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Ground Water Investigation of Nitrate and Pesticides in Northwest Ada County, Idaho

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Ground Water Investigation of Nitrate and Pesticides in Northwest Ada County, Idaho

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Abstract

A cooperative ground water study was conducted by the Division of Environmental Quality Boise Regional Office (DEQ) and the Idaho State Department of Agriculture (ISDA) in the northwest Ada County area. In February and March 1997, ten domestic wells were sampled to determine their ground water quality. These ten wells are located in an area of known nitrate and pesticide contamination. The ground water quality of a majority of these wells was unknown by both agencies and it was not known if the well owners were aware of their ground water quality.

Field parameters were measured at each site, prior to collecting samples. All samples were analyzed for total coliform, nutrients, volatile organic compounds, and pesticides. There were four wells with one nutrient, nitrate, with levels greater than 10 mg/l which is the drinking water Maximum Contaminant Level (MCL) and is above the State's Ground Water Standard. Those four wells, also, had detections of pesticide and volatile organic compounds. Three of these impacted wells have depths that are 120 feet deep or less, the depth of the fourth well was thought to be 200-240 feet deep according to the well owner. These wells are receiving ground water from the unconfined, shallow water bearing zone which has known ground water impacts, except, possibly the fourth well.

Introduction

Ground water contamination has been detected in an area of Ada County northwest of Eagle, Idaho. Monitoring data in the area (mostly from domestic wells) indicates that the shallow ground water zones (less that 150 feet deep) are impacted by nitrate and agricultural chemicals including dacthal, atrazine, 1,2-dichloropropane, and 1,2,3-trichloropropane. The project area is roughly two and one-half square miles in size. A majority of the study area is situated on permeable sand and gravel alluvial fan deposits. The specific source(s) of the ground water impacts has not been determined although the presence of agricultural pesticides indicates an impact from agricultural practices. Other potential contributors to ground water contamination in the area include septic systems, residential use of chemicals, a feedlot, and a municipal wastewater rapid infiltration treatment system. Figure 1, page 2, shows the areas of known nitrate and dacthal impacts.

Purpose and Objectives

The purpose of this study was to collect ground water quality information from domestic wells that had not previously been sampled by a resource agency. Several other domestic wells in the area have been sampled previously by DEQ, ISDA, and the Idaho Department of Water Resources (IDWR).

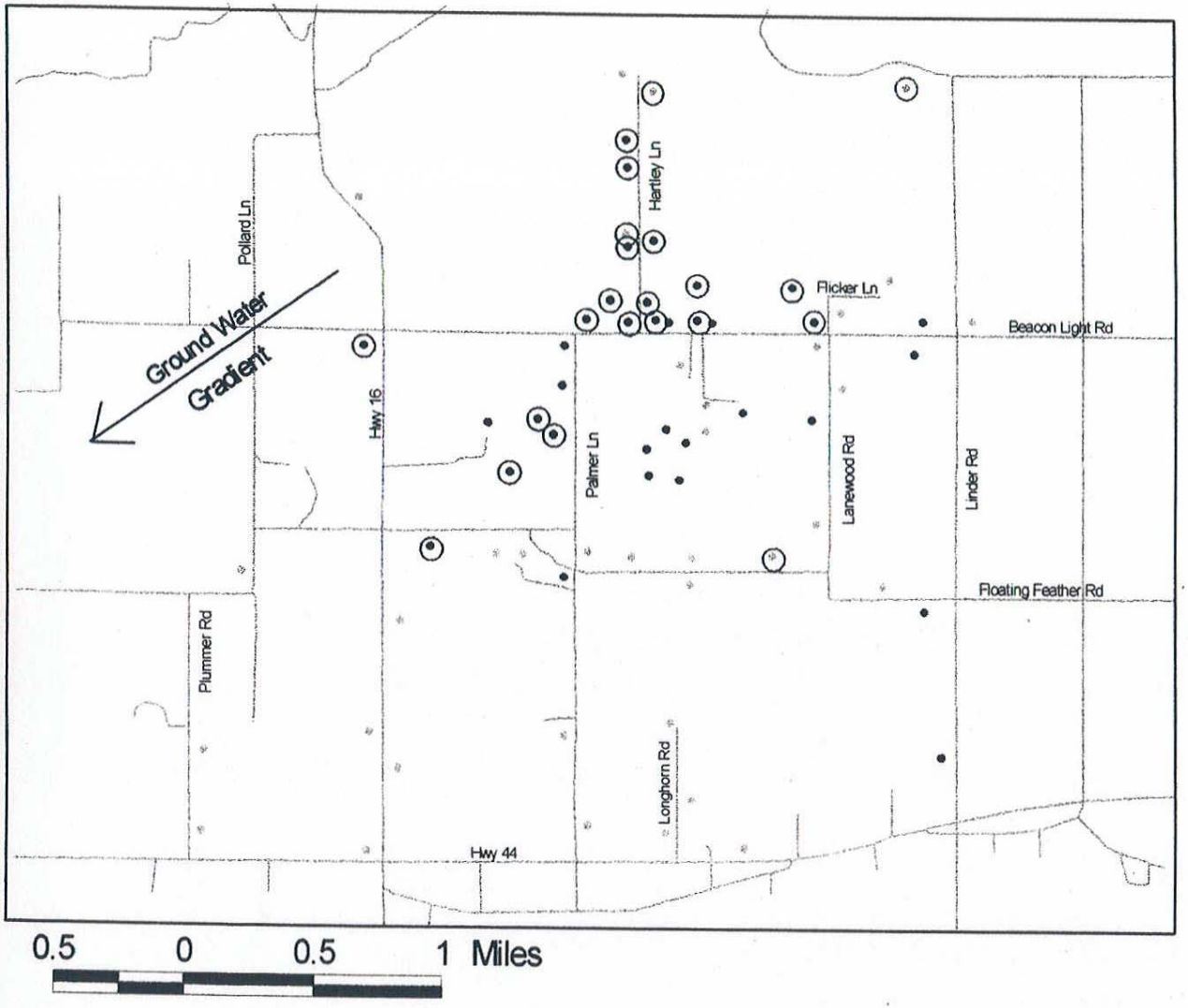
The objectives of this study were to use the data to evaluate the horizontal extent of the impacted area and to provide a basis for issuing health warnings or advisories to affected well owners. Data will also be used to determine the need for alternative water supplies for the affected residences.

