Ground Water Contours

Lesson Plan #2: How do we determine ground water flow direction and gradient?

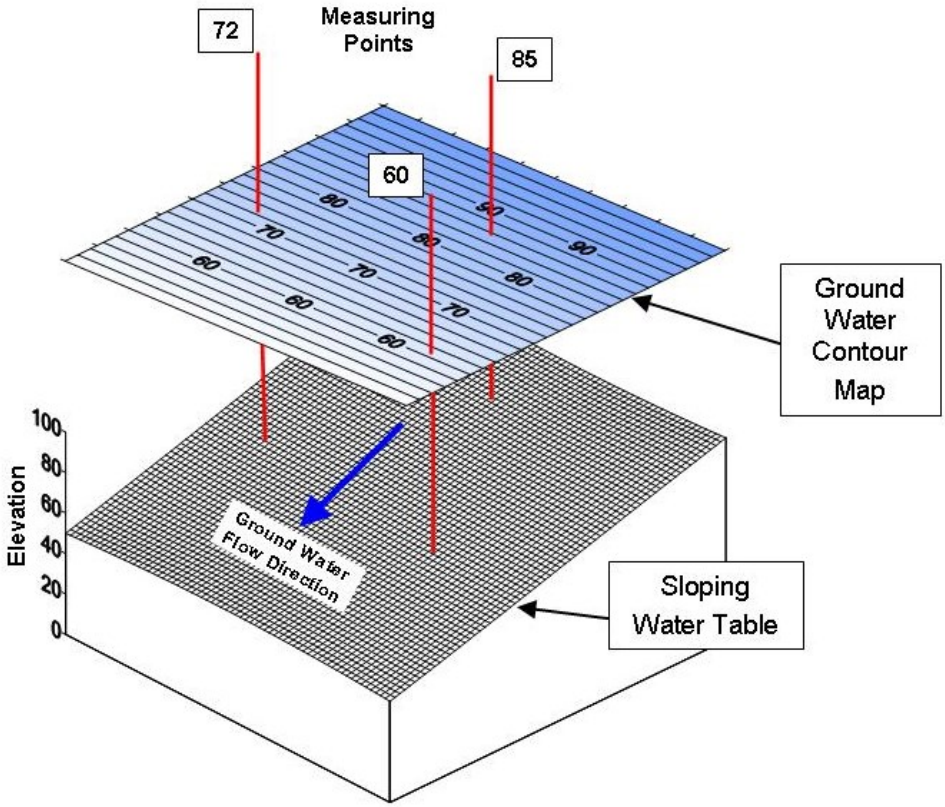
Objectives: Learn how to determine ground water flow direction, gradient, velocity and volume over time.

- Why are water levels measured?
- How to convert water levels to water elevations?
- How to plot water levels on a map?
- How to construct a ground water contour map?
- How to calculate flow direction, ground water velocity and volume over time?

Grades: 10– 12

Materials:

- Calculator/spreadsheet
- Map
- Idaho Driller's Reports



Water levels are measured in wells. The wells may have a pump in them and are used for pumping water or they maybe installed without any pump and are used only to collect water level and/or water quality data. A well that is installed only to measure water levels is called a piezometer.

There are a number of ways to measure the depth of water in a piezometer. The most common method is with the use of an electrical tape or e-tape. An e-tape consist of a battery activated two-lead wire with a weighted end. The wire is lowered down the well until the end makes contact with the water and completes a circuit. Once the circuit is completed a light or buzzer on the reel are activated. The depth is read from graduated markings on the wire.

