Ground Water Quality Technical Report No. 4

Black Cliffs Ground Water Quality Study: Nitrate Impact

Pocatello Area, Southeastern Idaho

Prepared by:

Gerry Winter
Joe Baldwin
Bruce Wicherski
Sandy Richlen

Idaho Department of Health and Welfare
Division of Environmental Quality
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Abstract

Nitrate contamination has been documented in a Pocatello city well, the Black Cliffs Mobile Home Park community well, and several small systems and private wells in an area of southeastern Pocatello. Samples collected by District VI Health Department in 1980 indicated the presence of elevated nitrate concentrations in several area wells.

The purpose of the study is to investigate the nitrate contamination of ground water in the vicinity of the Black Cliffs Mobile Home Park. The objectives include collecting and analyzing ground water samples, researching available data on the hydrogeologic environment, and evaluating the data collected to determine trends and potential sources of nitrogen.

Nitrate (as N) concentrations ranged from 0.005 to 20.6 mg / ℓ for 28 ground water samples and 1 surface water sample. The mean concentration is 7.43 mg / ℓ which includes a sample analysis from the Portneuf River. Three of the 15 sites sampled in 1980 exhibit decreasing concentrations of nitrate in the ground water by 1990. Concentrations at the remaining 12 sites increased from 0.09 to 19.33 mg / ℓ. The mean increase is 4.97 mg / ℓ over the 10 year period between sampling events. This increase is equivalent to an average increase of about 0.5 mg / ℓ per year.

The rapid increase in nitrogen at the majority of the wells is indicative of the presence of a continuing problem. The source of contamination is still present.

Soils data obtained from the bottom of the abandoned sewage lagoon indicate that this is not the source of the nitrogen that is impacting the ground water system. Land use activities in the area suggest that septic systems are the source of nitrogen that is increasing nitrate concentrations in the ground water.

This study was initiated by George Spinner of the Idaho Division of Environmental Quality (DEQ), Eastern Idaho Regional Office (Pocatello), in August of 1990. Nitrate contamination was affecting the quality of ground water pumped by a Pocatello city well, the Black Cliffs community well, and several small systems and private wells in the Black Cliffs area of southeastern Pocatello (Figure 1). Fourteen samples collected by the District VI Health Department in 1980 indicated the presence of elevated nitrate concentrations in several area wells. For the purposes of this study, an elevated concentration of nitrate is defined as exceeding 0.005 milligrams per liter (mg/ℓ).

Development has continued in the area. A sewage lagoon existed at one time but its use was discontinued in the late 1970s after the city extended a sewer line to Black Cliffs Mobile Home Park that had used the lagoon.

Central Office staff (Joe Baldwin and Bruce Wicherski) assisted in the collection of ground water samples for the analysis of common ions and in particular nitrate as nitrogen (N) in October of 1990.

Purpose and Objectives

The purpose of the study is to investigate the nitrate contamination of ground water in the vicinity of the Black Cliffs Mobile Home Park. The objectives include:

- Collecting and analyzing ground water samples for common ion concentrations and in particular nitrate concentrations,
- Researching available data on the hydrogeologic environment, and
- Evaluating the data collected to determine trends and potential sources of nitrogen.

Past Project and Literature Review

The District VI Health Department collected ground water samples in the area in 1980. Records indicate that 14 samples were collected and analyzed. Nitrate concentrations ranged from 0.27 to 19.4 mg /ℓ. The mean concentration was 8.15 mg /ℓ.

Samples collected from the Black Cliffs community supply well indicate an increasing trend in nitrate concentrations. As Table 1 shows, periodic sampling from this well indicates the presence of a significant problem.