Literature Review

DEQ conducted a nitrate study of the area in April 1990. This study area of approximately seven square miles showed a large range of nitrate results, from non-detect (<0.05 mg/l) to 62 mg/l. The well depths varied from 69 feet to 300 feet (with known well depths).

In July 1991, IDWR's Statewide Ground Water Quality Monitoring program sampled a well near the corner of Beacon Light Rd and Linder Rd that had volatile organic compounds (VOCs). The VOCs detected were 1,2-dichloropropane and 1,2,3-trichloropropane. As a follow up to these detections, DEQ sampled an adjacent well and 1,2-dichloropropane was detected.

These constituents were recognized by ISDA as compounds that are present in some pesticides. In December 1991, ISDA conducted a phase I study which sampled eight wells in the area for on-site measurements of temperature, pH, specific conductance and nitrate. In February 1992 these



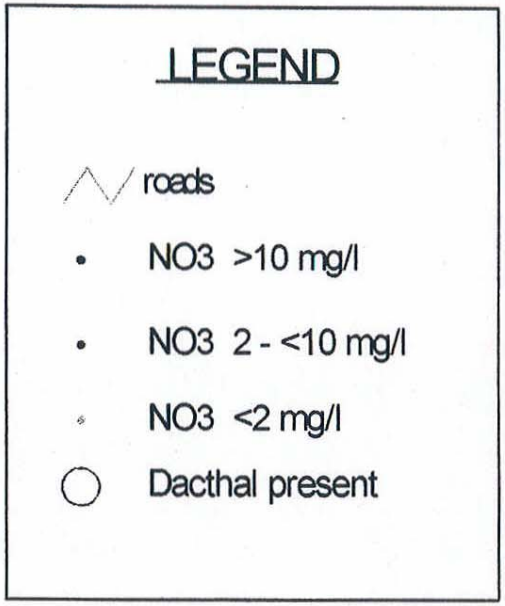


Figure 1. NW Ada County Nitrate (NO3) and Dacthal Results

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eight wells were re-sampled and the laboratory analyses detected 1,2-dichloropropane in two of the wells. A phase II study was conducted to determine the extent of the contamination. Ten additional wells were sampled in June 1992, for the phase II study, where 1,2-dichloropropane and 1,2,3-trichloropropane were detected in four of these wells. There were two recommendations from this study: 1) wells completed in the upper most water bearing zones should be tested for 1,2-dichloropropane, 1,2,3-trichloropropane and nitrate, and 2) more stringent well drilling standards be installed for future wells in the area.

ISDA conducted another ground water study in 1995. This study concentrated on nitrate, pesticides, and VOCs. There were thirty-nine wells sampled for this study, eighteen which had pesticide detections with sixteen of the eighteen wells, also, having positive VOC detections.

Also in 1995, some wells in this area were sampled as part of a cooperative regional ground water study that was being conducted by DEQ and the U.S. Geological Survey. The wells in this area were the only ones in Ada and Canyon Counties where nitrate, Dacthal, 1,2-dichloropropane and 1,2,3-trichloropropane were all detected in the same wells.

Study Area

The study area is located in Northwest Ada County. The wells are located in Township 5 North, Range 1 West, sections 34 and 35, and Township 4 North, Range 1 West, sections 2-4. Roads that encompass this area are Linder Rd on the east, Floating Feather on the south, Hwy 16 on the west, and the foothills on the north. Figure 1, page 2, shows these boundaries.

Climate

The valley has a semi-arid, temperate climate characterized by cool, wet winters and warm, dry summers (Dion 1972). The mean annual temperature is 51 degrees Fahrenheit. The mean annual winter and summer temperature is 33 degrees Fahrenheit and 71 degrees Fahrenheit, respectively. The mean annual precipitation is 11 inches; a majority of the precipitation falls during the winter as snow.

Soils

The soil survey of Ada County Area, Idaho (USDA Ada SCS, 1980) identifies two general soil map units in the area. The vast majority of the area consists of the Notus-Moulton-Falk map unit which occurs on flood plains, low terraces, and drainageways. The soils in this map unit are nearly level to sloping, poorly drained to well drained and very deep.

A small area in the northern portion of the study area consists of the Cashmere-Tindahay map

unit. This unit occurs on lacustrine foothills. The soils in this unit are nearly level to steep, well drained to somewhat excessively drained and very deep.

Geology and Hydrogeology

Driller's reports indicate that the hydrogeology of the area consists of an upper and lower water bearing zone composed of alternating layers of clay and sand, separated by a thick clay layer. Such a stratigraphic sequence is indicative of fluvial deposition. A review of the geology and geomorphology in the Boise Valley, by Kurt Othberg (1994), describes the area as sandy alluvium of side-stream valleys and gulches to sand of incised alluvial fans.

The ground water in the uppermost layer of the upper water bearing zone occurs under water table conditions and is encountered at depths ranging from 5 to 20 feet. This upper layer consists of a thick sequence of clayey sand, sand and gravel which is underlain by a 10 to 20 foot thick clay layer. Wells in the area range in depth from 60 to 300 feet. Most are less than 150 feet deep and pump ground water from the upper water bearing zone. A significant potential of ground water recharge in the upper water bearing zone would be from the intricate network of irrigation ditches and canals.