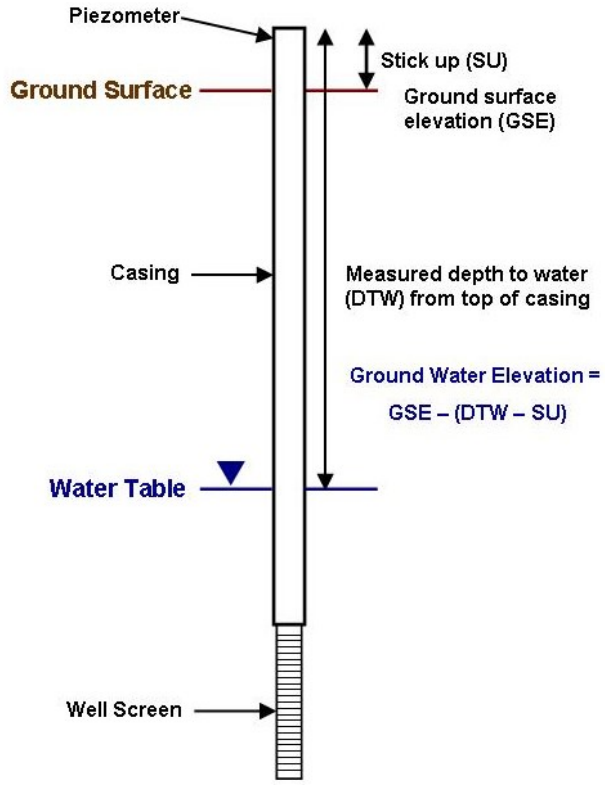




The use of the e-tape will determine the depth of water from the surface or top of casing. In order to compare the water levels with other wells a common datum needs to be established. Generally the water levels are converted to a water elevation. This is done by determining the elevation of the ground surface at the well and subtracting the distance to the ground water.

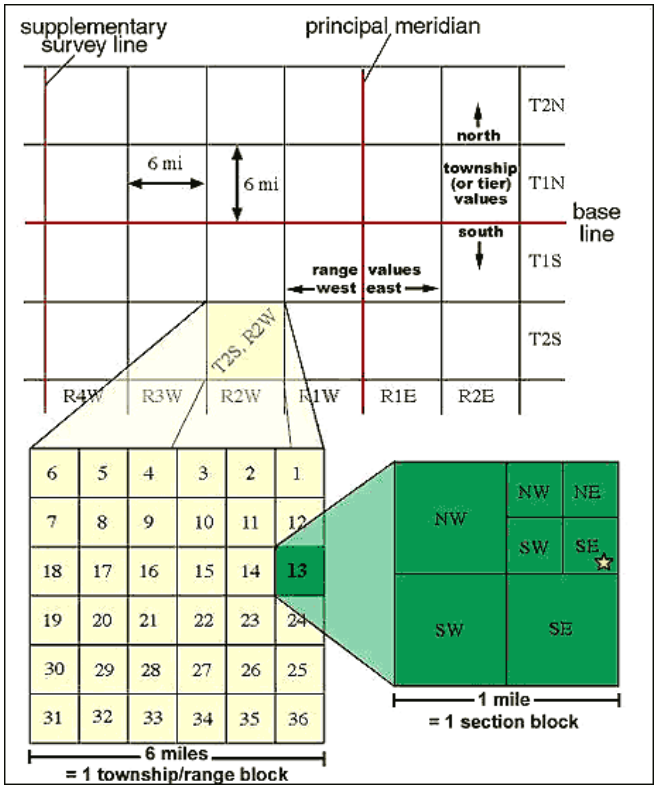
Ground Water Contours

Lesson Plan #2: How do we determine ground water flow direction and gradient?



The piezometers need to be located on a map so that the ground surface elevation can be determined. If you drill the piezometer you can locate it on the USGS topographic map or use a GPS to obtain the coordinates. Drilling wells can be expensive, so often times existing Driller's Reports are used. When a new well is drilled the Idaho Department of Water Resources requires that a Well Driller's Report be completed. The Well Driller's Report contains information regarding the well owner, location, aquifer material (lithology) and well construction. A Well Driller's report can be seen on Page 3.

The coordinate system that is used to locate water wells is called the Public Land Survey System (PLSS). The PLSS system was established by the Federal Government to convey land to private owners. The PLSS system divides the land into 6-mile by 6-mile blocks. The blocks are referenced by the Township and Range. The Township defines how far north-south above a base line you are, and the Range defines how far east-west from a base line you are. Each Township-range block is divided into 36 sections, which are one-mile square.



