for Twin Falls Main Canal (0.28 mg/L) (Figure 6 and Table 7).

Organic Nitrogen

Organic nitrogen is usually associated with suspended sediment and thus reaches surface waters via irrigation return flows. Organic (total Kjeldahl) nitrogen concentrations between stations did not show significant variation (upper station 0.25-2.2 mg/L, mean 0.86 mg/L vs. the lower station of 0.56-l.37 mg/L, mean 0.92 mg/L) (n=10 and n=9 respectively) (Table 4). The values for organic nitrogen found in Perrine Coulee were similar to the concentrations from the Twin Falls Main Canal (Figure 6 and Table 7). Little, if any, increase in organic nitrogen can be documented in Perrine Coulee.

Phosphorus

To prevent the development of biological nuisances and to control accelerated or cultural eutrophication, total phosphorus as phosphorus (P) should not exceed 0.05 mg/L in a stream where it enters a lake or reservoir (U.S. Environmental Protection Agency 1977). Since the water will enter the Snake River and eventually several reservoirs, this criteria could be applied. A desired goal for the prevention of plant nuisances in flowing waters not discharging directly to lakes or impoundments is 0.1 mg/L total phosphorus (MacKenthun 1973). These authors indicate that a reasonable criteria for total phosphorus is in the range of 0.05-0.10 mg/L.

Total phosphorus

Concentrations of total phosphorus followed the pattern shown above for nitrogen: the range was higher at the upper station (P1) (0.7-2.7 mg/L, n=20) as compared with the lower station (P2) (0.9-2.23 mg/L, n=21) and the mean was slightly higher at the lower station (0.69 mg/L) compared with the upper station (0.59 mg/L) (Table 5). At both stations all values (n=41) exceeded the suggested criteria for total phosphorus. Total phosphorus values peaked during July. Low values were found during April, September and October, when irrigation is minimal (Table 5). Total phosphorus was substantially higher in Perrine Coulee as compared with the Twin Falls Main Canal (mean 0.12 mg/L) (Figure 6 and Table 7).

Dissolved ortho-phosphate

Dissolved ortho-phosphate had a mean of 0.064 mg/L and a range of (0.007-0.270 mg/L) at the lower sample station (P2) compared with a mean of 0.047 mg/L and a range of 0.006-0.125 mg/L for the upper station (Table 5). No significant difference was seen between these two sample stations. Dissolved ortho-phosphate concentrations were higher in Perrine Coulee compared to the Twin Falls Main Canal data (mean 0.02 mg/L) (Figure 6 and Table 7).

BACTERIA

Fecal coliform bacteria are found in the intestinal tracts of warm-blood animals and are, therefore, used as indicators of contamination and the possible presence of other disease-causing organisms. Coliform bacteria are reported in terms of number of colonies per 100 mL of water sampled and several data points are calculated as geometric means. Fecal coliform bacteria can be used as an indicator of livestock contamination in rural areas (Clark 1985b, 1986).

Fecal coliform bacterial values varied over the period of the survey (Table 6). May, September and October showed the lowest concentrations and the summer months of June, July and August had the highest concentrations of bacteria present. The mouth station (P2) showed a range of 30-800/100 mL and a mean of 391 (n=19) compared with the upper station (P1) (10-700/100 mL and 250/100 mL, n=19) (Table 6). Given the variation in bacteria data and the precision estimates (Table 8), the data are uniform. Fecal coliform bacteria were significantly higher in the Perrine Coulee drainage compared with the Twin Falls Main Canal (mean 215) (Figure 7 and Table 7).

The segment of the Snake River between Milner Dam to Buhl (USB-70) is protected for primary contact recreation by the Idaho Water Quality Standards (Idaho Department of Health and Welfare 1985). The bacterial standards for primary contact recreation state that the geometric mean for fecal coliforms shall not exceed 50/100 mL or 500/100 mL at any one time (Idaho Department of Health and Welfare 1985). Since there are no specific water quality standards for irrigation drains, the standards for the receiving water (Snake River) will be used for comparison. Six samples at the lower station and

two samples at the upper station exceeded the single sample standard of 500/100 mL (Table 6). All samples (except two in May and the four in October) exceeded the 50/100 mL standard (Table 6). The values reported here were not as high as those reported for other agricultural irrigation drains in southern Idaho (Clark 1985a, 1985b, 1986; Clark and Bauer 1982, 1983), perhaps indicating fewer livestock in the Perrine Coulee System.

QUALITY ASSURANCE

Quality assurance is essential to any monitoring program for data integrity. The description of results in relative terms - excellent, good, fair, and poor - are personal value judgements of the author of acceptable data quality for purposes of water pollution assessment and may vary depending on the survey objectives or the desires of the investigator (Bauer et al. 1986).