The direction of ground water flow in the upper water bearing zone is to the southwest, towards the Boise River (Thomas and Dion, 1974). The direction of ground water flow in the lower water bearing zone is unknown, but surmised to be similar to the upper water bearing zone. Aquifer pump tests conducted by the Eagle Sewer District in Township 4 North, Range 1 West, section 3 yielded hydraulic conductivities in the upper water bearing zone to range from 250 to 550 ft/day.

Land Use

The study area is predominately rural. The residents own acreage that they farm and/or raise livestock. They are reliant upon their own wells for their domestic water use and individual septic systems for their household wastewater. They have access to surface water for flood or sprinkler irrigation.

There are a few businesses located in the study area. There is a large commercial stockyard that has a history of wasterwater management problems. South of this stockyard is where the Eagle Sewer District has their rapid infiltration basins. Also in the area, is a family owned dairy and hog farm. Figure 2, page 5, shows the location of the businesses in the area.

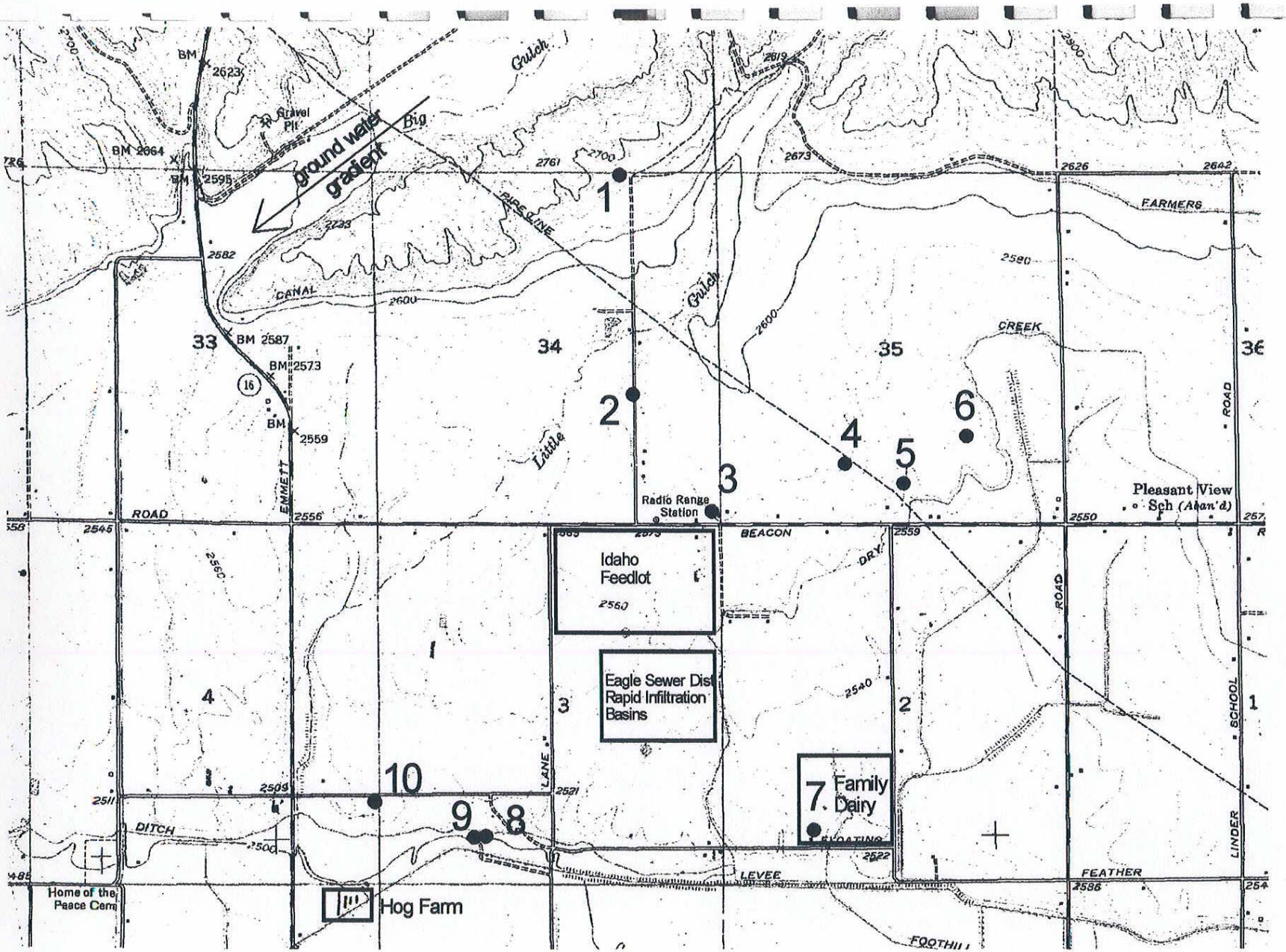

Figure 2. Location of Current Businesses*

*these businesses are surrounded by agricultural crop production

Methods and Materials

Nine of the ten wells were sampled during two consecutive days on March 11 and 12, 1997, the tenth well had be sampled three weeks earlier on February 20, 1997 for the well owners convenience. One duplicate ground water sample and one trip blank for each day of sampling was collected as quality control measures for each sampling event. Every well was tested for total coliform and fecal coliform. The nutrients which were analyzed at each well included ammonia, nitrate, total Kjeldahl nitrogen, and total phosphorus. Chloride was, also, analyzed at every well. The sampling parameters for VOCs and pesticides are listed in Table 1, below, and Table 2, page 7, respectively. Ground water sampling procedures and quality assurance/quality control can be found in appendix A and B, pages 16-19.

Table 1. List of VOCs analyzed by the State of Idaho Bureau of Laboratories.