Figure 1: Study area location and sampling site locations

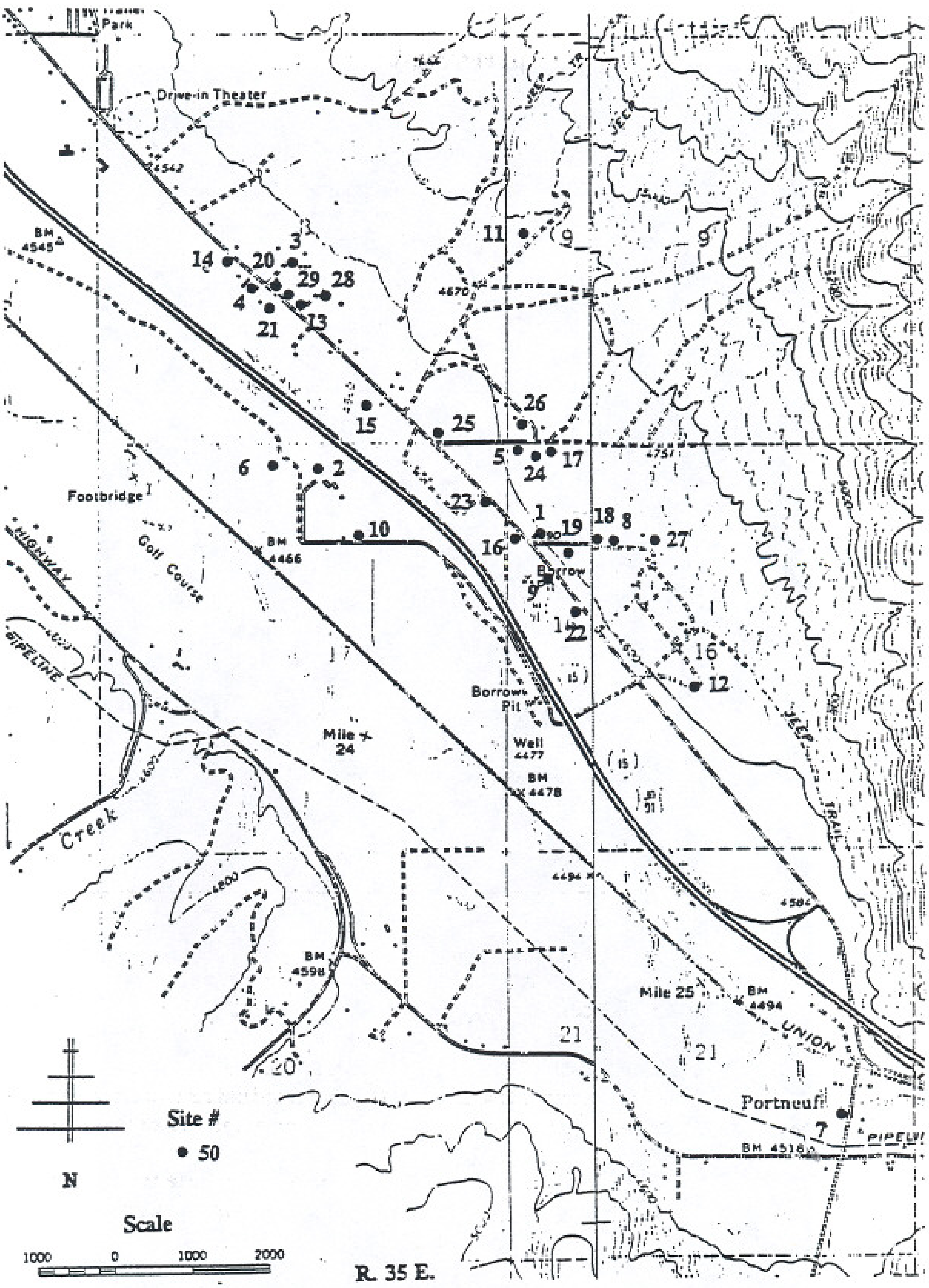


Table 1: Periodic Sampling Results of Black Cliffs well

Date	NO_3 (mg/l)	Cl (mg/l)
1980	0.12	-
11/80	9.57	264
4/87	10.20	-
6/87	10.80	-
3/89	14.47	-
10/90	13.5	296

Study Area

The Black Cliffs Mobile Home Park is located on the north side of Interstate 15, southeast of Pocatello in Bannock County. The study area, which includes the mobile home park and surrounding development, is located about 4 miles southeast of Idaho State University and about one half mile from the Portneuf River. All wells sampled are located northeast of the river.

Climate

The following climatologic data are summarized from NOAA (1990). The annual average precipitation in Pocatello is 10.86 inches. Approximately 40% of the precipitation occurs March through June. The average temperature is 48.2°F. The area experiences a large fluctuation in temperatures; in 1990 temperatures ranged between -29°F and 104°F.

Soils

Soil types that are dominant in the sampling area lying west of Interstate 15 are Broxon and McDole (U.S. Department of Agriculture, 1987). Broxon is a silt loam that occurs on low slopes (0-2%) on terraces. Broxon "formed in loess and silty alluvium overlying flood-deposited sand, gravel, cobbles, and stones of mixed mineralogy." The McDole-McDole Variant soils are complex but mainly silt loam (U.S. Department of Agriculture, 1987). It occurs on low slopes of 0-2%, on low terraces (McDole) and floodplains (McDole Variant). Table 2 compares the clay content, percent organic matter and permeability of these soils.

The main soils in the sampling area east of Interstate 15 include the Hondoho, Arbone, and the Pocatello. The Hondoho are gravely silt loam. It occurs on slopes of 4-12% on mountain foot slopes and terraces (U.S. Department of Agriculture, 1987).

The Arbone is a gravely silt loam that occurs on slopes of 4-12%. It occurs on mountain foot slopes and fan terraces. The Pocatello silt loam occurs on slopes of 1-4% on foothills and fan terraces. "It formed in loess and silty alluvium derived from loess." Again, Table 2 shows a comparison of clay content, percent organic matter, and permeability of all these soils (U.S. Department of Agriculture, 1987).

Geology

Table 2: Attributes of various soil types found in sampling areas

Soil	% Clay	% Organic Matter	P in/hr
Broxon (1 - 25in)	8 - 18	0.8 - 2	0.6 - 2
Broxon (25 - 60in)	0 - 5	0.8 - 2	>20
McDole	8 - 18	1 - 4	0.6 - 2
Hondoho (0 - 15in)	12 - 25	2 - 3	0.6 - 2
Hondoho (15 - 60in)	18 - 27	2 - 3	0.6 - 2
Arbone	13 - 18	1 - 3	0.6 - 2
Pocatello	5 - 15	0.8 - 1	0.6 - 2

The geology is some of the most complicated in the Pocatello Valley. Three major age groups of rocks underlie the foothills between 5th Street and the mountains (Rodgers, 1990). Quartzite, shale, and limestone of late Precambrian and early Cambrian age are common. Poorly consolidated pebble to cobble sized gravel and poorly consolidated white volcanic ash deposits are occasionally present, both are Tertiary in age. The third rock group in this area is the Quaternary age gravels, silty loess, and basalt. The basalt originated southeast of the study area and flowed down valley to where it ends near the northwestern edge of the study area. A drillers log of a well in T.7S.,R.35E., section 7AC shows the base of the basalt at an altitude of about 4,460 feet. The thickness of the basalt is about 50 feet.