Precision

Precision is a measure of agreement among individual measurements of the same property, under prescribed similar conditions (US EPA 1983). Precision is expressed in terms of concentration units (range of duplicates or standard deviation) or as it is related to the mean concentration (relative range or average coefficient of variation) (Bauer 1986; Bauer et al. 1986; and US EPA 1983). Precision was studied during 1984 and 1985 with duplicate samples being taken at subbasin 7-4 (Rock Creek project) for each sample run. Precision was good for suspended sediment, total Kjeldahl nitrogen, total phosphorus and nitrate-nitrite with mean relative ranges of 9.7, 9.9, 11.8 and 17.4 percent, respectively, for 1984-85 data (Table 8). Precision was poor in 1984-85 for dissolved ortho-phosphate and fecal coliform bacteria (mean relative ranges 23.2 and 44.8 percent, respectively) (Clark 1985b and Table 8).

Accuracy

Accuracy is a measure of the closeness of an individual measurement or an average of a number of measurements to the true value. Accuracy includes both precision and recovery (or bias) and can be expressed as a percent recovery (or percent bias) interval (US EPA 1983). Accuracy is expressed in mean percent recovery.

During 1985 the mean percent recovery for suspended sediment was excellent at 101% (95% confidence interval between 96 and 107%) (Table 9). Excellent recovery was also found for total Kjeldahl nitrogen (99%, ±2%), and total phosphorus (106.6%, ±5%). Recovery was fair for nitrate (92.4%, ±36%). Results for ortho-phosphate were erratic (Table 9). Some random contamination evidently occurred in June (±51% confidence interval) but was apparently corrected in July (±10.6 confidence interval) and August (±7.3 confidence interval) (Table 9).

The results of the quality assurance work done on the Rock Creek study show that the data for Perrine Coulee collected during the same time intervals are precise and

accurate. The problems with fecal coliform bacteria are to be expected, since they represent a dynamic biological community. The problem with dissolved ortho-phosphate has been corrected.

CONCLUSIONS AND RECOMMENDATIONS

Perrine Coulee is a source of suspended sediment, nutrients and bacteria to the Snake River. Concentrations of suspended sediment, inorganic nitrogen, total phosphorus, dissolved ortho-phosphate, and fecal coliform bacteria are increased substantially as the irrigation water travels through the Perrine Coulee System. The main months of impact are June-August, the primary months of irrigation in the area.

Any application of land management practices that can help prevent soil erosion on the farmland or that can capture sediment before it enters the Perrine Coulee System or the Snake River will help improve the quality of those waters.

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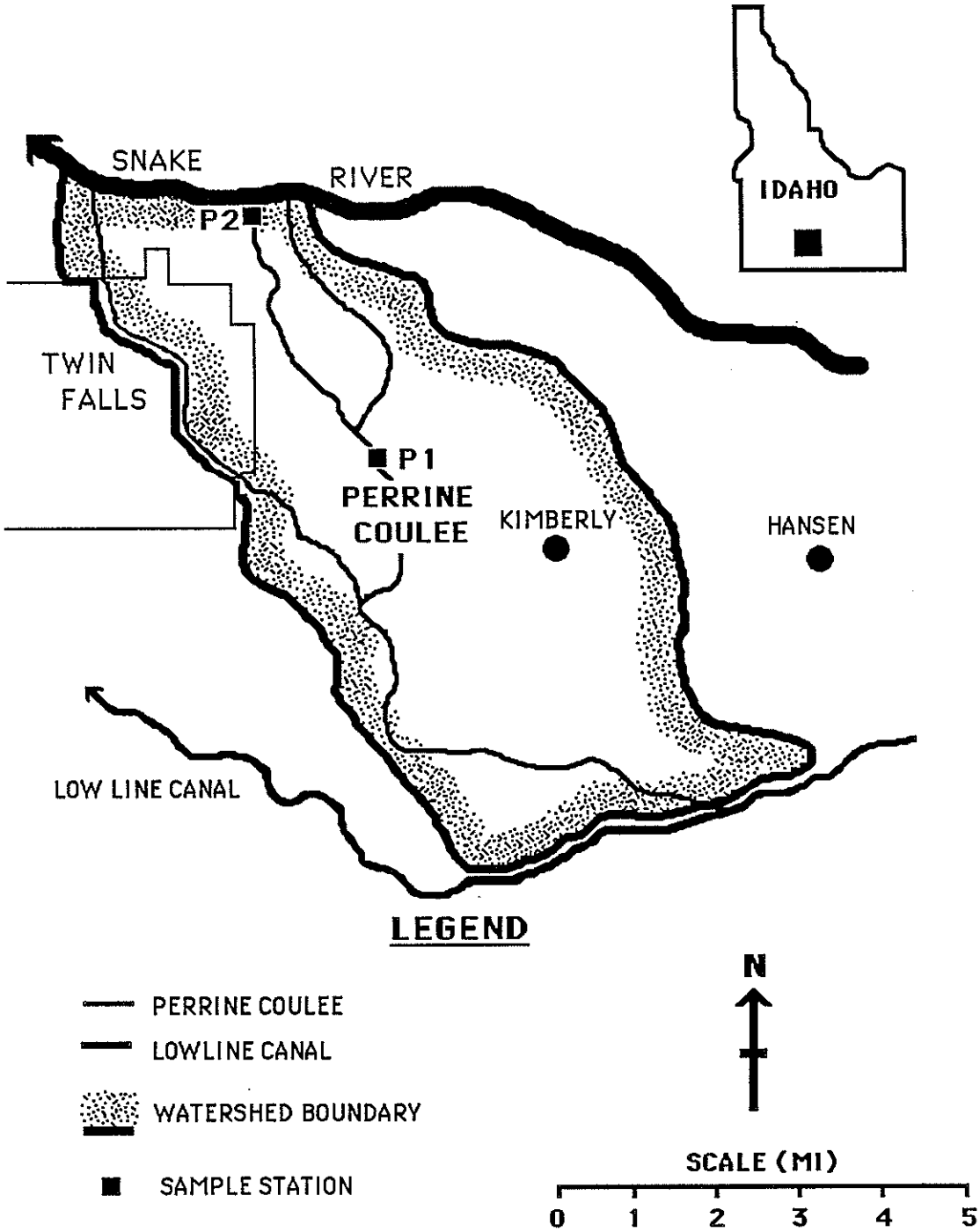