Method: EPA 502.2/8021

Benzene	1,2-Dichlorobenzene	Methylene chloride
Bromobenzene	1,3-Dichlorobenzene	Naphthalene
Bromochloromethane	1,4-Dichlorobenzene	n-Propylbenzene
Bromodichloromethane	Dichlorodifluoromethane	Styrene
Bromoform	1,1-Dichloroethane	1,1,1,2-Tetrachloroethane
Bromomethane	1,2-Dichloroethane	1,1,2,2-Tetrachloroethane
n-Butylbenzene	1,1-Dichloroethene	Tetrachloroethene
sec-Butylbenzene	cis-1,2-Dichloroethene	Toluene
tert-Butlybenzene	trans-1,2-Dichloroethene	1,2,3-Trichlorobenzene
Carbon Tetrachloride	1,2-Dichloropropane	1,2,4-Trichlorobenzene
Chlorobenzene	1,3-Dichloropropane	1,1,1-Trichloroethane
Chloroethane	2,2-Dichloropropane	1,1,2-Trichloroethane
Chloroform	1,1-Dichloropropene	Trichloroethene
Chloromethane	cis-1,3-Dichloropropene	Trichlorofluoromethane
2-Chlorotoluene	trans-1,3-Dichloropropene	1,2,3-Trichloropropane
4-Chlorotoluene	Ethylbenzene	1,2,4-Trimethylbenzene
Dibromochloromethane	Hexachlorobutadiene	1,3,5-Trimethylbenzene
1,2-Dibromoethane	Isopropylbenzene	Vinly Chloride
1,2-Dibromomethane	p-Isopropyltoluene	Xylenes (total)

1,2-Dibromo-3-chloropropane

Table 2. List of pesticides analyzed by the University of Idaho Laboratory.

Method 515.1

Acifluorfen	MCPA	4-Nitrophenol
Bentazon	Dicamba	Pentachlorophenol
Chloramben	3,5-Dichloroben. Acid	Picloram
2,4-D	Dichloroprop	2,4,5-T
Dalapon	Dinoseb	2,4,5-TP
2,4-DB	Dacthal (DCPA)	

Method: EPA 507

Alachlor	Ethoprop	Prometon
Ametryn	Fenamiphos	Prometryn
Atraton	Fenarimol	Pronamide
Atrazine	Hexazinone	Propazine
Bromacil	Merphos	Simazine
Butachlor	Methyl Paraoxon	Simetryn
Butylate	Metolachlor	Stirofos
Carboxin	Metribuzen	Tebuthiuron
Chlorpropham	Mevinphos	Terbacil
Cycloate	MGK-264	Terbufos
Diazinon	Molinate	Terbutryn
Dichlorvos	Napropamide	Triademefon
Diphenamid	Norflurazon	Tricyclazole
Disulfoton	Pebulate	Vernolate
EPTC		

Method: Non-Reg Ops + LDL

Azinphos Methyl	Cyanazine	Methyl Parathion
Benefluralin	Ethalflualin	Parathion
Benthiocarb	Fonofos	Pendemethalin
Chlorpyrifos	Malathion	Triallate

Results and Discussion

Figure 3, page 9, shows the locations of the wells which were sampled for this study. The areal extent of the ten wells encompasses approximately two and one-half square miles.

It is very important to have the well driller reports for the wells in a study in order to have a basic knowledge of the construction of the well and the lithology that the well was drilled through during construction. Regretfully, when a study area has specific boundaries of interest it is not uncommon that the well driller reports for all wells in the area were never submitted to Idaho Department of Water Resources (IDWR), which is the agency where such records are kept. Only three well driller reports, (sites #2, #5, and #6) could be found at IDWR.

The well driller report for site #5 states that the well depth is 231 feet deep with a bentonite seal from the ground surface down 20 feet. The lithology on the well driller report shows numerous clay layers that were drilled through when the well was developed. Site #6 has similar characteristics, the well is 245 feet deep with a 28 foot bentonite surface seal and numerous clay layers.

The well driller report for site #2 is distinctly different from site #5 and #6. The well driller report for site #2 states the well as being 74 feet deep with the well cuttings being used for an 18 foot surface seal. The lithology of this well is comprised of sandy clays, sands, and coarse sand/gravel.

Previous data indicates that ground water has been impacted in the shallow water bearing zones of the unconfined sandy soils of the alluvial fan of Little Gulch Creek. It appears that site #2 is located within those sandy soils of the shallow water bearing zone. Whereas the soil types appear to be of a different geologic composition where site #5 and #6 are located.

There is quite a difference in the ground water results for Site #5 and #6, compared to site #2. Site #5 and #6 had nitrate results of 1.79 and 1.8 mg/l, respectively, and no detections of pesticides or VOCs. Site #2 had a nitrate level of 45.2 mg/l and detections of dacthal, atrazine, 1,2-dichloropropane, and 1,2,3-trichloropropane.

A similar analogy is reveled when reviewing the data on the wells that did not have well driller reports available. Site # 3 and #10 are reported by the owner's to be shallow wells. The owner stated that the well at site #3 is 65 feet deep and the well at site #10 is 120 feet deep. Both of these wells have been used for at least twenty years which could make the surface seal questionable and neither of the wells are flowing artesian (indicating that the well was drilled into the shallow, unconfined water bearing zone). The water quality of these two wells shows impacts from nitrate, dacthal (atrazine and metribuzen at site #3), and 1,2,3-trichloropropane (1,2-dichloropropane at site #3).