The north edge of the basalt flow is covered by Quaternary alluvial fan deposits derived from the hills to the north (Trimble, 1976). The surface and southern part of the basalt flow was scoured by floodwater from Lake Bonneville, leaving the black outcrops for which Black Cliffs Mobile Home Park is named. Age dating of organic material and mollusks from underlying lake beds by carbon-14 methods indicate that the basalt is from 32,000 to 35,000 years old (Trimble, 1976).

The Tertiary and older rocks are commonly fractured and tilted east about 45° (Trimble, 1976). The Quaternary rocks are flat lying. Three inactive normal faults cut through the Tertiare and older rocks at dips of 20° to 50°. The traces of faults are mostly hidden by the younger Quaternary deposits.

Hydrology

Little is known about the hydrogeology of this area but the wellhead protection grant awarded to Pocatello will fund more investigation of the hydrology in the area. It is believed that shallow ground water moves from the highlands to the Portneuf River. The direction of flow is probably toward the southwest to west.

There is no information available on the hydrogeologic properties of the rocks or the unconsolidated sediments present in this area. Depths to ground water, as reported on drilling logs, appears to range from 23 to 200 feet. Ground surface elevations are about 80 feet higher than the river in this area.

Land Use

The area has been developed over the years. Initially, the area was dominated by agriculture but now the area is mostly urban. Some homes are located on small acreages and have a few head of livestock (horses or cattle). The sewage lagoons at Black Cliffs leaked until abandoned in 1980 when the city extended a sewer line to the area (Spinner, 1990). Other residences in the area still use septic systems for disposal and treatment of domestic wastes.

Water Use

The major use of ground water in the area is for domestic purposes. Some ground water is used for commercial purposes.

Irrigation water from ground water is used for the acreage that remains in agriculture. The predominant method of irrigation is sprinkler. It is estimated that less than 10% of the study area is irrigated.

Materials and Methods

The District VI Health Department collected samples from area wells in 1980. Additional samples were collected by DEQ in 1990 to assist in the assessment of the ground water quality problem in the area. Data are limited to describe the nature of these sampling efforts.

Sources of data

District VI, Health Department

Samples were collected and analyzed from 14 wells in 1980. Information is lacking on the methods used to collect the samples or the level of quality assurance / quality control employed. Results from these analyses are included in Table 8.

IDEQ Special Projects

IDEQ resampled about half of the wells that were sampled by the Health District in 1980. An additional 15 samples were collected for a total of 29 wells. One sample was collected from the Portneuf River for comparison purposes; all other samples were collected from wells.

Preparation

Samples were collected from the wells after pumping the well for approximately 10 minutes. Specific conductivity, pH, and temperature were monitored until they were constant to assure that chemical differences in the water being sampled were minimal.

Samples were collected in new 1 liter cubitainers. One container at each site was preserved with 2 m ℓ sulfuric acid for preservation of nitrogen species; while the other container was not acidified. The containers were placed on ice for transport to the Idaho Bureau of Laboratories in Boise. Holding times were met.

Fifteen samples were collected for analysis for several common ions (NO_3, pH, Ca, Mg, K, Na, SO_4, HCO_3, and Cl). Data on these ions were collected in order to characterize the source of the ground water and to help distinguish hydrochemical distinctness between ground water sources. Fourteen samples were collected for analysis of a more limited list of ions (Na, Cl, NO_3, and total P).

A study specific quality assurance / quality control (QA / QC) plan was not in effect when this study was conducted. Duplicate and spiked samples were not used. However, a cation/anion balance was calculated to ascertain the validity of the common ion data where sufficient common ion analyses were requested. The ion balance errors calculated for samples 1 through 15 are less than 10%, which is considered to be excellent.

Total coliform analyses were conducted for all samples collected from wells except the last site (#29) and the Portneuf River (#7). Sites 5, 6, 13, and 18 had counts greater than one. The data are inconclusive as to whether septic systems are impacting ground water quality.

Soils were sampled to assess the potential source of nitrogen in the abandoned lagoon. Control samples were collected from adjacent soils near the lagoon. Analyses included ammonia, nitrate, Kjeldahl nitrogen, and pH.

Nitrate (as N) concentrations ranged from 0.27 mg / ℓ to 19.4 mg / ℓ for the samples collected by the District VI Health Department. The mean concentration is 8.15 mg / ℓ.

Figure 2 illustrates the relative quality of the ground waters by comparing the concentrations of the major ions from the 15 samples in a Piper diagram. The percentage of Na+K ions occurs in approximately the same proportion as Ca and Mg at 12 sites (1, 2, 3, 5, 6, 7, 9, 10, 12, 13, 14, and 15). Sites 4, 8, and 11 tend to fall outside this cluster. In general, these sites have a lower percentage of Mg and a higher percentage of K.

The total well depth is reported to be 600 feet at site 11; the well owner reported a sulfide odor in the water from the well. The percentage of sodium relative to calcium was elevated and nitrate as N was non-detectable. This indicates that the well produces water from a deep aquifer where water has been in the flow system for a long time. Calcium has been replaced by sodium through ion exchange and the well is deep enough that the nitrate concentration is at background concentration. In addition, the remaining sites tend to cluster into two groups; 2, 5, 6, 7, 8, and 10 and 1, 3, 9, 12, 13, 14 and 15.