Figure 1. Map of the Perrine Coulee System, Twin Falls County, Idaho.

Figure 2. Sample station (P1) Perrine Coulee at Shoshone Falls Road near Highway 30. Photo taken July 28, 1985.

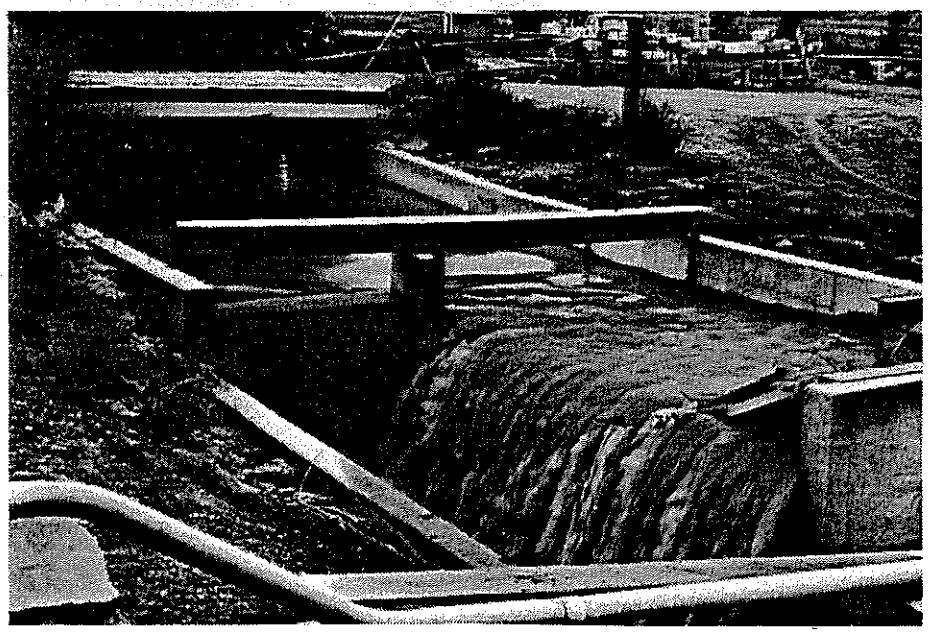

Figure 3. Sample station (P2) Perrine Coulee near the mouth. The discharge from this irrigation structure enters the intake for the K. W. Inc. hydroelectric facility shown in the lower right hand corner of Figure 4. Photo taken June 5, 1985.