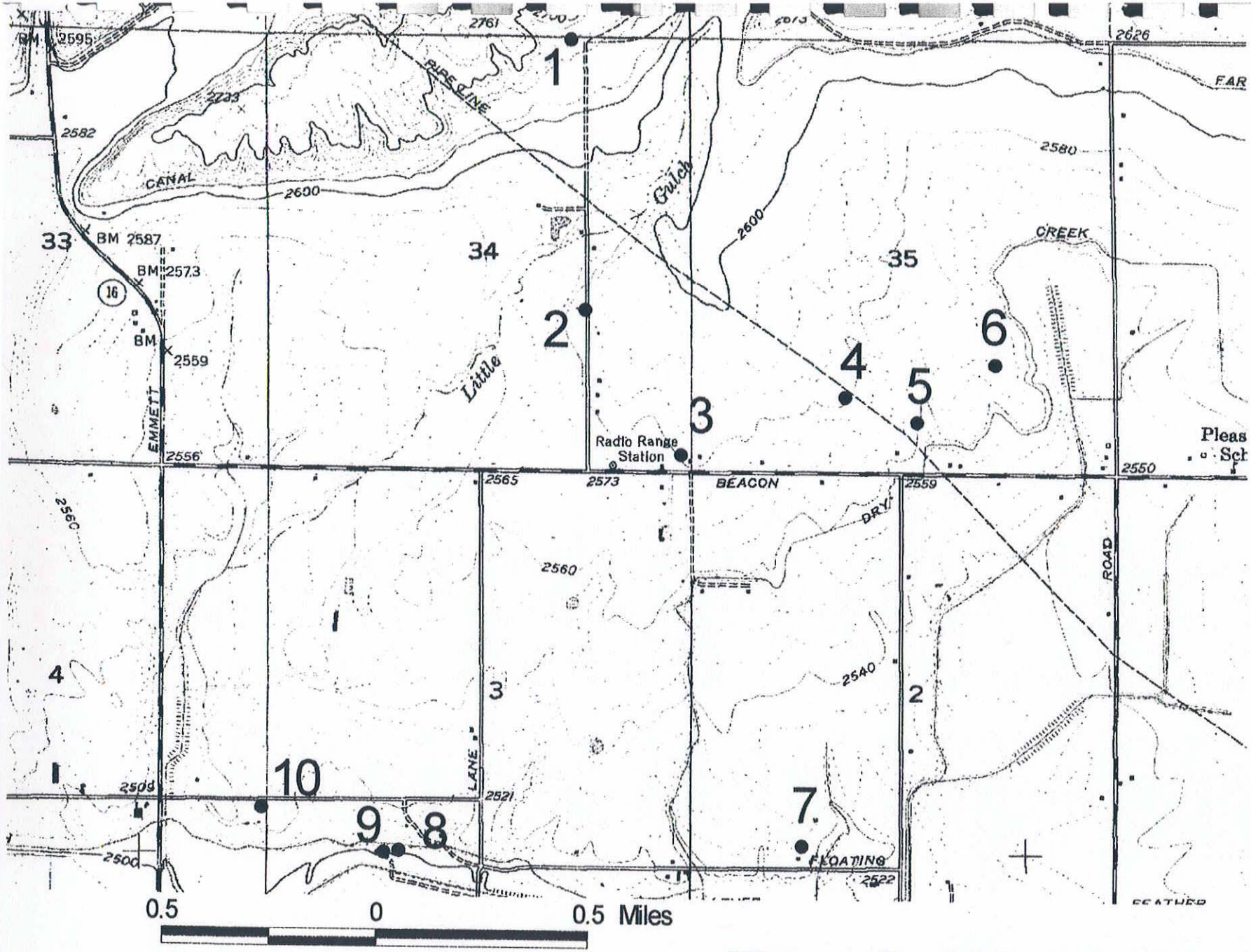

Figure 3. NW Ada County Wells Sampled in Spring 1997

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The owner of the well at site #1 states that this well is 351 feet deep. The depths of the wells at site #8 and 9 were unknown by the owner, but both wells are artesian (indicating that the wells are drilled into a deeper, confined water bearing zone). The ground water quality of these three wells are significantly different from the wells at sites #3 and #10. The nitrate levels at sites #1, #8, and #9 are 0.362 mg/l, 0.093 mg/l, and 0.1 mg/l, respectively. There were no detections of pesticides or VOCs in these three wells.

The divergence from the above trend is found with sites #4 and #7. The well owner states that their well at site #4 is 200-240 feet deep and the well at site #7 is 240 feet deep. Neither of these wells are known to be artesian and site #4 is only about 1000 feet away from site #5 (which the results did not show ground water impacts) . Even though these wells (sites #4 and #7) are reported to be deeper wells the ground water quality shows impacts. The nitrate levels was 16.7 mg/l at site #4 with pesticide and VOC detections. Site #7 has a nitrate concentration of 0.253 mg/l with a low level of dacthal detected. Dacthal is the only constituent in the results that show an impact to the ground water quality at site #7.

Figure 4, page 11, shows the location of the wells with elevated nitrate levels. Figure 5, page 12, shows the location of the wells with dacthal detections. Table 3, page 13, shows the date the samples were taken, the field parameters at each site, and a list of the constituents which had results above the laboratory detection level for any of the wells sampled.

Conclusion and Recommendations

In conclusion, this study concurs with the previous studies by the Idaho State Department of Agriculture that there are ground water impacts in the shallow, unconfined, water bearing zones within the alluvial fan of Little Gulch Creek. The soils in this alluvial fan have an extremely fast percolation rate from the ground surface down to the ground water table.

The current land uses in this area may be following recommended guidelines for their operations, but the impacts to the ground water portrays problems with the current land uses as a possible consequence of the type of soil. The data shows the problems within the Little Gulch alluvial fan are probably occurring from the over application of fertilizers, pesticides/herbicides, and wastewater from the feedlot and the rapid infiltration basins. The other conceivable factor compounding the ground water impacts is from the close proximity and, consequently, concentration of the impacted ground water in the vicinity from agricultural production, the feedlot operation, and the rapid infiltration basins.

