WATER QUALITY STATUS REPORT ● REPORT NO. 72

SELECTED TRIBUTARIES OF THE LOWER PORTNEUF RIVER

Bannock County, Idaho

1987

Prepared by
Blaine Drewes

Pocatello Field Office
150 N. Third Avenue)
Pocatello, Idaho 83201

Department of Health & Welfare
Division of Environment
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ABSTRACT

The Lower Portneuf River was identified in the Agricultural Nonpoint Source Pollution Abatement Program as a first priority stream segment for reduction of agriculture related pollutants above Marsh Creek. Below Marsh Creek it was identified as being moderately affected by agricultural pollution. From 19 November 1985 to 8 July 1986 a water quality study was conducted on the lower Portneuf drainage. Eight tributaries of the Portneuf River were chosen as sampling sites to determine the amount of agricultural pollutants which may affect the water quality of the Portneuf River.

The Portneuf River is a major tributary of the Snake River, emptying into the American Falls Reservoir. There are 270,676 acres with 17 perennial streams and numerous intermittent streams in the watershed. Above Marsh Creek, the beneficial uses are domestic and agricultural water supplies, cold water biota, salmonid spawning, and primary and secondary contact recreation. Below the Marsh Creek confluence, the designated uses are agricultural water supply, cold water biota, salmonid spawning, and secondary contact recreation. Primary contact recreation is protected for future use.

Nutrients and sediment are the major pollutants during times of high flow, although every stream consistently exceeded most EPA nutrient standards throughout the entire study period. Bacterial counts are inversely related to flow and are another major pollutant during low creek flows. Only three of the eight streams sampled (Rapid Creek, Dempsey Creek and the North Fork of Pocatello Creek) did not exceed State water quality standards for coliform bacteria. Most of the bacteria comes from livestock and mitigation plans should reflect this.

Sediment loss peaked at 237 tons on 11 April 1986 for the tributaries sampled. Sediment loading for the study period averaged 63.8 tons/ day for all the monitoring stations combined.

Although there were no samples taken during storm events, runoff was high during the spring snowmelt resulting in high flows in late April and early May.

INTRODUCTION

The Portneuf River originates on the Blackfoot Indian Reservation in southeastern Bingham County. The river flows south through Caribou and Bannock Counties to Lava Hot Springs. There it turns westward and flows through Pocatello forming the Power-Bannock County line in its lower reaches. The Portneuf River is a major water contributor to the American Falls Reservoir. The area covered by this report is bounded by the Fort Hall Indian Reservation on the north, the Portneuf Range Mountains on the east, and the Bannock Range and Marsh Creek Watershed on the west (Fig. 1). The project area adjoins the Upper Portneuf River Agriculture Project Area submitted by the Caribou Soil Conservation District in 1984 and approved for implementation funding in 1986. Within the Lower Portneuf River Project Area, there are 17 perennial tributaries and numerous intermittent streams.

The lower Portneuf River watershed contains 270,676 acres which include broad plains, narrow valleys, rolling hills, and steep mountains. Elevations range from 4,440 feet at Pocatello to 9,260 feet on Bonneville Peak. The uplands above the valley floors are moderately steep and used for dry cropland. The bases of the Bannock and Portneuf Mountains contain extensive alluvial fans.