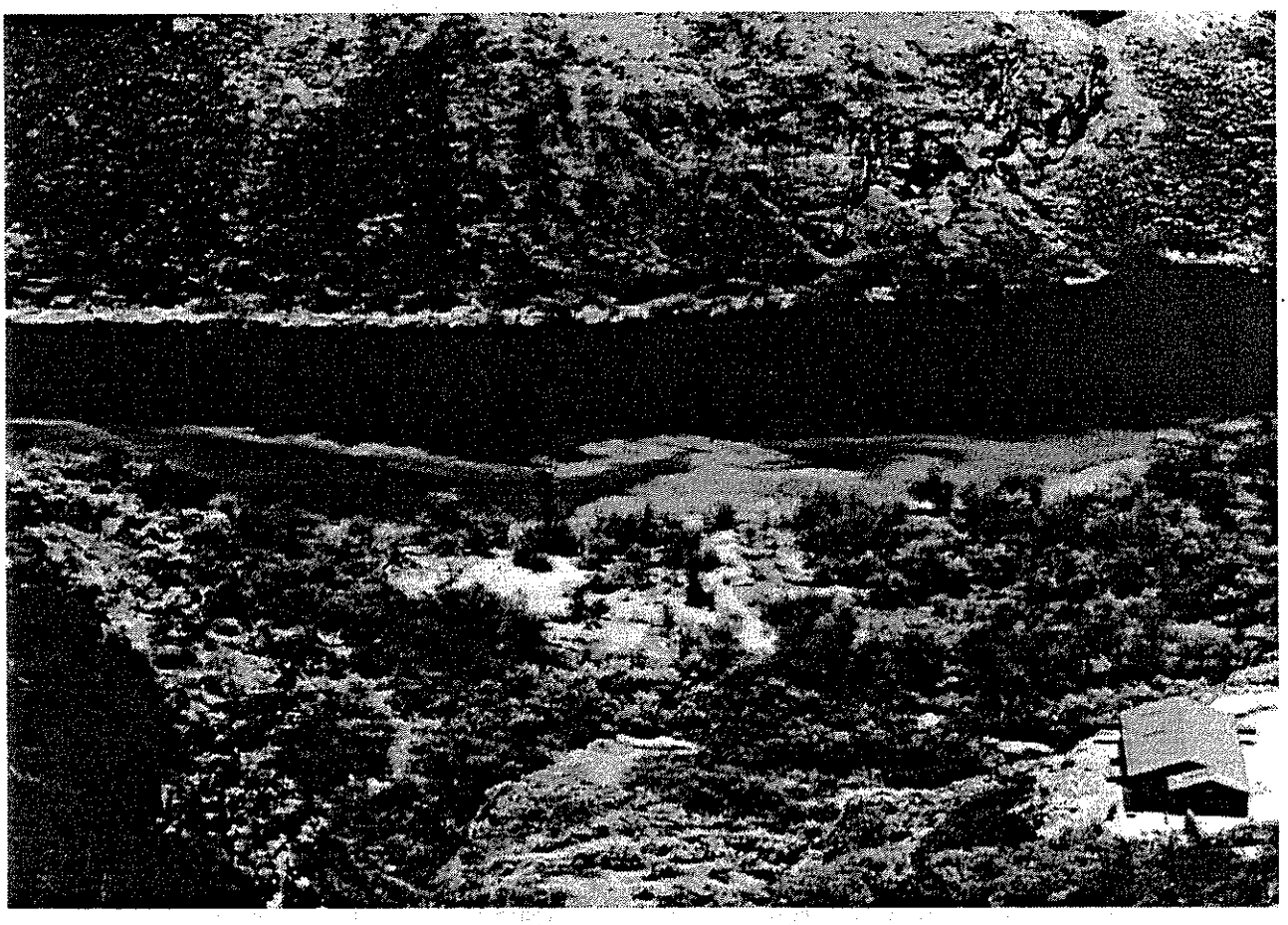

Figure 4. The Snake River at the confluence with Perrine Coulee. A delta and sediment plume resulting from Perrine Coulee are visible in the photograph center. The K. W. Inc. hydroelectric facility are in the lower right hand corner of the photograph. Photo taken May 28, 1985.