The percentage of SO_4 to Cl also suggests that three types of ground water exist or that there is some degree of hydrochemical distinctness between three groups of sites. Sites 8 and 11 again fall out of the general groupings. Two clusters again appear. Group 1 includes 2, 4, 5, 6, 7, and 10. The second group includes 1, 3, 9, 12, 13, 14, and 15. The clustering of hydrochemically distinct sites are grouped according to apparent similarities (Table 3).

Assuming that sites 4, 8, and 11 are outliers, the remaining sites can be grouped into hydrochemically distinct groups. These two groups are identified on Figure 3. The stiff diagrams of Figure 3 suggest that sites 3, 13, and 15 are distinctly different ground water types.

Sites 1, 3, 9, 12, 13, 14, and 15 all show evidence that man is having a significant impact on ground water quality (Figure 2). The nitrate concentrations at these sites exceed 3.70 mg / ℓ and average 10.4 mg / ℓ Nitrate concentrations range from 3.77 mg / ℓ to 18.7 mg / ℓ Background concentrations, prior to man's impact, appear to occur at concentrations below detection limits (approximately 0.005 mg / ℓ) based on the occurrence of two values at less tham 0.005 mg / ℓ. Man's impact, therefore, seems to be affecting the general chemistry of the ground water on the study area.

The water sample from site 7 (Portneuf River upstream of the study area) plots with the group of wells having small nitrate and chloride concentrations. This suggests that the Portneuf River is in communication with the ground water system in the Black Cliffs area.

The apparent outliers, 4, 8, and 11 do not fall into a particular temperature regime (Table 4). The apparent hydrochemical groupings distinguished from the Piper diagram are not evident based upon temperature differences. There is no apparent correlation between temperature and total dissolved solids concentrations. The concentration of total dissolved solids normally increases as temperature increases. The differences in the temperature of the ground water sampled are probably a function of sampling environment rather than hydrogeological environment.

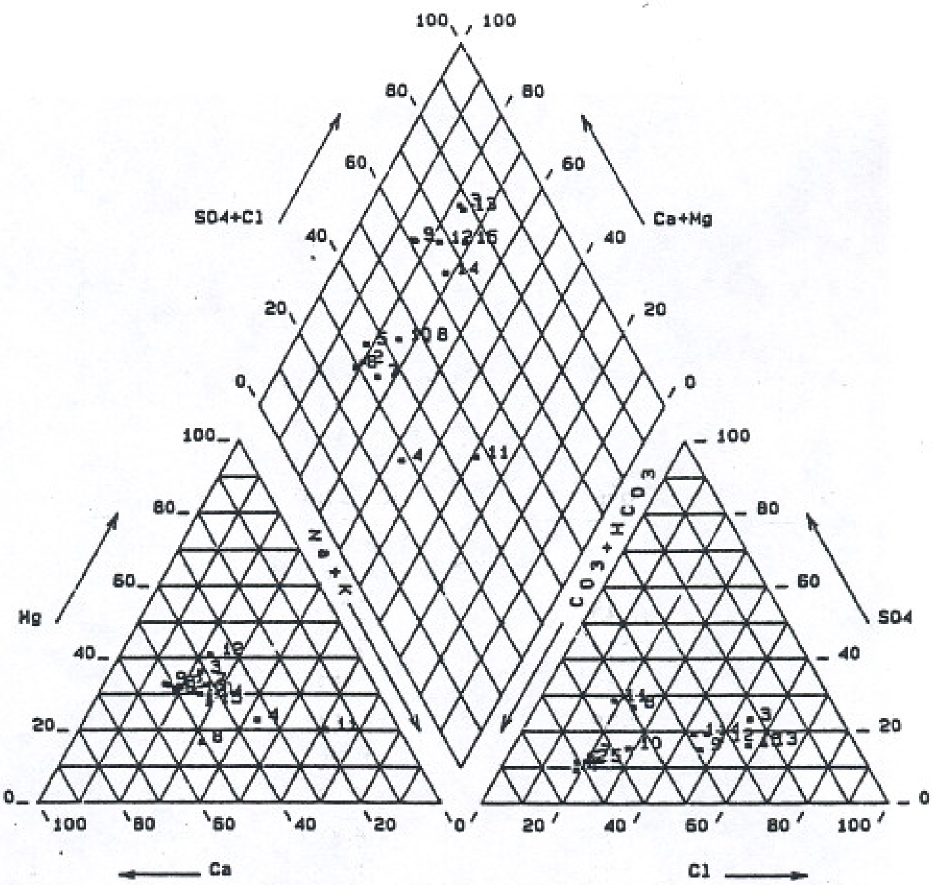
Table 3: Clustered ground water types

Mg & Ca	SO_4+Cl & Ca + Mg	Cl & SO_4
1,2,3,5,6,7,9,10,12,13,14,15	2,5,6,7,8,10	2,4,5,6,7,10
4	1,3,9,12,13,14,15	1,3,9,12,13,14,15
8	4	8
11	11	11