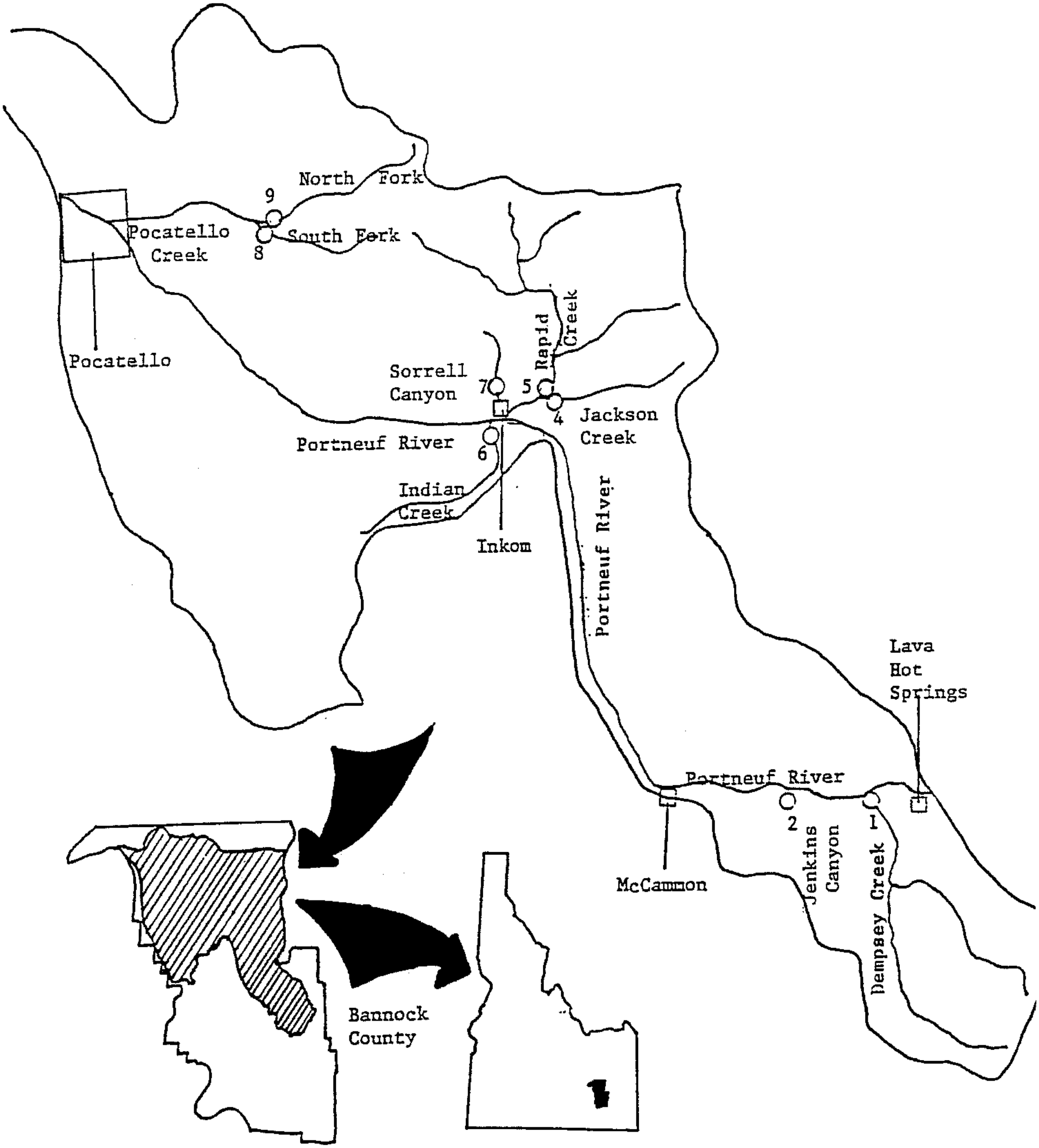
The main soil groups found in the lower Portneuf River watershed are as follows:

1. Deep soils on bottom lands, low terraces, and medium terraces.
    a) Downy-Arimo Association
    Alluvial terraces created by the Bonneville flood.
    b) Streambed Association
    Flood plain and Holocene terrace along the Portneuf River.

2. Very deep soils on loess covered foothills and alluvial fan terraces.
    a) Rexburg-Ririe Association
    Loess covered fan terraces on both sides of the Portneuf River Valley.

3. Moderately deep and deep soils on alluvial fan terraces, foothills and mountain slopes.

Figure 1: Lower Portneuf Watershed
Showing Sampling Stations



a) Volmer- Camelback Association
Lower mountain slopes associated with limestone rock, generally occurring on north and east facing slopes.

b) Bezzant-Ireland Association
Lower mountain slopes associated with limestone rock, generally occurring on south and west facing slopes

c) Pavhroo-Sedgewick-Greys Association
Higher mountain slopes occurring on north and east facing slopes, generally associated with quartzite and sandstone.

4. Shallow and moderately deep soils on lava flow.
   a) McCarey-McCarrey Varient- Lava Flow Association
   Lava flow at the north end of the valley running north of Arimo to Inkom and into Pocatello. (Portneuf SWCD, 1986).

The soils in the project are predominately silt loam developed in loess and alluvium and are highly erosive. Most of the farms have slopes ranging from 4 percent to 35 percent.

The climate in the lower Portneuf watershed is characterized by long, cold winters and moderately hot, dry summers. Prevailing winds are from the southwest and average annual rainfall varies from 10 inches in Pocatello to over 20 inches in the mountains mostly in the form of snow. (Portneuf SWCD, 1986).

Of the 270,696 acres within the study area, dry cropland makes up 16.5%, irrigated cropland 8.6%, rangeland 62.8%, forest and recreation 6.5%, and 5.3% is urban (Table 1). Wheat, barley, and alfalfa hay are the primary crops raised and beef cattle are the primary livestock on the rangelands. Approximately 44,890 acres of cropland are considered to be critical acres, with 70 operators working these acres (Portneuf SWCD, 1986).

According to America's Soil and Water: Condition and Trends, issued by the USDA Soil Conservation Service, "Southeastern Idaho cropland is planted in hard red wheat one year and left fallow the next to conserve moisture. Erosion occurs during intense summer rainstorms and even more destructive rains in the late winter, when a thawed layer of soil moves downhill over frozen subsoil."