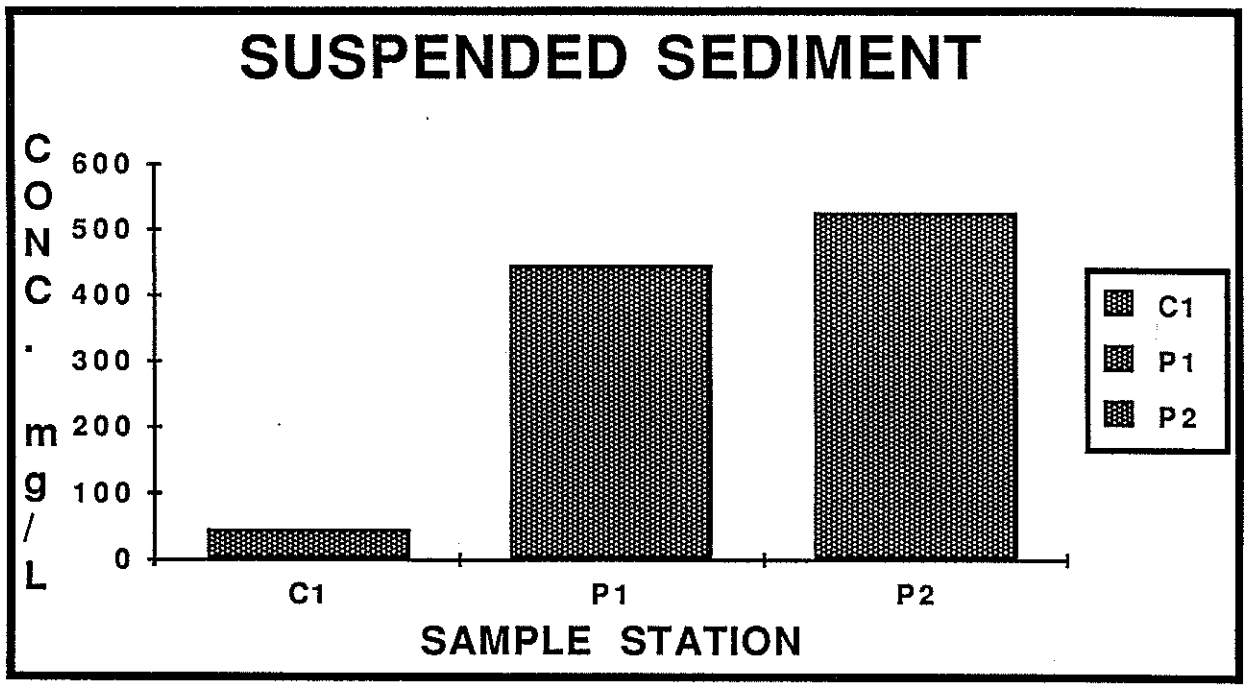

Figure 5. Mean suspended sediment concentrations (in mg/L) for the Perrine Coulee survey, 1985. Sample station designations are: C1 - Twin Falls Main Canal near Hansen; P1 - Perrine Coulee drain at Shoshone Falls Road; and P2 - Perrine Coulee drain at Snake River rim.

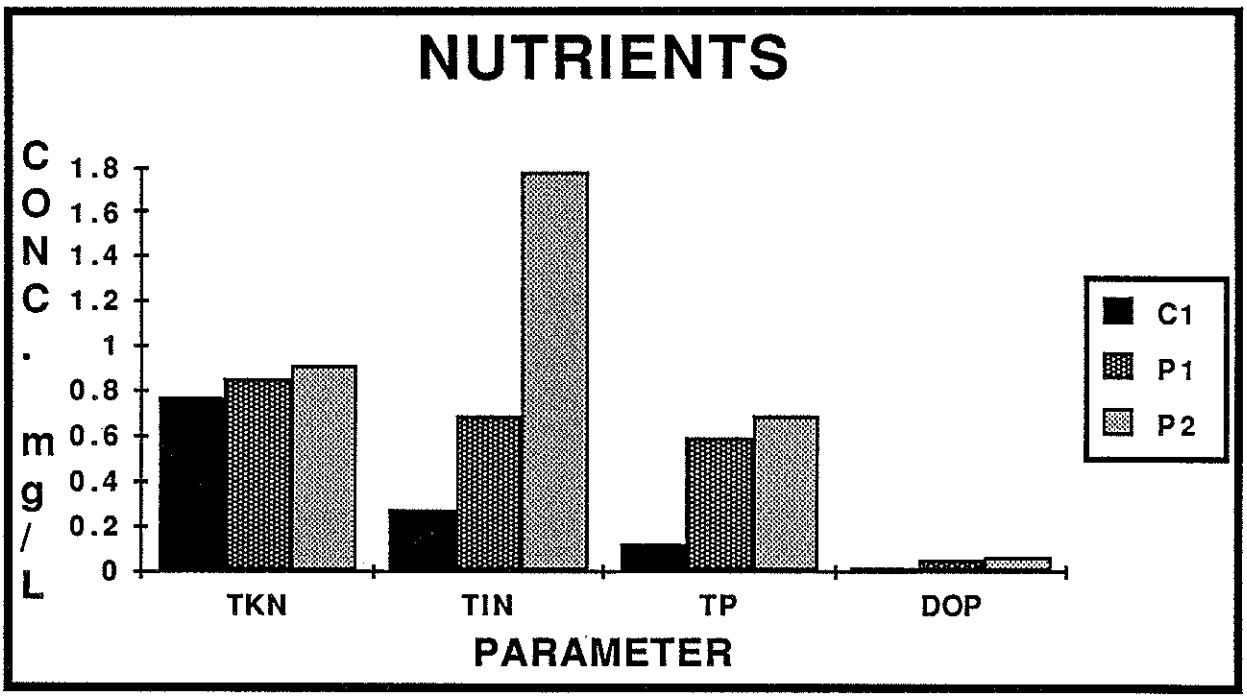

Figure 6. Mean nutrient concentrations (in mg/L) for the Perrine Coulee survey. The parameters are: TKN - total Kjeldahl nitrogen (organic nitrotgen); TIN - total inorganic nitrogen; TP - total phosphorus; and DOP - dissolved ortho-phosphate. Sample station designations are: C1 - Twin Falls Main Canal near Hansen; P1 - Perrine Coulee drain at Shoshone Falls Road; and P2 - Perrine Coulee drain at Snake River rim.