Each section is then divided into four equal area sections called quarter sections. Each quarter section is divided again into four equal area sections called quarter-quarter sections. A typical PLSS site description can be seen on the Well Driller's Report on page 3. The PLSS description would be T.51 N., R. 5 W., Section 32, NE 1/4, NW 1/4. The well location can be seen on the map also on page 4.

Once you plot the well location on the map, you can determine the ground surface elevation. Measuring the depth to ground water, the ground water elevation can be calculated. By calculating the ground water elevation for at least three wells, the ground water flow direction and gradient can be determined

Ground Water Contours

Lesson Plan #2: How do we determine ground water flow direction and gradient?

Form 238-7
8/90

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES

USE TYPEWRITER OR BALLPOINT PEN

WELL DRILLER'S REPORT

State law requires that this report be filed with the Director, Department of Water Resources within 30 days after the completion or abandonment of the well.

1. WELL OWNER
Name M. Smith
Address 110 Pleasant View Dr
Drilling Permit No. 95-91-N-132
Water Right Permit No. _____

2. NATURE OF WORK
☒ New well ☐ Deepened ☐ Replacement
☐ Well diameter increase
☐ Abandoned (describe abandonment procedures such as materials, plug depths, etc. in lithologic log)

3. PROPOSED USE
☒ Domestic ☐ Irrigation ☐ Test ☐ Municipal
☐ Industrial ☐ Stock ☐ Waste Disposal or Injection
☐ Other _____ (specify type)

4. METHOD DRILLED
☒ Rotary ☐ Air ☐ Hydraulic ☐ Reverse rotary
☐ Cable ☐ Dug ☐ Other _____

5. WELL CONSTRUCTION
Casing schedule: ☒ Steel ☐ Concrete ☐ Other _____

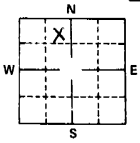
Thickness	Diameter	From	To
.250 inches	6 inches	+ 1 feet	184 feet
_____ inches	_____ inches	_____ feet	_____ feet
_____ inches	_____ inches	_____ feet	_____ feet
_____ inches	_____ inches	_____ feet	_____ feet

Was casing drive shoe used? ☒ Yes ☐ No
Was a packer or seal used? ☐ Yes ☒ No
Perforated? ☐ Yes ☐ No
How perforated? ☐ Factory ☐ Knife ☐ Torch ☐ Gun
Size of perforation _____ inches by _____ inches

Number	From	To
_____ perforations	_____ feet	_____ feet
_____ perforations	_____ feet	_____ feet
_____ perforations	_____ feet	_____ feet

Well screen installed? ☐ Yes ☒ No
Manufacturer's name _____
Type _____ Model No. _____
Diameter ____ Slot size ____ Set from _____ feet to _____ feet
Diameter ____ Slot size ____ Set from _____ feet to _____ feet
Gravel packed? ☐ Yes ☐ No ☐ Size of gravel _____
Placed from _____ feet to _____ feet
Surface seal depth 18 Material used in seal: ☐ Cement grout
☒ Bentonite ☐ Puddling clay ☐ _____
Sealing procedure used: ☐ Slurry pit ☐ Temp. surface casing
☒ Overbore to seal depth
Method of joining casing: ☐ Threaded ☒ Welded ☐ Solvent Weld
☐ Cemented between strata
Describe access port Well Cap

6. LOCATION OF WELL
Sketch map location must agree with written location.



Subdivision Name _____
Lot No. _____ Block No. _____
County Kootenai
NE¼ NW¼ Sec. 32, T. 51 N ☐ S ☐ R. 5 E ☐ W ☒

MICROFILMED MAY 05 1992

7. WATER LEVEL
Static water level 155 feet below land surface.
Flowing? ☐ Yes ☒ No G.P.M. flow _____
Artesian closed-in pressure _____ p.s.i.
Controlled by: ☐ Valve ☐ Cap ☐ Plug
Temperature _____ °F. Quality _____
Describe artesian or temperature zones below.