Table 1: Land Usage, Acreage, and Ownership

Land Use	Acres
Dry Cropland	44,894
Irrigated Cropland	23,430
Rangeland	170,259
Forest	13,548
Recreation, Wildlife	4,180
Urban	14,610
Total	270,696

Land Ownership

Owner	Acres
Private	110,597
State	8,129
BLM	65,522
U.S. Forest Service	65,408
Fort Hall Reservation	6,655
Municipalities	14,385
Total	270,696

The 1983 Idaho Agricultural Abatement Plan identifies stream segments in which farmland runoff is impacting water quality. The Portneuf River from its source to Marsh Creek (USBR 410) has been designated as severely impacted by sediment from nonirrigated cropland. Further remarks indicate the main problem lies with the Portneuf River and six Tributaries. The Portneuf River from Marsh Creek to the mouth (USBR 420) has been designated as moderately affected by non-irrigated cropland with bacteria and channel erosion problems.

The Idaho Water Quality Standards and Wastewater Treatment Requirements, 1985 designate the Portneuf River from its source to Marsh Creek as a special resource water protected for domestic and agricultural water supplies, primary contact recreation, and salmonid spawning. The Portneuf River from Marsh Creek to its mouth is designated as protected for agricultural water supply, salmonid spawning area, and secondary contact recreation. Primary contact recreation is protected for future use.

The Portneuf Soil and Water Conservation District in their Pre-Application for Lower Portneuf River Watershed, Idaho Agricultural Water Quality Program state:

> "The severity of water quality problems for the Portneuf River is known; the following items present the known facts about the Portneuf.
>
> Sediment and associated pollutants impair recreational opportunities on the Portneuf. Turbidity caused by sediment reduces aesthetic enjoyment of the stream. Secondary contact recreation is prohibited by the bacterial load and deposited sediment. The possibility for development of a game fish population is prohibited by the yearly input of sediment. Sediment degrades the habitat, decreases the number and kinds of fish food organisms, and may directly impact fish growth and reproduction. Because of the year-round high quality spring flow there is a possibility of establishing a resident cold water or warm water fishery. However there will have to be improvements in water quality and habitat before this is possible."

The purpose of this study is to determine if agricultural lands adversely affects the water quality of the Portneuf River and its tributaries, and to help determine critical areas that should be treated.

METHODS and MATERIALS

Eight tributaries of the Portneuf River were sampled on 18 November 1985 and at biweekly intervals from 25 February 1986 to 8 July 1986 . This sampling program insured that seasonal flow patterns would be represented. Sample stations were selected to ensure that they were in agricultural areas which were believed to contribute heavily to water quality degradation of the Portneuf River. The other nine tributaries were not sampled due to lack of access or nominal agricultural usage within the watersheds. The location of the sampling stations are shown in Figure 1.

Methods of collection, preservation, and analysis followed Standard Methods (APHA, 1985), or EPA guidelines (EPA, 1979). Grab samples for chemical and bacterial analysis were taken at the same time as the physical parameters. A churn splitter supplied by Bel-Art Products was used to collect samples from the area of highest flow in each stream. Sub-samples were drawn from the churn splitter. Chemical and biological constituents were analyzed by the Idaho Bureau of Laboratories in Boise and Pocatello.

Sample Sites

Eight tributaries of the Portneuf River were chosen for sampling sites to include the largest agricultural land area feasible and based on accessibility. Those sites are:

a) Station 1. Dempsey Creek at the USGS Crest Gauge. Dempsey Creek is a receiving stream for Deer, Snodgrass, East, and Beaverdam Creeks. Storet #2080461.

b) Station 2. Jenkins Canyon at the culvert on HWY 30 N. Samples here were discontinued after 2 February 1986 due to the small watershed and lack of flow. Storet #2080462.

c) Station 4. Jackson Creek at the road crossing. This station has relatively little agricultural area, but the natural springs at the headwaters made this ideal for base data collection. Storet #2080464.

d) Station 5. Rapid Creek at the Inkom USGS station. Inman, Webb, Sawmill, McNabb, Hagler, and Moonlight Creeks are tributaries of Rapid Creek. Storet #2080465.

e) Station 6. Indian Creek at the county road crossing. This station monitored the impact of the Indian Creek drainage on the Portneuf River. Storet #2080466.

f) Station 7. Sorrell Canyon at the mouth. This stream runs through a grazing region and is indicative of the impact of livestock on the Portneuf River. Storet # 2080467.

g) Station 8. South Fork of Pocatello Creek at the USGS station. This covers the area between Camelback Mt. and Chinks Peak. Storet #2080468.

h) Station 9. North Fork of Pocatello Creek at Parks Road. This station covers the area north of Camelback Mt., west of Moonlight Mt., and south of Little Pocatello Creek. Storet #2080469.