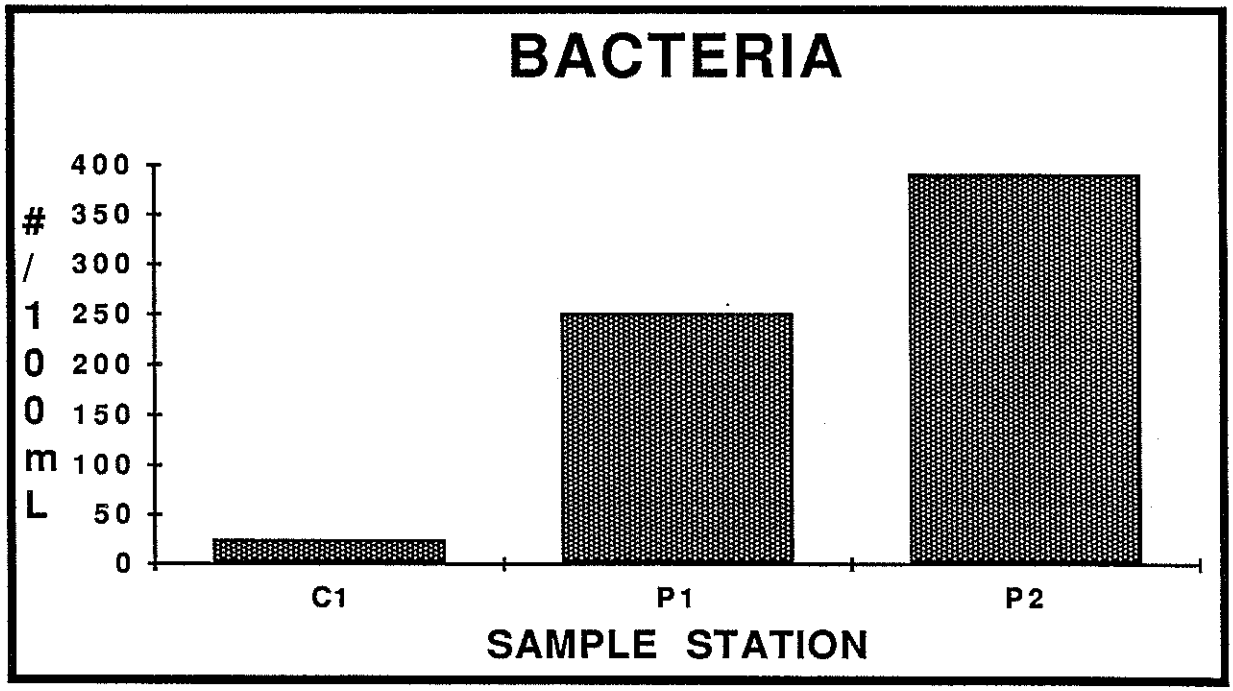

Figure 7. Fecal coliform bacteria geometric means (colonies/100mL) for the Perrine Coulee survey, 1984-1985. Sample station designations are: C1 - Twin Falls Main Canal near Hansen; P1 - Perrine Coulee drain at Shoshone Falls Road; and P2 - Perrine Coulee drain at Snake River rim.