8. WELL TEST DATA
☐ Pump ☐ Bailer ☒ Air ☐ Other _____

Discharge G.P.M.	Pumping Level	Hours Pumped
20+	184	4

9. LITHOLOGIC LOG

Bore Diam.	Depth From	Depth To	Material	Water Yes	Water No
8	1	60	Large gravel		
6	60	184	Sand & gravel	X	

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SEP 09 1991
Department of Water Resources

10.
Work started 8-20-1991 finished 8-21-1991

11. DRILLERS CERTIFICATION
I/We certify that all minimum well construction standards were complied with at the time the rig was removed.
Firm Name Bronson Water Well Firm No. 360
Address Spirit Lake, ID Date 8-23-1991
Signed by (Firm Official) A P Bronson
and
(Operator) Robert F Bronson

USE ADDITIONAL SHEETS IF NECESSARY — FORWARD THE WHITE COPY TO THE DEPARTMENT

Static Water

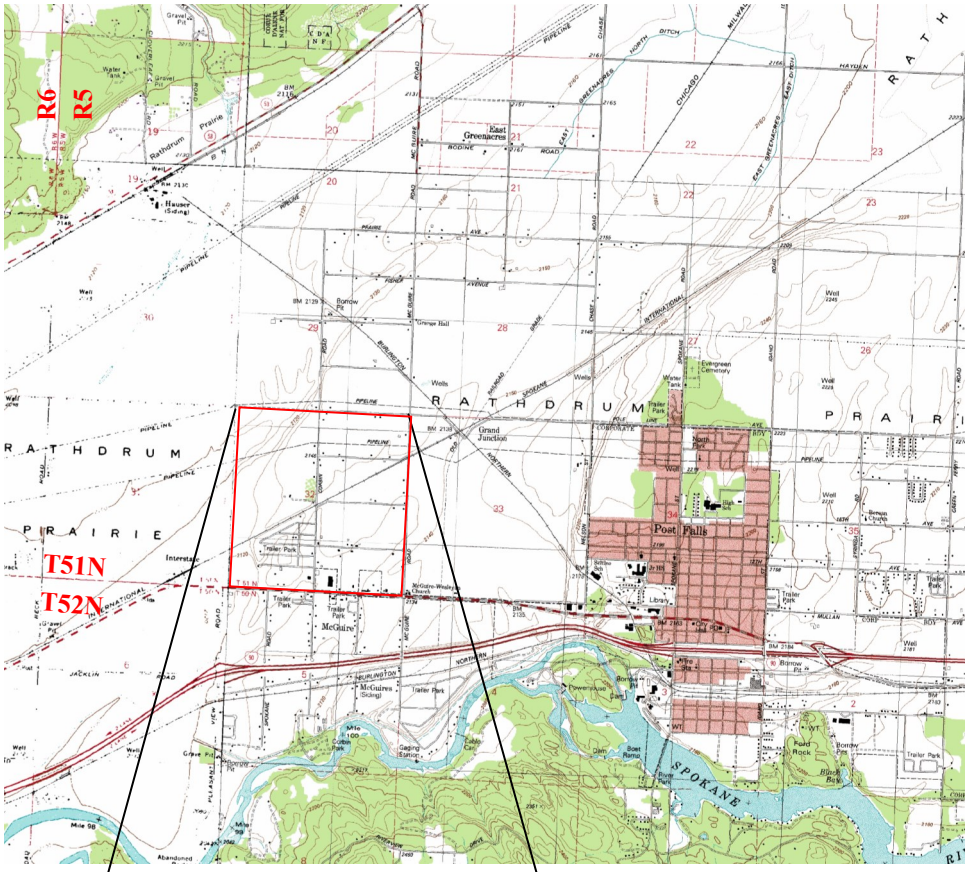
Lithologic Description

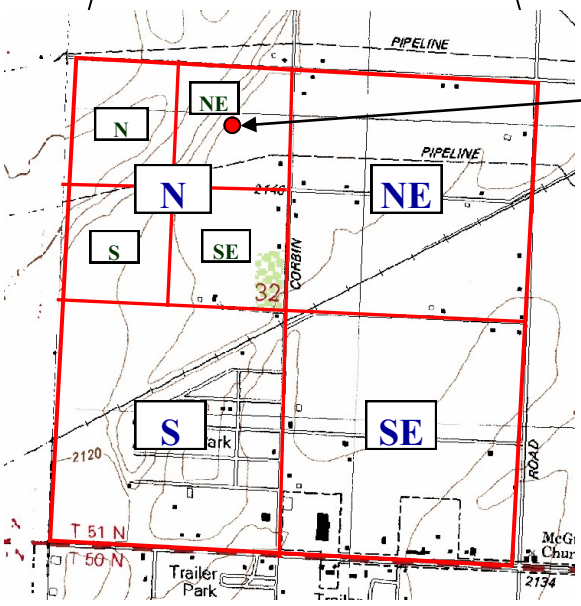
PLSS Well Location

IDAHO Department of Environmental Quality

Ground Water Contours

Lesson Plan #2: How do we determine ground water flow direction and gradient?





Well Location T51N, R5W, NE 1/4, NW 1/4, Section 32

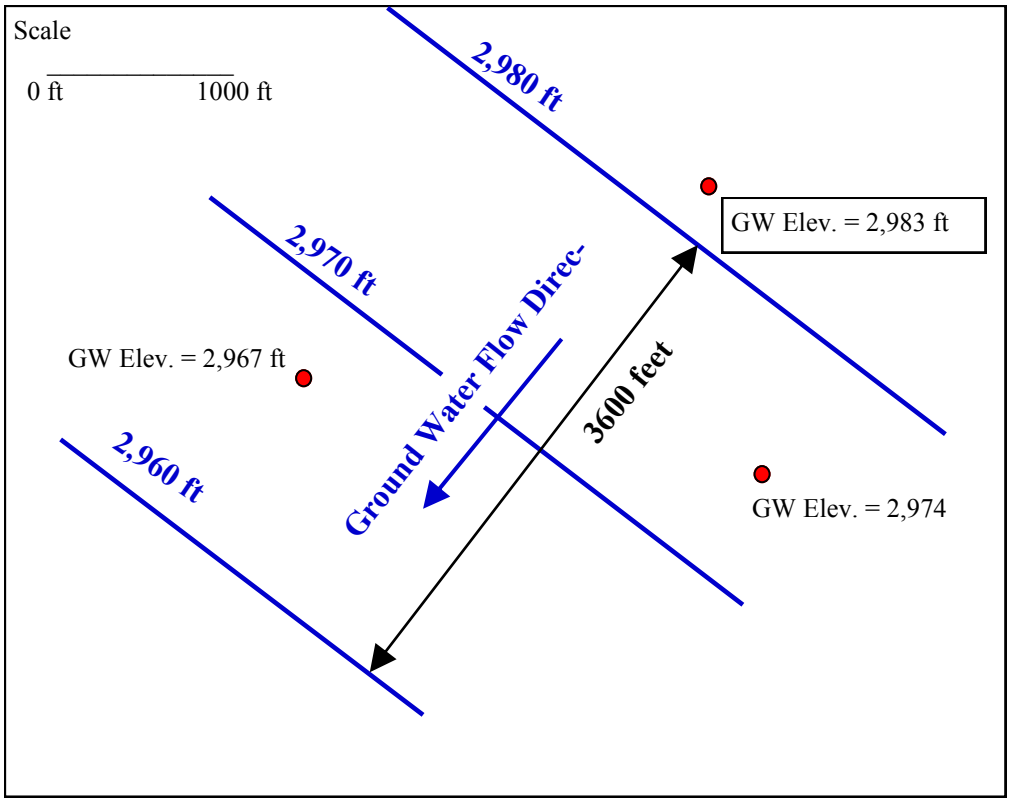
Ground Surface Elevation = 2,130 feet msl

From Driller's log page 3;
Depth to water = 155 feet .
Assume stick up = 0.0 feet

Ground Water Elevation :
= 2,130 ft -(155 ft—0.0 ft)
=2,130 ft –155 ft
= 1,975 feet msl

Ground Water Contours

Lesson Plan #2: How do we determine ground water flow direction and gradient?