Note that there is no station #3 as this was deleted prior to sampling.

Parameters

Most parameters sampled were those which would be indicative of agricultural runoff, both crop farming and livestock. Other parameters which were sampled were used for general background data which may point out changes in designated stream segments not necessarily related to agriculture. Total load contributions were computed with the assumption that the grab samples were representative of the stream segment for a 24 hour period. The parameters sampled are listed in Table 2.

Discharge

Flows were determined at each station by measuring the cross-section of each creek and determining the velocity of the creek. Stream widths were measured to the nearest inch. Enough depths were measured to the nearest inch along the width transect so that an accurate cross sectional area of the stream could be calculated. The velocity of the stream was measured to the nearest 0.1 foot /sec. at 0.6 depth using a Marsh McBirney 201 portable current meter.

Chemical and Biological Constituents

Grab samples for chemical and biological constituents were taken at the same time that the flow was measured. Samples were taken at the point of highest flow. The sample was split into 3 cubitainers (1000 ml) and a pre-sterilized 250 ml nalgene bottle. One cubitainer received 2 ml of concentrated sulfuric acid, one cubitainer received 2 ml concentrated

Table 2: Parameters Sampled

Parameter	Storet #
Total Ammonia as N	00610
Total Nitrite as N	00615
Total Nitrate as N	00620
Total Kjeldahl Nitrogen as N	00625
Total Phosphorus as P	00665
Ortho Phosphate as P	70507
Specific Conductance	00095
Turbidity	00076
Suspended Sediment	80154

nitric acid, and one received no preservative. All samples were cooled to 4 degrees Centigrade at the time of collection. Samples were analyzed by the Idaho Bureau of Laboratories in Boise and Pocatello.

RESULTS and DISCUSSION

Discharge

Flows in all creeks increased predictably during the spring thaw (Tables 3 through 10), with the highest discharge for each tributary occurring during the months of April and May. Comparison of the discharges clearly show that Rapid Creek maintains the highest flow. Only Rapid Creek and Dempsey Creek had any flow exceeding 30 cfs. The flows from the North and South Forks of Pocatello Creek, Sorrell Canyon, Indian Creek, Jackson Creek, and Jenkins Canyon make it highly unlikely that these tributaries had a significant impact on the Portneuf River during the study period. Data from the USGS gauge station on the South Fork of the Pocatello Creek shows a historic high flow of 536 cfs on 26 March 1975. At that time the USGS station on the Portneuf River at Pocatello showed a flow of 1540 cfs. This indicates the possibility of severe impacts on the Portneuf River by the tributaries during rainstorms or rapid snowmelts.

Sediment

Suspended sediment is one of the main constituents of nonpoint stream pollution, consisting of solid material that is in suspension and is being transported by water 3 inches above the stream bottom to the top of the water column.

The very fine wind deposited (loess) topsoils which cover much of south-eastern Idaho hold water extremely well. With adequate amounts of water, the top layer of soil becomes a colloidal suspension and may actually flow over frozen or drier subsoil (Brownfield pers. comm. 1987). This appears to have happened on 22 February during an early thaw in most tributaries sampled and on 18 November at the South Fork of Pocatello Creek.

The concentration of suspended sediment was adjusted to tons/day using the formula given on page 19.

TABLE 3 : Discharge (cfs), Suspended Sediment (mg/ 1) and Nutrients (mg/1) for Dempsey Creek, Station 1

	Discharge	Suspended Sediment	NH_3-N	NO_2 + NO_3-N	TKN	TP-P	O-Phos.
18 Nov. 85	15.00	6		0.266	0.13	<0.05	0.013
22 Feb. 86	23.53	74	0.024	1.170	0.53	0.1	0.006
10 March	51.30		0.050		1.20	0.3	0.034
23 March	51.00	50	0.025	0.580	0.60	0.1	0.039
11 April	113.92	192	0.489	0.497	0.67	0.2	0.015
22 April	132.92	184	0.094	0.253	0.91	0.2	0.020
6 May	117.60	184	0.153	0.342	0.80	0.2	0.030
20 May	84.00	226	0.023	0.167	0.99	0.3	0.024
3 June	79.80	246	0.038	0.159	0.89	0.2	0.010
17 June	61.60	64	0.021	0.304	0.33	0.1	0.010
8 July	35.00	2	0.037	0.478	0.68	0.1	0.019
Mean Flow	69.61						

TABLE 4: Discharge (cfs), Suspended Sediment (mg/l) and Nutrients (mg/l) for Jenkins Canyon, Station 2

	Discharge	Suspended Sediment	NH_3-N	NO_2 + NO_3-N	TKN	TP-P	O-Phos.
18 Nov. 85							
22 Feb. 86	0.10	228	0.434	4.41	1.98	0.9	0.402
10 March							
23 March							
11 April							
22 April							
6 May							
20 May							
3 June							
17 June							
8 July							
Mean Flow	0.10						