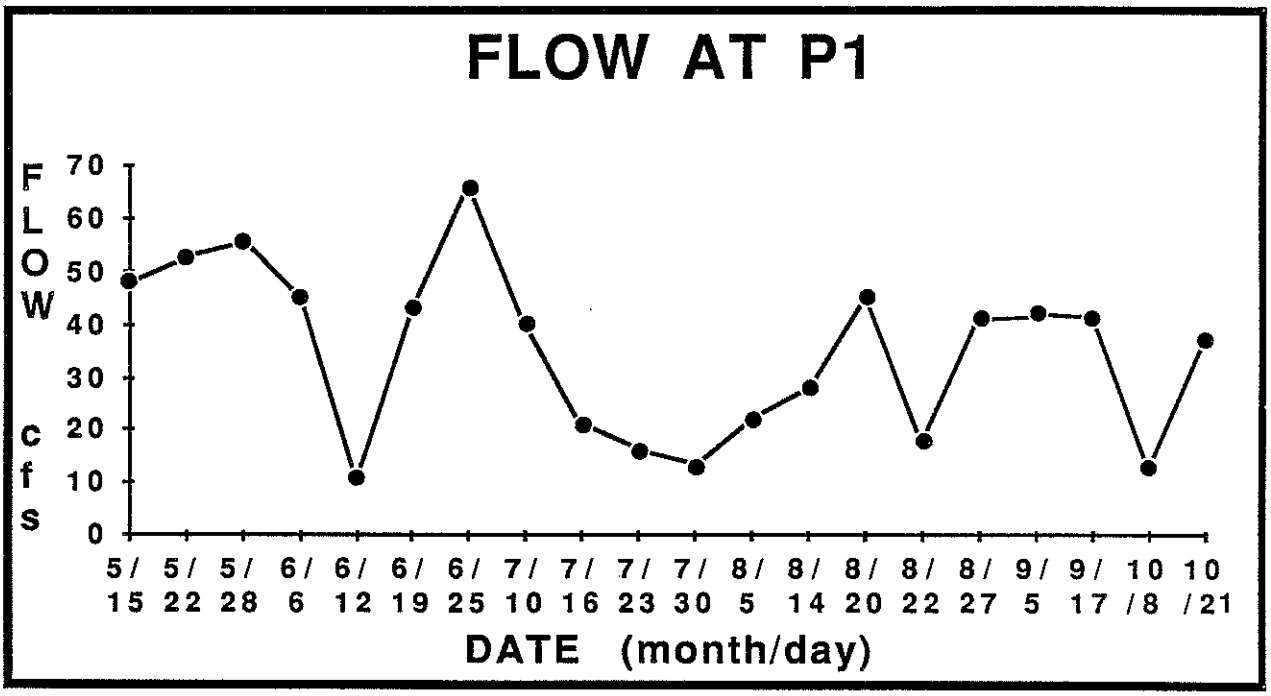

Figure 8. Flow (discharge in cubic feet per second) for the Perrine Coulee survey, 1985. Sample station P2 - Perrine Coulee drain at Snake River rim.

TABLE 1. List of sample stations for Perrine Coulee survey.

Station No.	Description	STORET No.
P1	Perrine Coulee at Shoshone Falls Road and Highway 30 Latitude 42°33'08"N, Longitude 114°24'03"W Township 10S, Range 17E, Section 30 River Mile 324.3/612.7/3.3 Elevation 3,810' (1161.3m)	2060241
P2	Perrine Coulee at Snake River rim, near mouth Latitude 42°35'33"N, Longitude 114°26'01"W Township 9S, Range 17E, Section 33 River Mile 324.3/612.7/0.2 Elevation 3640' (1109.5m)	2060242
C1	Twin Falls Main Canal near Hansen At 3600 North Road crossing Latitude 42°31'08"N, Longitude 114°16'31"W Township 10S, Range 19E, Section 30 Elevation 4100' (1250m)	2060142

TABLE 2. Flow (discharge) in cubic feet per second for Station P2 (Perrine Coulee near the mouth) for 1985.

SAMPLE DATE (1985)		FLOW (DISCHARGE) (cfs)
05-15		48
05-22		53
05-28		56
06-06		45
06-12		11
06-19		43
06-25		66
07-10		40
07-16		21
07-23		16
07-30		13
08-05		22
08-14		28
08-20		45
08-22		18
08-27		41
09-05		42
09-17		41
10-08		13
10-21		37
	MEAN	35

TABLE 3. Suspended sediment for Perrine Coulee, 1984-1985.

DATE MONTH/DAY	SAMPLE STATION Shoshone Falls Rd. and Hwy. 30 (P-1) (CONCENTRATION mg/L)	Near Mouth (P-2) CONCENTRATION (mg/L)	LOADING (tons/month)
1984			
08-01	1647	773	n/a
1985			
04-16	27	--	n/a
05-15	616	645	
05-22	451	581	
05-28	513	811	2,987
06-06	344	410	
06-12	294	370	
06-19	183	481	
06-25	40	425	1,441
07-10	636	736	
07-16	2105	1722	
07-23	580	1212	
07-30	857	746	1,979
08-05	359	540	
08-14	238	206	
08-20	172	408	
08-22	--	451	
08-27	76	196	872
09-05	156	220	
09-17	38	42	
10-08	60	40	
10-21	24	14	43
		TOTAL (May-October)	7,322

-- no sample

TABLE 4. Nitrogen concentrations for Perrine Coulee 1984-1985.