Table 4: Selected field parameter results grouped by temperature

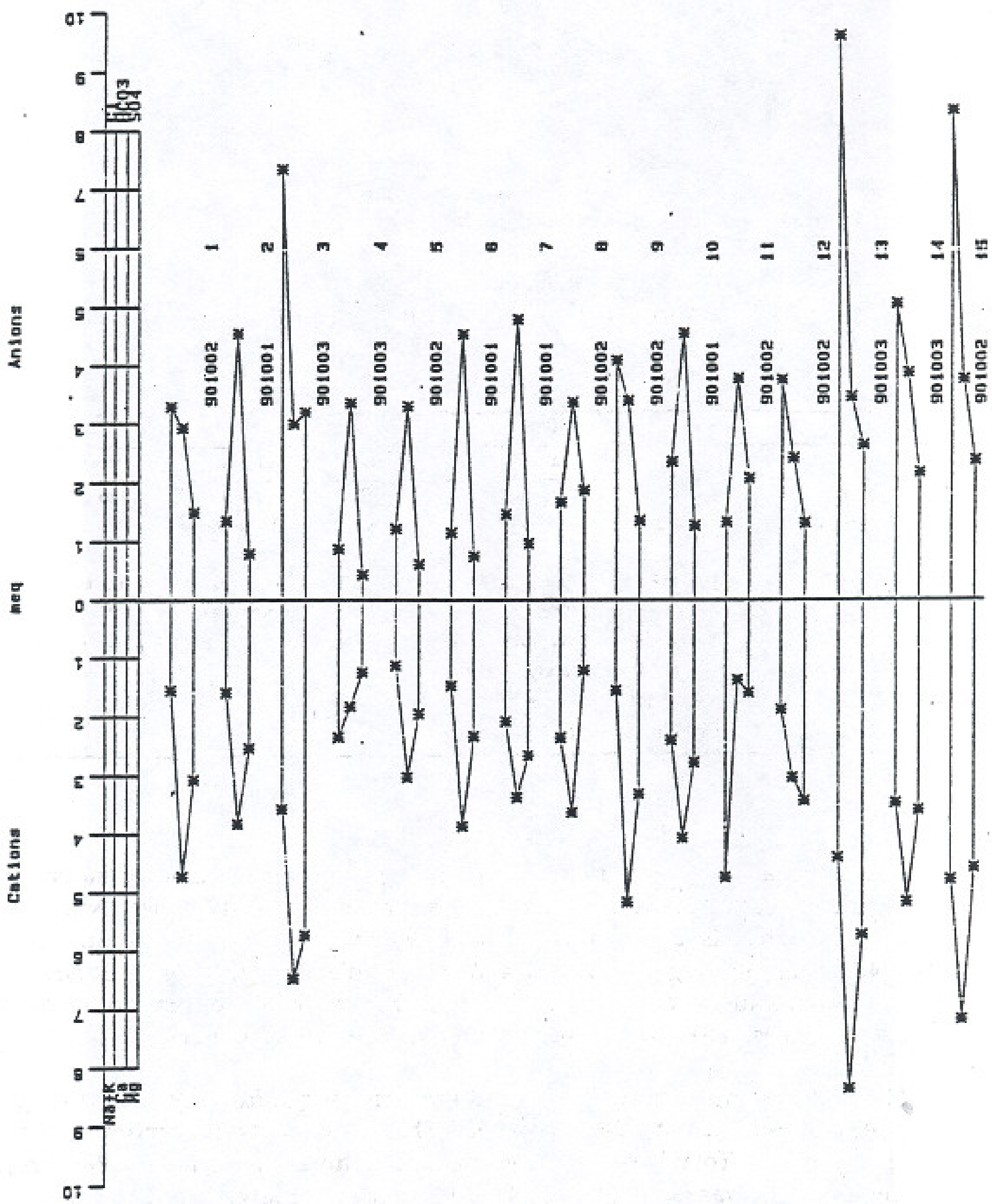
Site	pH	Sp. Cond.	Temp.
13	7.3	1700	12.2
3	7.45	1446	12.3
6	7.45	702	12.5
2	7.44	722	12.6
23*	7.48	1352	13.7
16*	7.38	1314	13.8
21*	7.36	1750	14.2
29*	7.36	1750	14.2
20*	7.76	600	14.3
12	7.83	827	14.4
10	7.36	856	14.5
15	7.53	1551	14.5
9	7.60	958	15.0
1	7.65	885	15.3
4	7.79	508	15.9
18*	7.59	721	15.9
19*	7.53	1515	15.9
24*	7.57	1214	16.1
17*	7.69	783	16.3
28*	7.40	598	16.3
26*	7.61	1187	16.4
5	7.61	604	16.5
8	7.57	717	16.5
25*	7.55	1322	16.6
22*	7.53	1122	16.7
11	7.96	758	16.8
7	8.48	742	17.6
14	7.50	1160	17.7
27*	7.55	725	17.7

Figure 2: Piper diagram of Analyzed common Ions



Site #	Date (YYMMDD)	Nitrate (N) (mg/L)	Well depth (feet)
1	901002	10.8	400
2	901001	1.49	50
3	901003	9.22	-
4	901003	0.13	-
5	901002	1.79	165
6	901001	1.43	-
7	901001	0.41	-
8	901002	0.35	200
9	901002	8.25	200
10	901001	3.16	70
11	901002	<0.005	600
12	901002	3.77	75
13	901003	18.7	-
14	901003	8.44	144
15	901002	13.5	-

Figure 3: Stiff diagram of analyzed common ions



The apparent hydrochemically distinct ground water types are not related areally (Figures 1 and 2). The distinctness may be created by the differences associated with variable well depths and completion intervals. Data obtained from well logs of four wells sampled demonstrate a large difference in well depths (Table 5) and geology (Table 6).