TABLE 5: Discharge (cfs), Suspended Sediment (mg/l) and Nutrients (mg/l) for Jackson Creek, Station 4

	Discharge	Suspended Sediment	NH_3-N	NO_2 + NO_3-N	TKN	TP-P	O-Phos.
18 Nov. 85	1.80	<2		2.320	0.10	<0.05	0.047
22 Feb. 86	2.13	200	0.025	1.869	0.84	0.3	0.071
10 March	2.80		0.087		1.02	0.2	0.047
23 March	3.02	76	0.055	1.297	0.78	0.2	0.061
11 April	7.25	228	0.305	0.872	0.55	0.2	0.028
22 April	5.58	144	0.118	0.765	0.72	0.3	0.032
6 May	6.40	140	0.105	0.632	0.56	0.2	0.032
20 May	6.40	204	0.027	0.425	0.83	0.3	0.034
3 June	5.00	74	0.008	0.364	0.44	0.1	0.018
17 June	2.20	38	0.050	0.959	0.27	0.1	0.045
8 July	0.10	2	0.055	3.160	0.53	0.2	0.107
Mean Flow	3.88						

TABLE 6: Discharge (cfs), Suspended Sediment (mg/l) and Nutrients (mg/l) for Rapid Creek, Station 5

	Discharge	Suspended Sediment	NH_3-N	NO_2 + NO_3-N	TKN	TP-P	O-Phos.
18 Nov. 85		2		1.120	1.12	0.06	0.039
22 Feb. 86	105.42	288	0.088	1.783	1.00	0.5	0.050
10 March	112.23		0.070		1.07	0.3	0.049
23 March	107.64	106	0.034	0.179	0.90	0.2	0.054
11 April	190.18	230	0.160	0.693	0.67	0.3	0.037
22 April	185.48	104	0.110	0.704	0.55	0.2	0.033
6 May	115.20	86	0.045	0.648	0.35	0.1	0.021
20 May	127.00	118	0.022	0.454	0.56	0.2	0.023
3 June	97.30	56	0.018	0.460	0.37	0.1	0.013
17 June	66.00	18	0.026	1.211	0.99	0.4	0.127
8 July	13.20	6	0.020	1.287	0.36	0.1	0.041
Mean Flow	111.97						

TABLE 7: Discharge (cfs), Suspended Sediment (mg/l) and Nutrients (mg/l) for Indian Creek, Station 6

	Discharge	Suspended Sediment	NH_3-N	NO_2 + NO_3-N	TKN	TP-P	O-Phos.
18 Nov. 85	1.26	24		2.120	0.29	0.08	0.059
22 Feb. 86	1.99	560	0.061	2.377	1.56	0.9	0.093
10 March	2.85		0.110		2.72	1.1	0.095
23 March	1.63	44	0.021	1.713	0.36	0.1	0.060
11 April	5.72	110	0.095	0.822	0.39	0.2	0.030
22 April	4.23	90	0.086	0.790	0.47	0.2	0.035
6 May	5.40	152	0.101	0.829	0.57	0.2	0.036
20 May	2.60	54	0.026	0.850	0.49	0.1	0.030
3 June	2.40	50	0.018	1.028	0.49	0.1	0.033
17 June	1.10	28	0.021	1.926	0.34	0.1	0.034
8 July	0.90	4	0.043	1.836	0.33	0.1	0.044
Mean Flow	2.73						

TABLE 8 : Discharge (cfs), Suspended Sediment (mg/l) and Nutrients (mg/l) for Sorrell Canyon, Station 7

	Discharge	Suspended Sediment	NH_3-N	NO_2 + NO_3-N	TKN	TP-P	O-Phos.
18 Nov. 85	<.1	34		2.50	0.53	0.16	0.067
22 Feb. 86	1.33	472	0.024	1.635	1.65	0.8	0.123
10 March	1.16		0.052		0.92	0.3	0.085
23 March	1.46	58	0.063	0.180	0.49	0.2	0.081
11 April	1.42	224	0.117	1.394	0.52	0.4	0.066
22 April	1.26	142	0.201	1.095	0.47	0.2	0.072
6 May	1.20	66	0.059	0.901	0.48	0.2	0.073
20 May	2.80	154	0.042	0.877	0.93	0.3	0.085
3 June	0.90	52	0.128	1.134	0.49	0.2	0.089
17 June	0.60	42	0.055	2.106	0.28	0.2	0.119
8 July	0.20	72	0.051	2.354	0.97	0.3	0.139
Mean Flow	1.13						

TABLE 9: Discharge (cfs), Suspended Sediment (mg/l) and Nutrients (mg/l) for South Fork Pocatello Creek Station 8