	TOTAL KJELDAHL		INORGANIC NITROGEN	
	concentration (mg/L)			
DATE MONTH/DAY	Shoshone Falls (P-1)	Near Mouth (P-2)	Shoshone Falls (P-1)	Near Mouth (P-2)
1984				
08-01	2.20	1.20	1.81	0.01
1985				
04-16	0.65	--	4.54	--
05-15	1.24	1.37	0.86	0.09
05-22	--	--	--	--
05-28	--	--	0.12	0.99
06-06	--	--	--	--
06-12	--	--	--	--
06-19	--	--	0.17	0.81
06-25	--	--	--	--
07-10	--	--	--	--
07-16	--	--	0.08	1.39
07-23	--	--	--	--
07-30	--	--	0.15	2.19
08-05	--	--	0.13	2.35
08-14	0.92	0.97	0.02	2.91
08-20	0.72	1.14	--	--
08-22	--	--	--	--
08-27	0.72	0.89	--	--
09-05	0.68	0.91	0.08	2.15
09-17	0.25	0.56	0.11	2.11
10-08	0.70	0.66	0.23	2.79
10-21	0.49	0.58	0.61	3.52

-- no sample

TABLE 5. Phosphorus concentrations for Perrine Coulee 1984-1985.

	TOTAL PHOSPHORUS		DISSOLVED ORTHO-PHOSPHATE	
	CONCENTRATION (mg/L)			
DATE MONTH/DAY	Shoshone Falls Falls (P-1)	Near Mouth (P-2)	Shoshone Falls Falls (P-1)	Near Mouth (P-2)
1984				
08-01	1.860	0.760	0.054	0.017
1985				
04-16	0.070	--	0.006	--
05-15	0.730	0.820	0.047	0.036
05-22	0.440	0.620	0.027	0.060
05-28	0.780	1.220	0.091	0.039
06-06	0.390	0.550	0.024	0.052
06-12	0.390	0.460	0.110	0.164
06-19	0.240	0.580	0.040	0.039
06-25	0.550	0.540	0.052	0.041
07-10	0.600	0.990	0.014	0.038
07-16	2.750	2.230	0.016	0.036
07-23	--	1.290	0.012	0.007
07-30	1.040	0.830	0.036	0.051
08-05	0.550	0.670	0.049	0.057
08-14	0.320	0.350	0.030	0.051
08-20	0.290	0.600	0.047	0.046
08-22	--	0.440	--	0.270
08-27	0.170	0.330	0.024	0.510
09-05	0.310	0.400	0.077	0.095
09-17	0.120	0.130	0.125	0.077
10-08	0.140	0.130	0.009	0.018

-- no sample

TABLE 6. Fecal coliform bacteria concentrations for Perrine Coulee 1984-1985.

DATE	SAMPLE STATION (colonies/100 mL) Shoshone Falls Rd. and Hwy. 30 (P-1)	Near Mouth (P-2)
1984		
08-01	700	700
1985		
04-16	--	--
05-15	10	<10
05-22	200	400
05-28	200	600
06-06	90	410
06-12	160	400
06-19	200	600
06-25	200	200
07-10	100	800
07-16	300	300
07-23	700	300
07-30	500	300
08-05	100	400
08-14	410	230
08-20	300	600
08-22	--	--
08-27	230	800
09-05	250	180
09-17	80	150
10-08	20	30
10-21	<10	40

-- no sample

TABLE 7. Water quality data for the Twin Falls Main Canal near Hansen, 1980-1982. Data collected for Rock Creek survey and reported in Martin (1984).

		CONENTRATION (mg/L)		
PARAMETER	N	Min	Max	Mean
Suspended Sediment	15	10	170	44.7
Total Kjeldahl Nitrogen	13	0.42	2.2	0.77
Total Inorganic Nitrogen (Nitrate + Nitrite)	10	0.01	1.9	0.28
Total Phosphorus	15	0.03	0.25	0.12
Dissolved Ortho-phosphate	12	0.005	0.07	0.02
Fecal Coliform Bacteria*	15	4	215	25

*colonies/100mL

TABLE 8. Precision of split samples for subbasin station 7-4, 1984-1986 irrigation seasons.

PARAMETER	PRECISION 1984 N	1984 Average Relative Range(%)	1985 N	1985 Average Relative Range(%)
Suspended Sediment	13	11.2	14	8.2
Total Kjeldahl Nitrogen	15	9.9	--	--
Nitrate-Nitrite	15	14.1	6	20.7
Total Phosphorus	15	12.6	14	10.9
Dissolved Ortho-phosphate	14	19.5	14	26.9
Fecal Coliform Bacteria	17	37.4	14	52.1

-- = inadequate sample size

TABLE 9. Accuracy (% recovery) for Rock Creek and subbasin stations, June, July and August 1985.

		ACCURACY	
Parameter	N	Average % Recovery	95% CI
Suspended Sediment	52	98.2	± 2.1
Total Kjeldahl Nitrogen	39	96.2	± 1.7
Nitrate	54	99.1	± 4.4
Total Phosphorus	79	101.9	± 2.1
Dissolved Ortho-phosphate*:			
June	*25*	*93.9*	*± 51*
August	24	93.2	± 6.5
September	27	87.8	± 7.3
Aug./Sept. pooled	51	90.3	± 4.1

* June ortho-phosphate precision samples appeared to be randomly contaminated and are therefore excluded from the pooled estimate.