Based upon the historic and current information gathered for this area the following recommendations are:

1) Reiterate the Idaho State Department of Agriculture's recommendation for the well owners

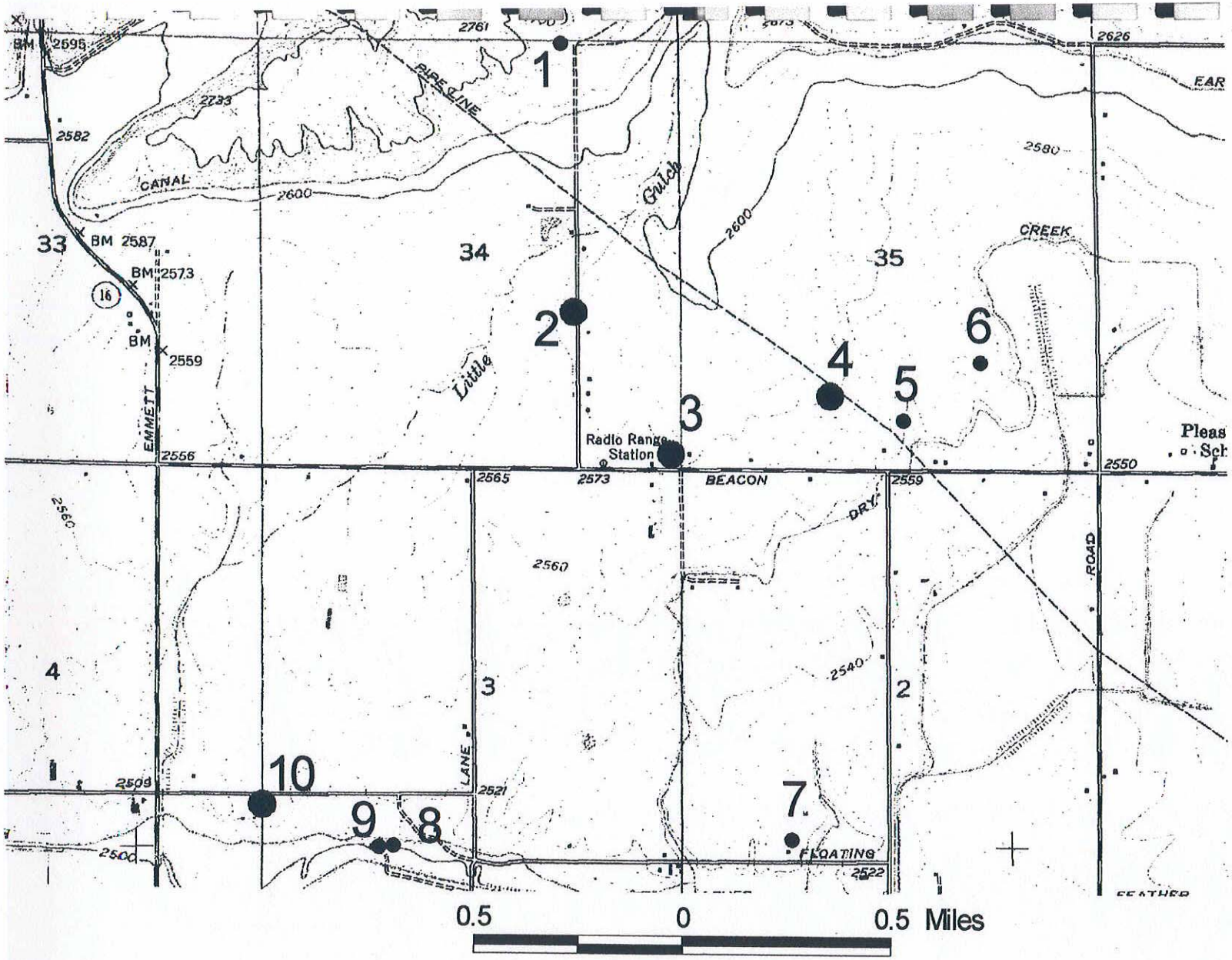

Figure 4. NW Ada County Spring 1997 Nitrate Results

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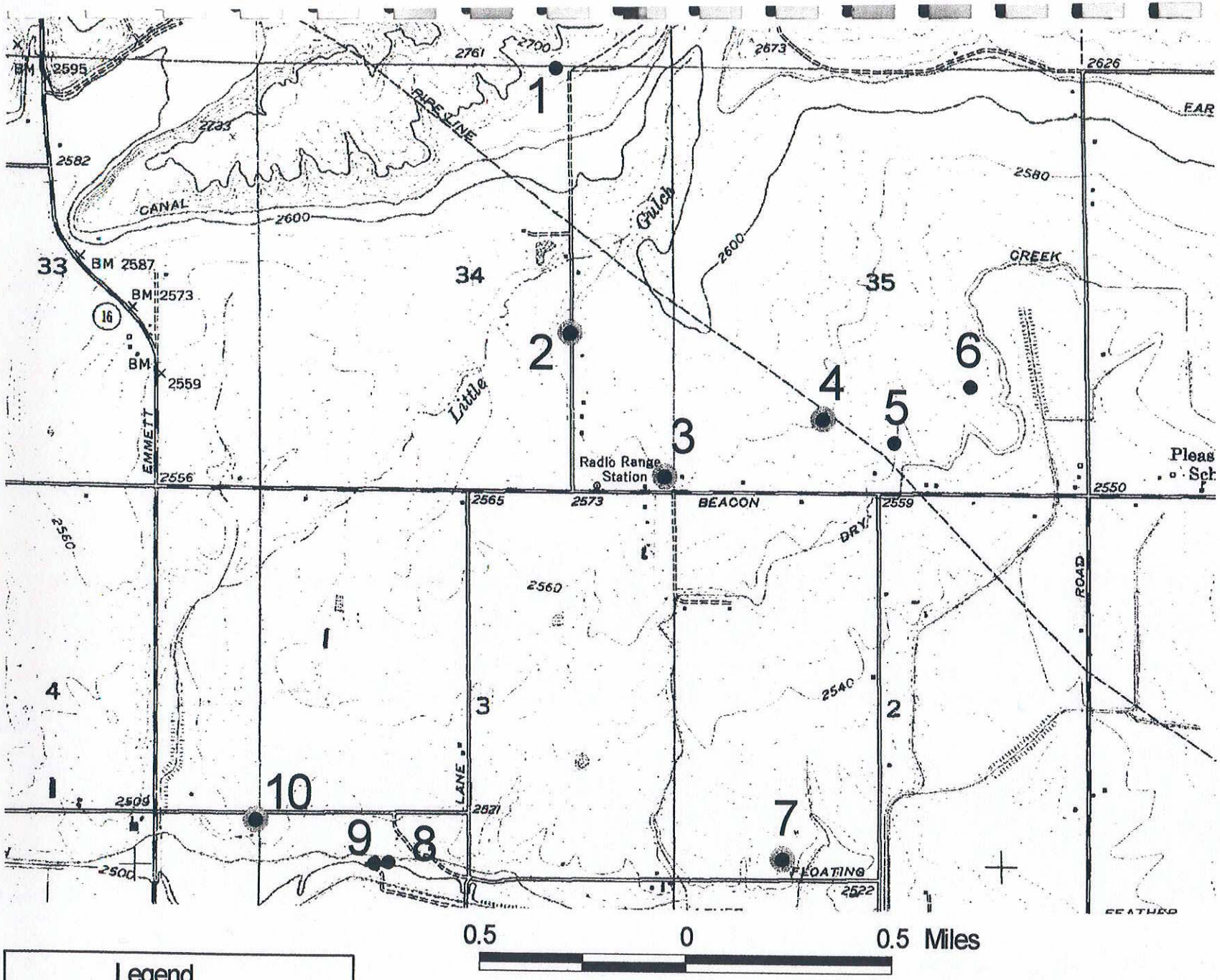

Figure 5. NW Ada County Spring 1997 Dacthal Results

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Table 3. NW Ada County March 1997 Sample Results

Site #	Date Sampled	Total Coliform col/100ml	Chloride mg/l	Nitrogen NH4 mg/l as N	Total Kjeldahl Nitrogen mg/l as N	Nitrogen NO2+NO3 mg/l as N	Total Phosphorus mg/l	Dacthal ug/l	Atrazine ug/l	Metribuzen ug/l	1,2-dichloro propane ug/l	1,2,3-tri-chloro-propane ug/l	Water Temp °C	pH standard units	Specific Conductance US/CM
1	03/12/97	absent	7.1	0.01	ND	0.362	0.05	ND	ND	ND	ND	ND	15.6	7.44	245
2	03/12/97	absent	57.1	0.009	0.09	45.2	0.21	42	0.019	0.19	0.62	12.4	13	6.97	1025
3	03/11/97	present	17.9	0.007	0.15	12.4	0.22	3.1	0.014	0.06	ND	1.6	13.9	7.32	509
4	03/12/97	absent	17.9	0.01	ND	16.7	0.24	23	0.054	0.14	0.41	6.73	12.5	7.36	699
5	03/11/97	absent	8.9	0.011	ND	1.79	ND	ND	ND	ND	ND	ND	14.2	7.28	476
6	03/11/97	absent	8	0.006	ND	1.8	ND	ND	ND	ND	ND	ND	13.6	8.56	444
7	03/12/97	absent	1.8	0.007	ND	0.253	0.06	0.25	ND	ND	ND	ND	15	7.33	208
8	03/11/97	absent	3.6	0.008	ND	0.093	0.06	ND	ND	ND	ND	ND	14.8	7.37	213
9	02/20/97	present	2.8	0.005	ND	0.1	0.05	ND	ND	ND	ND	ND	14.4	7.44	214
10	03/12/97	absent	10.7	0.008	ND	10.6	0.08	0.022	ND	ND	ND	0.18	14.1	7.09	445

LEGEND

ND = non-detect

non-detect levels are:

Total Kjeldahl Nitrogen as N = <0.05 mg/l
Total Phosphorus = <0.05 mg/l
Dacthal = <0.008 ug/l
Atrazine = <0.013 ug/l
Metribuzen = <0.015 ug/l
1,2-dichloropropane = <0.21
1,2,3-trichloropropane = <0.21 ug/l

with elevated nitrates (greater than 10 mg/l) to obtain alternatives for domestic water sources or treatments.