	Discharge	Suspended Sediment	NH_3-N	NO_2 + NO_3-N	TKN	TP-P	O-Phos.
18 Nov. 85	<.1	1680		1.140	0.79	0.32	0.162
22 Feb. 86	0.67	30	0.036	1.557	0.43	0.2	0.024
10 March	0.78		0.066		1.24	0.3	0.060
23 March	0.73	54	0.050	1.164	0.60	0.2	0.065
11 April	2.78	208	0.058	1.035	0.67	0.3	0.063
22 April	4.25	216	0.051	0.941	0.98	0.4	0.064
6 May	3.10	112	0.112	0.756	0.66	0.2	0.052
20 May	3.50	98	0.054	0.664	0.63	0.2	0.047
3 June	1.30	46	0.034	0.774	0.50	0.2	0.070
17 June	1.10	36	0.035	1.016	0.32	0.2	0.078
8 July	0.20	10	0.035	2.339	0.43	0.1	0.042
Mean Flow	1.68						

TABLE 10 : Discharge (cfs), Suspended Sediment (mg/l) and Nutrients (mg/l) for North Fork Pocatello Creek Station 9

	Discharge	Suspended Sediment	NH_3-N	NO_2 + NO_3-N	TKN	TP-P	O-Phos.
18 Nov. 85	2.88	8		1.970	0.17	0.07	0.048
22 Feb. 86	7.02	896	0.078	2.293	2.02	1.3	0.077
10 March	4.59		0.037		0.88	0.4	0.049
23 March	4.40	126	0.050	2.107	0.71	0.2	0.041
11 April	27.77	696	0.119	2.227	1.69	0.9	0.077
22 April	13.81	300	0.409	1.928	1.07	0.5	0.062
6 May	11.80	222	0.057	1.766	0.75	0.4	0.039
20 May	12.90	176	0.084	1.641	0.59	0.3	0.031
3 June	9.70	114	0.085	1.653	0.72	0.3	0.045
17 June	8.90	78	0.060	2.246	0.58	0.2	0.065
8 July	5.10	42	0.027	2.095	0.54	0.2	0.079
Mean Flow	9.53						

$$tons/ day = (mg/ l)*(cfs)*(0.0027)$$

where mg/l is the concentration in milligrams/ liter, and cfs is the flow in cubic feet per second. Using this formula, the loading from the various streams can be ascertained.

Rapid Creek and Dempsey Creek contributed the most suspended sediment to the Portneuf River (Table 11). Data indicate that Rapid Creek contributed up to 117 tons/day and Dempsey Creek up to 65 tons/day of suspended sediment to the Portneuf River. High suspended sediment loads for the other six tributaries combined was 68 tons/ day, of which the North Fork of Pocatello Creek contributed 52 tons.

If the average sediment load (tons/day) is compared to the cropland acreage (Table 12), the most soil lost per acre is in the Dempsey Creek drainage followed by the South Fork of Pocatello Creek and the North Fork of Pocatello Creek. Rapid Creek, Jackson Creek, Sorrell Canyon, and Indian Creek showed smaller sediment losses per acre. Based upon drainage size and sediment loss per acre, conservation efforts in the Dempsey Creek drainage should positively affect water quality in a short time.

Nutrients

Nitrogen

Nitrogen, one of the two nutrients tested for in this study, is an essential element in healthy plant growth. There are three major interconvertible types of nitrogen found in water and soil: organic nitrogen, ammonia (NH_3), and the nitrate and nitrite complex ($NO_2 + NO_3$).

Organic nitrogen consists of complex nitrogen bearing compounds usually found in plant and animal tissues and waste. Sources for organic nitrogen include livestock wastes and leaf litter. Organic nitrogen is tested by using the Kjeldahl digestion method where the organic nitrogen is converted to ammonia. The ammonia is titrated to determine the concentration of organic nitrogen plus non-organic ammonia. Total organic nitrogen is determined by subtracting the ammonia concentration from the total Kjeldahl nitrogen concentration.

Ammonia may be applied to cultivated fields as a nitrogen fertilizer. Other sources of ammonia are cattle wastes and organic compounds which have been broken down by bacterial action.