Table 5: Well log information of four random sites

Site #	Elevation (Ft)	Well Depth	Casing Length (Ft)	Diameter of Casing (In)	Well Construction Date	Well Use	Depth to Water (Ft)
01	4640	201	201	8 & 6	1973	D	80
06	4475	100	12	12	1961	I	23
10	4495	69.25	69.25	10	1955	I	33.25
17	4600	400	400	4,6,8	1972	D	200

D = domestic I = industrial

Table 6: Comparison of geology at four random sites

Site 01		Site 06		Site 10		Site 17	
Depth (ft)	Material	Depth (ft)	Material	Depth (ft)	Material	Depth (ft)	Material
0 to 8	Topsoil	1 to 7	Topsoil	0 to 22	Topsoil	0 to 51	Topsoil
8 to 12	Gravel	7 to 33	Brown clay	22 to 34	Topsoil/sand/ gravel	51 to 105	Gray Basalt
12 to 88	Yellow clay/some rock	33 to 61	clay/sand/ gravel	34 to 69	Sand/gravel/ some clay	105 to 400	Clay/Sand/ Gravel
88 to 97	Basalt	61 to 64	Hard clay/rock	-	-	-	-
97 to 163	Yellow clay	64 to 90	Sandy clay/rock	-	-	-	-
163 to 192	Rock	90 to 100	Cinders	-	-	-	-
192 to 210	Gravel	100 to 104	Rock	-	-	-	-

Soils were sampled from the bottom of the lagoon and from an adjacent property (Table 7). Sampling depths ranged from the surface to a depth of 44-48 inches. Nitrate concentrations in the lagoon soils ranged from 2.1 to 5.2mg/kg;the lowest concentration occurred at a depth of 48 inches. The highest concentration occurred at a depth of 30-36 inches. Kjeldahl nitrogen concentrations ranged from 180-269mg/kg;the highest concentration occurred at a depth of 0-12 inches. The lowest concentration occurred at a depth of 44-48 inches.

The control samples from the adjacent property ranged from 2.9 to 37.1mg/kg;the lowest concentration occurred at a depth of 46-50 inches. The highest concentration occurred at a depth of 0-12 inches. Total kjeldahl nitrogen concentrations ranged from 139-953mg/kg.The highest concentration was found at a depth of 0-12 inches; the lowest concentration was found at a depth of 46-50 inches.

Table 7: Soil sample data from Black Cliffs lagoon

Depth (in)	NH_3 as Nitrogen (mg/kg)	NO_3 as Nitrogen (mg/kg)	Total Kjeldahl Nitrogen as Nitrogen (mg/kg)	pH	% Moisture
0 - 12	6.3	3.6	269	9.48	4.4
12 - 24	7.2	2.9	245	9.50	5.0
30 - 36	4.7	5.2	223	9.35	4.9
44 - 48	5.8	2.1	180	9.38	2.5
0 - 12	21.2	37.1	953	8.24	4.7
16 - 20	8.3	14.2	381	9.63	13.0
29 - 33	7.4	5.8	189	9.38	2.8
46 - 50	9.7	2.9	139	9.41	9.2

Table 8: Comparison of site nitrate levels

Site Number	1980 Nitrate Level (ppm)	1990 Nitrate Level (*mg/ℓ)
02	*	1.49
03	*	9.22
04	11.28	0.134
05	*	1.79
06	*	1.43
07	*	0.413
08	*	0.358
09	2.07	8.25
10	*	3.18
11	*	0.005
12	*	3.77
13	10.97	18.7
14	4.87	8.44
15	*	13.5
16	19.40	12.8
17	1.24	2.85
18	.27	0.360
19	8.17	20.6
20	*	0.305
21	9.37	16.9
22	*	8.97
23	7.67	10.6
24	11.65	16.5
25	*	17.8
26	12.30	10.6
27	1.41	2.12
28	*	0.005
29	13.37	13.5

*limited analysis

Nitrate

Nitrate (as N) concentrations ranged from 0.005 to 20.6 mg / ℓ for 28 ground water samples and one surface water sample. The mean concentration is 7.43 mg/ℓ which includes a sample analysis from the Portneuf River. Three of the 15 sites sampled in 1980 exhibit decreasing concentrations of nitrate in the ground water by 1990. Concentrations at the remaining 12 sites increased from 0.09 to 19.33 mg/ ℓ. The mean increase is 4.97 mg/ ℓ (n=12) over the 10 year period between sampling events. This increase is equivalent to an average increase of about 0.5 mg/ ℓ per year (Table 8). A regression analysis of nitrate versus chloride concentrations was made for wells 1 through 15 to determine the correlation between these two parameters. An R^2 of 0.86 was obtained, indicating there is a good correlation between nitrate and chloride at impacted sites. Both parameters are present in domestic waste water and are conservative, i.e. they move readily with ground water and are not readily adsorbed onto soil particles.

The rapid increase in nitrate concentrations in the majority of the wells is indicative of the presence of a continuing problem. The source of nitrogen appears to still be present.

Soils data obtained from the bottom of the old sewage lagoon indicate that this is not the source of the nitrogen that is loading the ground water system. Land use activities in the area suggest that septic systems are the source of nitrogen that is increasing nitrate concentrations in the ground water.

Vulnerability

The vulnerability or susceptibility of ground water to contamination is dependent upon several primary factors including depth to ground water, recharge, and soil types. Ground water vulnerability has not been mapped in this area. The fact that the ground water is contaminated indicates that it is susceptible to contamination although man's influence on the system can over-ride many natural barriers to contamination.

Conclusions

The rapid increase in nitrogen in the majority of the wells is an indication that the source of contamination is still present. Land use activities in the area suggest that septic systems are the source of nitrogen that is increasing nitrate concentrations in the ground water.