2) Request that the Idaho Department of Water Resources thoroughly review well abandonment and construction practices in the Northwest Ada County area to prevent cross contamination of the impacted shallow water bearing zone into the deeper water bearing zone.

3) The newly adopted ground water rules by the Department of Health and Welfare, Division of Environmental Quality (IDAPA 16.01.11.400.03) addresses what shall take place when ground water contamination exceeds a ground water standard. The study area exceeds the ground water standard for nitrate. The following is the wording from the ground water rules: "The discovery of any contamination exceeding a ground water standard that poses a threat to existing or projected future beneficial uses of ground water shall require appropriate actions, as determined by the Department, to prevent further contamination. These actions may consist of investigation and evaluation, or enforcement actions if necessary to stop further contamination or clean up existing contamination, as required under the Environmental Protection and Health Act, Section 39-108, Idaho Code."

The new ground water rules should, at a minimum, be the impetus for the agency/interagency combined efforts for implementing "Best Management Practices" for the land uses in the area, such as:

a) The Idaho State Department of Agriculture need to work with the area farmers to establish agronomic rates for fertilizer and pesticide/herbicide use.

b) The Idaho State Department of Agriculture, the Environmental Protection Agency, and the Division of Environmental Quality need to work with the Idaho Feedlot to establish agronomic rates for operation's wastewater application. Also, determine the integrity of the seal in the wastewater lagoons.

c) The Division of Environmental Quality and the Eagle Sewer District need to determine if the rapid infiltration basins are contributing to the nitrate concentration in the ground water of the area.