Table 11 : Flow (MGD) and Suspended Sediments (Tons/day)

DATE	Station Number 1	2	4	5	6	7	8	9
18 Nov. 85	9.68		1.16		0.81	0.10	0.10	1.86
	0.24		0.01		0.08	0.01	0.45	0.06
22 Feb. 86	15.18	0.06	1.37	68.01	1.28	0.86	0.43	4.53
	4.68	0.06	1.14	81.60	2.99	1.69	0.05	16.90
10 March	33.10		1.81	72.41	1.84	0.75	0.50	2.98
23 March	32.90		1.95	69.45	1.05	0.94	0.42	2.84
	6.86		0.62	30.70	0.19	0.23	0.09	1.49
11 April	73.50		4.68	122.70	3.69	0.92	1.79	17.92
	58.85		4.45	117.68	1.69	0.86	1.55	52.01
22 April	85.75		3.60	119.66	2.73	0.81	2.74	8.91
	65.79		2.16	51.89	1.02	0.48	2.47	11.15
6 May	75.87		4.13	74.32	3.48	0.77	2.00	7.61
	58.21		2.41	26.65	2.21	0.21	0.93	7.04
20 May	54.19		4.13	81.94	1.68	1.81	2.26	8.32
	51.07		3.51	40.32	0.38	1.16	0.92	6.11
3 June	51.48		3.23	62.77	1.55	0.58	0.84	6.26
	56.67		1.54	14.66	0.32	0.13	0.16	2.98
17 June	39.74		1.42	42.58	0.71	0.39	0.71	5.74
	10.61		0.23	4.95	0.08	0.07	0.11	1.87
8 July	22.58		0.06	8.52	0.56	0.13	0.13	3.29
	0.29		<0.01	0.33	0.01	0.04	0.01	0.58

Table 12: Subwatershed Acreage and Sediment Loading

Subwatershed	Acreage[1]	Sediment(Tons/ acre)[2]
Dempsey Creek	1,211	6.00
Jackson Creek	549	0.68
Rapid Creek	12,273	0.77
Sorrell Canyon	403	0.23
Indian Creek	921	0.28
S.F. Pocatello Creek	31	5.00
N.F. Pocatello Creek	2,125	1.09

1 Cropland Acreage (Portneuf SWCD)

2 During sampling period (232 days) Formula : $\frac{(232 \text{ days}) (\text{Tons/ day})}{\text{Acreage}}$

Samples were tested for both nitrate and nitrite nitrogen. This is due to the interconvertibility of the two compounds and the difficulty in achieving a steady state condition before analysis (APHA, 1985). Total inorganic nitrogen (nitrate, nitrite, and ammonia) concentrations were consistently over the 0.3mg/ l recommended as a limit for nuisance aquatic vegetation (IDHW, 1980) with only 4 of the 71 samples below the recommendation. Total nitrates and nitrites were the dominant forms in all of the creeks except for Dempsey Creek where total Kjeldahl nitrogen was the main nitrogen nutrient.

Total Kjeldahl nitrogen exceeded nitrite-nitrate nitrogen in Jackson Creek on May 20 and June 3, Rapid Creek on March 23 and May 20, Sorrell Canyon on March 23 and May 20, and the South Fork of Pocatello Creek on April 22. Total Kjeldahl nitrogen was the major nitrogen nutrient on Dempsey Creek on all sampling dates except for November 11 and February 25.

This shows that nitrogen compounds are a major pollutant in these creeks, and under higher flow conditions such as summer thunderstorms, the impact on the Portneuf River and the American Falls Reservoir could be great.

Phosphorus

Phosphorus was the other major plant nutrient tested for during the study. It is usually the limiting nutrient for plant growth in the study area (Buhidar, pers. comm. 1986). Total phosphorus and total ortho-phosphate samples from all stations exceeded the recommended EPA guidelines for nuisance growth of aquatic vegetation (Tables 3 through 10). EPA studies have suggested that concentrations of total phosphorus over 0.1 mg/ l and ortho-phosphate concentrations over 0.025 mg/ l could encourage this vegetation growth (Mackenthun, 1973). Total phosphorus was higher than 0.1 mg/ l on 56 of the 71 samples taken. Sorrell Canyon and the South Fork of Pocatello Creek samples always exceeded the recommended criterion.

Ortho-phosphate recommendations were exceeded on 60 of the 71 sampling occasions. Indian, North Fork of Pocatello, Sorrell, and Jenkins Creeks exceeded the EPA recommendations on every date sampled. This again shows the possibility of significant nutrient loading in the Portneuf River during high flows.

Bacteria

Idaho Water Quality Standards and Wastewater Treatment Requirements establishes a single sample maximum of 800 fecal colonies/100 ml sample for secondary contact recreation and 500/100 ml for primary contact recreation. All sampling stations except Dempsey Creek and Jenkins Canyon are secondary contact streams. Dempsey Creek and Jenkins Canyon are primary contact streams. The standards were exceeded on Jackson Creek (20 May,), Indian Creek (17 June, and 8 July), Sorrell Canyon (25 February, 20 May, 3 and 17 June, and 8 July), South Fork of Pocatello Creek (17 June and 8 July), and Jenkins Creek (25 February) (Table 13). Analysis of the fecal coliform/ streptococcus coliform ratio showed that contamination was from non-human sources in 57 of the samples, mixed human livestock in 13, and from humans once (Table 14).