Soils data obtained from the bottom of the old sewage lagoon indicate that this is not the source of the nitrogen that is loading the ground water system. Land use activities in the area suggest that septic systems are the source of nitrogen that is increasing nitrate concentrations in ground water.

Acknowledgments

Many people made significant contributions to this report. The Eastern Idaho Regional Office, specifically George Spinner, initiated the study and requested assistance from the central office. The samples were collected by Joe Baldwin and Bruce Wicherski. Initial data that identified the problem were collected by the District VI Health Department in 1980.

Literature Cited

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Glossary of Terms and Acronyms

Background: [1]natural background ground water quality is ground water quality unaffected by man, or [2]site background ground water quality is the water quality directly upgradient of a site.

Hydrochemical distinctness: When the concentration(s) of a chemical constituent(s) in ground water at a site within a specified hydrogeologic unit makes the ground water identifiable (distnct) from ground water at another site in the same hydrogiologic unit, or the same site in a different hydrologic unit.

Hydrogeological: Pertaining to the hydrogeologic environment, its properties or characteristics.

IDEQ: Idaho Division of Environmental Quality.

Kjeldahl nitrogen: An analytical procedure which measures the amount of organic nitrogen and ammonia nitrogen.

Pesticide: Substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest. Also substance intended as a plant regulator, defoliant, or desiccant. Pesticides can accumulate in the food chain / or contaminant the environment if misused.

NOAA: National Oceanic and Atmospheric Administration.

Quartzite: A granulose metamorphic rock consisting essentially of quartz.

Quaternary: The second period of the Cenozoic era, following the Tertiary period; the Quaternary period occurred between 12,000,000 years ago and recent time.

Tertiary: The earlier of the two geologic periods in the Cenozoic era; the Tertiary period occurred between 70,000,000 and 105,000,000 years ago.

Appendix

The following Appendix shows the results of all the data collected for the Black Cliffs Ground Water Study. On the table, BCS indicates the samples were collected for the Black Cliffs Ground Water Study, and SL indicates the samples were analyzed at the Idaho Bureau of Laboratories.

DEQ Ground Water Quality Technical Reports

Snake Plain Aquifer Technical Report
September 1985

The Rathdrum Prairie Aquifer Technical Report
August 1988

Ground Water Contamination and Monitoring Activities on the Rathdrum Prairie Aquifer.
April 1991

Ground Water Vulnerability Assessment Snake Plain, Southern Idaho.
April 1991

Annual Ground Water Contamination Report, State Fiscal Year 1991
1991

Appendices to the Annual Ground Water Contamination Report, State Fiscal Year 1991
1991

Ground Water and Soils Reconnaissance of the Lower Payette Area, Payette County, Idaho.
1993

Idaho Snake-Payette Rivers Hydrologic Unit Ground Water Quality Assessment.
1993

SITE NUMBER	WELL ID (T,R,SEC, Q, #)	ELEV. (FT.)	CO. CODE	PROG CODE	LAB USED	DATE (YYMMDD)	LAB CA (MG/L)	LAB MG (MG/L)	LAB NA (MG/L)
01	07S35E16BBC01	4600	BANNOCK	BCS	SL	901002	95.000	37.500	34.000
02	07S35E08ABB01	4495	BANNOCK	BCS	SL	901001	77.000	31.000	34.000
03	07S35E08CAA01	4555	BANNOCK	BCS	SL	901003	130.000	70.000	81.000
04	07S35E08CAD01	4550	BANNOCK	BCS	SL	901003	37.000	15.500	52.000
05	07S35E16BBB01	4610	BANNOCK	BCS	SL	901002	61.000	24.000	24.000
06	07S35E08BAA01	4475	BANNOCK	BCS	SL	901001	78.000	28.500	31.000
07	07S35E21DAC01	4490	BANNOCK	BCS	SL	901001	68.000	32.500	43.000
08	07S35E16BAC01	4630	BANNOCK	BCS	SL	901002	73.000	15.000	54.000
09	07S35E16BCB01	4590	BANNOCK	BCS	SL	901002	104.000	40.500	33.000
10	07S35E17ABD01	4495	BANNOCK	BCS	SL	901001	82.000	34.000	51.000
11	07S35E09CBB01	4760	BANNOCK	BCS	SL	901002	28.000	19.500	106.000
12	07S35E16CAA01	4620	BANNOCK	BCS	SL	901002	61.000	42.000	42.000
13	07S35E08DBC01	4553	BANNOCK	BCS	SL	901003	168.000	70.000	97.000
14	07S35E08CAB01	4550	BANNOCK	BCS	SL	901003	104.000	44.000	77.000
15	07S35E08DCD01	4565	BANNOCK	BCS	SL	901002	144.000	56.000	106.000
16	07S35E 08BBC01	4590	BANNOCK	BCS	SL	901002			66.000
17	07S35E16BBB02	4640	BANNOCK	BCS	SL	901002			41.000
18	07S35E16BBD01	4620	BANNOCK	BCS	SL	901002			56.000
19	07S35E16BCA01	4610	BANNOCK	BCS	SL	901002			58.000
20	07S35E08CAA02	4553	BANNOCK	BCS	SL	901002			31.000
21	07S35E08CAD02	4550	BANNOCK	BCS	SL	901002			120.000
22	07S35E16BCD01	4590	BANNOCK	BCS	SL	901001			61.000
23	07S35E17AAD01	4580	BANNOCK	BCS	SL	901002			69.000
24	07S35E16BBB03	4620	BANNOCK	BCS	SL	901002			48.000
25	07S35E08DDC01	4580	BANNOCK	BCS	SL	901002			55.000
26	07S35E09CCC01	4630	BANNOCK	BCS	SL	901002			46.000
27	07S35E16BAD01	4675	BANNOCK	BCS	SL	901003			40.000
28	07S35E08DBC02	4555	BANNOCK	BCS	SL	901003			46.000
29	07S35E08CAD03	4553	BANNOCK	BCS	SL	901002			58.000