4) Periodic ground water sampling of the wells at sites #2 and #10 by the Division of Environmental Quality. Site #2 is the most impacted well from the agricultural practices. Site #10 appears the be the most downgradient well of the ground water impacts and past three ground water sampling episodes have shown a significant increase in the nitrate concentration. These two wells could provide the trend ground water quality information for this area.

Acknowledgment

I want to express a sincere thank you to all the well owners who granted permission to enter their property and sample their well water. Thanks, also, for the assistance from my partners Rob Howarth, DEQ, and Gary Bahr, ISDA, in helping to keep everything running smoothly. And to My DEQ co-workers Anjanette Cude, Ron Lane, Rob Howarth, Dean Yashan, and Ed Hagan for diligently reviewing and commenting on the draft report. Also to Gary Bahr, ISDA, for diligently reviewing and commenting on the draft report.

APPENDIX A

Ground Water Sampling Procedures

At each site, the outside faucet or hydrant located closest to the well was chosen as the sampling location. A hose was connected to the faucet or hydrant with a flow splitter and a short section (approximately 5 feet) of hose placed at the end. The faucet or hydrant was then turned on the full amount possible. The longer, or main hose was, given the majority flow of water with a controlled amount of water flowing into a bucket from the shorter hose.

A bucket was used to best imitate a flow-through chamber in order to best represent the zone or zones of the aquifer in which the well was installed. The meters used to collect the field parameter data were placed in the bucket. The meters used were for measuring temperature, pH, and specific conductance.

Measurements with the meters were taken about every five minutes and recorded on a field sheet. Sampling was not conducted until the meters had stabilized for at least two measurements. The stabilized field parameter measurements indicate chemical stability of the ground water entering the well and directly being pumped out. This was important in order to sample for aquifer characteristics versus the water that was allowed to sit in the well casing, where the water chemistry could be altered by the materials of the well casing and the atmosphere.

After the chemical stability of the ground water had been determined, the hoses were removed. The faucet or hydrant was allowed to run for 10-15 seconds prior to the samples being collected. Latex gloves were worn in order to eliminate cross contamination from the hands.

A bacteria sample was collected in a sterile 250 ml polyethylene bottle, the bottle was filled to the neck and tightly capped. Care was taken to not touch the faucet or hydrant with the sample bottle for all samples collected.

Two 40 ml glass bottles were used for collecting VOC samples. All bottles were filled to the top, with meniscus at the lip of the bottles and then tightly capped with a teflon-lined cap. The bottles were checked for air bubbles, if there was a bubble more water was immediately added to remove the air and the bottle was then tightly resealed.

Clean, one liter cubitainers were filled for the nutrient and chloride samples. A total of two cubitainers were used, one preserved with sulfuric acid and one unpreserved.

Clean, one liter amber glass bottles were used to collect the pesticide samples. Four, unpreserved, bottles were filled at every site.

All samples were labeled with a site identification number, a project number, the type of analysis, the date, and the time of collection. These were then placed in a cooler with ice, until arriving at the Idaho State Bureau of Laboratories or to Horizon Air to be air freighted to the University of Idaho Laboratory at the end of the day.

The field sheet was filled out to note all necessary sampling procedure information at every site, and any comments relevant to the site. In addition, a chain of custody sheet was filled out for the VOC samples. All equipment used at each site was triple rinsed with deionized water then carefully packed for use at the next site.

APPENDIX B

QUALITY ASSURANCE / QUALITY CONTROL

All probes used for measuring field parameters were inspected every morning before leaving the office. Any necessary repairs or cleaning was conducted at the DEQ laboratory before going to the sampling sites. The condition and number of all necessary sample containers was checked before leaving for the sampling sites.

Prior to it's use at each site the Orion pH meter was calibrated daily with a fresh pH standard of 4 SU and 7 SU. If the ground water had a pH of greater than 7.8 SU the pH meter was re-calibrated to a pH standard of 7 SU and 10 SU.

Temperature was checked with three different instruments at each site with a non-mercury thermometer, the pH meter and the conductivity meter. The recorded ground water temperature for the field sheets were taken from the conductivity meter. The recorded air temperature on the field sheets was taken from the non-mercury thermometer.

The Orion conductivity meter was calibrated at each site with a conductivity standard as close as possible to the measurement at each site. A small plastic container of the fresh standard was placed in the bucket with the meter probes and allowed to equilibrate to the temperature of the ground water being sampled. After the samples were collected, the conductivity probe was placed into the conductivity standard to determine the correction factor.

The bucket, all hoses and splitters were kept (physically) clean. The hoses were drained at each site. The bucket, splitter and short hose were rinsed with deionized water at every site prior to packing back into the vehicle (Nielson 1991).

Latex gloves were worn when collecting all samples. All samples were collected in clean containers and were labeled with the site identification number, date, time of sample collection, project number, and type of analysis. This information was also recorded on the field sheets, along with the field parameters and notable site conditions. All necessary laboratory forms were filled out for all samples collected.

Pesticide samples were packed in ice and promptly shipped to Analytical Sciences Laboratory at the University of Idaho at the end of the day. The bacteria, organic and inorganic samples were packed in ice until taken to the State of Idaho Bureau of Laboratories in Boise, Idaho at the end of the day.

A trip blank was filled in the laboratory each sampling morning and carried in the cooler all day.

This trip blank was analyzed for VOCs. In addition to a duplicate VOC sample taken at one site each sampling day. Duplicate pesticide samples were taken at one site per sampling day, also.

APPENDIX C

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