CONCLUSIONS and RECOMMENDATIONS

Water quality standards or recommended criteria were consistantly exceeded in all of the drainages sampled. Primary contaminants are suspended sediment, inorganic nitrogen, total phosphorous, ortho-phosphate, and bacteria.

No samples were collected during a storm event, although records indicate that heavy rainstorms or a heavy snowmelt increases the tributary flows considerably. The one record of a storm event on the South Fork of Pocatello Creek indicates that it contributed one- third of the total flow of the Portneuf River. Since the amount of suspended sediment is related to the flow rate, the impact on the Portneuf River must have been substantial.

Discharges from Rapid Creek and Dempsey Creek were high enough during the study to affect the Portneuf River water quality. The mean flow of the Portneuf River at Pocatello from February through July is 446 cfs. During the study, Dempsey Creek and Rapid Creek had an average combined flow of 186 cfs. These two streams, therefore, contribute an average of 41.9% of the total flow of the Portneuf River. With both streams exceeding nutrient recommendations, the impact on the Portneuf River appears to be substantial.

It is recommended that the Lower Portneuf Agricultural Water Quality Program be funded for implementation if the Portneuf Soil and Water Conservation District requests funding. Although the Dempsey Creek

Table 13 : Fecal Coliform / Streptococcus Counts (*/100ml)

DATE	Station Number 1	2	4	5	6	7	8	9
18 Nov. 85	<10		100	10	550	20	10	<10
	60		310	180	8200	1200	610	700
25 Feb. 86	<10	1300	20	70	40	950	10	30
	330	930	480	7500	430	890	270	270
10 March	10		10	20	330	<10	210	<10
	960		520	650	2900	270	1300	830
24 March	40		120	20	40	100	120	10
	220		170	230	460	50	180	4100
11 April	170		40	40	50	80	170	10
	1000		660	670	600	500	610	2100
22 April	60		140	40	40	30	180	10
	490		1300	640	1400	820	850	2400
6 May	150		350	50	180	640	180	10
	100		380	230	580	290	220	820
20 May	200		1100	500	630	2300	100	10
	300		550	340	2000	270	110	150
6 June	220		150	100	120	1100	350	110
	240		300	190	20000	600	3300	740
17 June	180		610	300	1410	2900	920	100
	170		2190	530	3200	970	4200	760
8 July	40		370	140	1200	6700	1400	150
	240		2200	70	6300	48000	2500	1400

Underlined numbers exceed Idaho Water Quality Standards (800 coliform colonies/ 100ml).

Table 14: Fecal Coliform / Fecal Streptococcus ratios for Tributaries of the Lower Portneuf (by date)

	18 Nov 1985	25 Feb 1986	10 Mar 1986	24 Mar 1986	11 Apr 1986	22 Apr 1986	6 May 1986	20 May 1986	3 June 1986	17 June 1986	8 July 1986
Dempsey Cr.	0.16	0.03	0.01	0.18	0.17	0.12	1.50	0.67	0.91	1.06	0.17
Rapid Cr.	0.32	0.01	0.03	0.09	0.06	0.06	0.22	1.47	0.52	0.57	2.00
Indian Cr.	0.06	0.09	0.11	0.09	0.08	0.03	0.31	0.32	0.06	0.44	0.19
Sorrell Cn.	0.07	1.06	0.03	2.00	0.16	0.04	2.21	*8.52*	1.83	2.99	0.14
Jackson Cr.	0.02	0.04	0.02	0.70	0.06	0.11	0.92	2.00	0.50	0.28	0.17
S. F. Pocatello	0.02	0.03	0.25	0.66	0.27	0.21	0.82	0.90	0.11	0.22	0.56
N. F. Pocatello	0.01	0.11	0.01	0.01	0.01	0.01	0.01	0.07	0.15	0.13	0.11

Coliform / Streptococcus Ratios:

<0.7 indicates livestock influences

0.7 to 4.1 indicates human-livestock mixed influences (underlined)

>4.1 indicates human influences (Italisized)

drainage shows the greatest potential for agricultural pollution, the Rapid Creek drainage should also be considered as a first priority since these creeks appears to impact the Portneuf River to a greater extent than the other drainages. The North and South Forks of Pocatello Creek and Sorrell Canyon have high potentials for sediment, nutrient, and bacterial pollution loading into the Portneuf River and should be considered as second priority.

Due to the high bacterial counts in Sorrell Canyon, the South Fork of Pocatello Creek, Indian Creek, Jackson Creek, and Jenkins Creek a livestock waste control program is highly recommended on these drainages.

ACKNOWLEDGEMENTS

We would like to acknowledge those people who assisted with the data compilation and technical advice needed for the completion of the water quality analysis for the Lower Portneuf Non-point Source Pollution Abatement Project.

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