LAB K (MG/L)	SITE NUMBER	LAB HCO3 (MG/L)	LAB CL (MG/L)	LAB S04 (MG/L)	LAB NO3 (MG/L)	LAB PH (PH UNITS)	LAB COND (UMHOS/CM)	FIELD PH (PH UNITS)
3.400	01	179.000	117.000	72.000	10.800	7.100	810.000	7.650
5.500	02	278.000	48.000	38.000	1.490	7.200	648.000	7.440
2.900	03	183.000	260.000	153.000	9.220	7.100	1297.000	7.450
4.400	04	204.000	31.000	21.000	0.134	7.400	459.000	7.790
4.100	05	201.000	43.000	29.000	1.790	7.200	513.000	7.610
5.300	06	276.000	41.000	36.000	1.430	7.100	630.000	7.450
8.500	07	292.000	52.000	47.000	0.413	7.900	630.000	8.480
10.600	08	206.000	59.000	90.000	0.358	7.200	612.000	7.570
5.400	09	207.000	145.000	65.000	8.250	7.200	835.000	7.600
7.200	10	277.000	83.000	61.000	3.180	7.200	735.000	7.360
6.000	11	230.000	47.000	99.000	<0.005	7.400	612.000	7.960
2.500	12	147.000	133.000	63.000	3.770	7.400	735.000	7.830
8.400	13	210.000	341.000	126.000	18.700	7.300	1645.000	7.300
5.500	14	236.000	179.000	104.000	8.440	7.400	918.000	7.500
8.000	15	229.000	296.000	114.000	13.500	7.400	1413.000	7.530
	16		213.000		12.800	7.200	1198.000	7.380
	17		91.000		2.850	7.400	689.000	7.690
	18		45.000		0.360	7.200	648.000	7.590
	19		297.000		20.600	7.300	1361.000	7.530
	20		39.000		0.305	7.400	501.000	7.760
	21		352.000		16.900	7.200	1574.000	7.360
	22		191.000		8.970	7.300	942.000	7.530
	23		241.000		10.600	7.300	1185.000	7.480
	24		178.000		16.500	7.300	1002.000	7.570
	25		234.000		17.800	7.400	1125.000	7.550
	26		183.000		10.600	7.400	1030.000	7.610
	27		54.000		2.120	7.500	648.000	7.550
	28		56.000		<0.005	7.500	501.000	7.400
	29		208.000		13.500	7.300	1148.000	7.360

FIELD COND (UMHOS/CM)	SITE NUMBER	FIELD TEMP (DEG.C.)	LAB TOTAL P (MG/L)	BACTERIA TOTAL COL. (/100ML)	AGENCY DATA	LOCALE
885.000	01	15.300	<0.05	1.000	GW/DEQ	POCATELLO
722.000	02	12.600	<0.05	1.000	GW/DEQ	POCATELLO
1446.000	03	12.300	<0.05	1.000	GW/DEQ	POCATELLO
508.000	04	15.900	<0.05	1.000	GW/DEQ	POCATELLO
604.000	05	16.500	<0.05	2.000	GW/DEQ	POCATELLO
702.000	06	12.500	<0.05	21.000	GW/DEQ	POCATELLO
742.000	07	17.600	<0.05		GW/DEQ	POCATELLO
717.000	08	16.500	<0.05	1.000	GW/DEQ	POCATELLO
958.000	09	15.000	<0.05	1.000	GW/DEQ	POCATELLO
856.000	10	14.500	<0.05	1.000	GW/DEQ	POCATELLO
758.000	11	16.800	<0.05	1.000	GW/DEQ	POCATELLO
827.000	12	14.400	<0.05	1.000	GW/DEQ	POCATELLO
1700.000	13	12.200	<0.05	60.000	GW/DEQ	POCATELLO
1160.000	14	17.700	<0.05	1.000	GW/DEQ	POCATELLO
1551.000	15	14.500	<0.05	1.000	GW/DEQ	POCATELLO
1314.000	16	13.800	<0.05	1.000	GW/DEQ	POCATELLO
783.000	17	16.300	<0.05	1.000	GW/DEQ	POCATELLO
721.000	18	15.900	<0.05	2.000	GW/DEQ	POCATELLO
1515.000	19	15.900	<0.05	1.000	GW/DEQ	POCATELLO
600.000	20	14.300	<0.05	1.000	GW/DEQ	POCATELLO
1750.000	21	14.200	<0.05	1.000	GW/DEQ	POCATELLO
1122.000	22	16.700	<0.05	1.000	GW/DEQ	POCATELLO
1352.000	23	13.700	<0.05	1.000	GW/DEQ	POCATELLO
1214.000	24	16.100	<0.05	1.000	GW/DEQ	POCATELLO
1322.000	25	16.600	<0.05	1.000	GW/DEQ	POCATELLO
1187.000	26	16.400	<0.05	1.000	GW/DEQ	POCATELLO
725.000	27	17.700	<0.05	1.000	GW/DEQ	POCATELLO
598.000	28	16.300	<0.05	1.000	GW/DEQ	POCATELLO
1750.000	29	14.200	<0.05		GW/DEQ	POCATELLO