An example can be seen above of three wells and the ground water elevations calculated for each plotted on a map. Ground water elevation contours with equal elevation change, also called the **contour interval**, were plotted. In this case the contour interval is 40 feet. The interval maybe smaller or larger depending on the ground water elevation change and the distance between wells.

The ground water **flow direction** is from the high ground water potential (2,980 ft) to the low potential (2,900 ft). The ground water flow direction can be represented by an arrow drawn perpendicular to the ground water contour lines.

The ground water gradient is a description of how steep the water table is sloping.. The gradient is defined by the vertical change (decrease or increase) of the water table divided by the horizontal distance that the change occurs.
The **gradient** can be calculated as follows using the numbers in the above figure;

$$\frac{2980\text{ ft}—2960\text{ ft:}}{3600\text{ ft}} = 20\text{ ft}/3600\text{ ft} = 0.006\text{ ft/ft}$$

The ground water **velocity** (from Lesson #1) can be calculated;

V = K i / ne
Where:
K = hydraulic conductivity (L/T)
i = ground water gradient (L/L)
ne = effective porosity

L = unit length (usually feet, centimeters, or meters)
T = unit Time (usually seconds or days)

The **volume of water** that flows through the aquifer over a given time period can be calculated from the velocity and cross sectional area of the aquifer.

Ground Water Contours

Lesson Plan #2: How do we determine ground water flow direction and gradient?

The aquifer material appears to be a sand and gravel (as described on the Driller's Log on page 4) . A representative hydraulic conductivity for a sand and gravel would be approximately 100 feet/day. A typical effective porosity for this material would be about 0.25. The ground water velocity would be;

V = (100 ft/day)(0.006 ft/ft)/(0.25)
V = 2.4 ft/day.

The ground water velocity can range from a few feet a year to 50 feet per day. The ground water velocities observed in the Rathdrum Prairie Aquifer can be in the tens of feet per day.

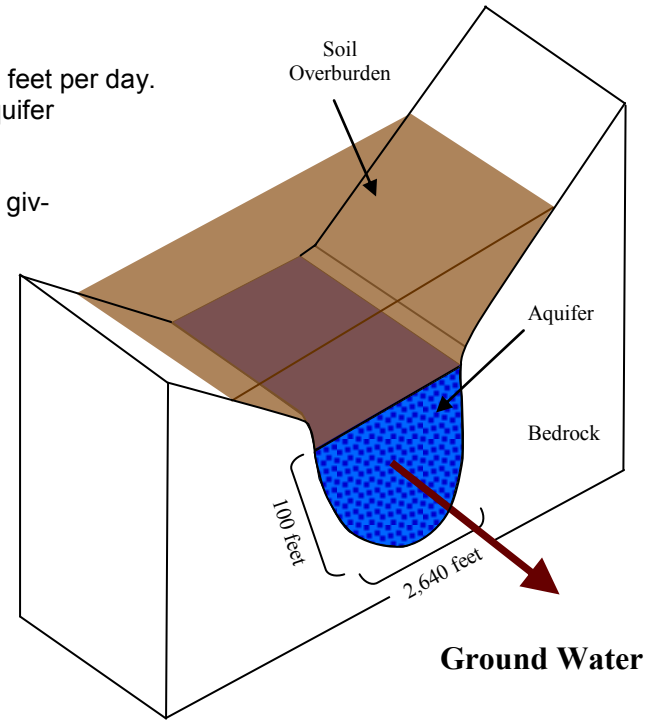
The rate of water that flows through a portion of the aquifer per a given time period can be calculated as follows;

Rate per time period = V * A

Where:
V = Ground water velocity (L/T)
A = Area of aquifer perpendicular to flow (L^2).

If the aquifer in this exercise is 100 feet deep and 0.5 miles wide (2,640 feet) then the rate of ground water flow is;

= (2.4 ft/day) (100 ft * 2,640 ft)
= (2.4 ft/day) (264,000 ft^2)
= 633,600 ft^3/day
= 633,600 ft^3/day * 7.48 gallons/ft^3
= 4,739,328 gallons per day

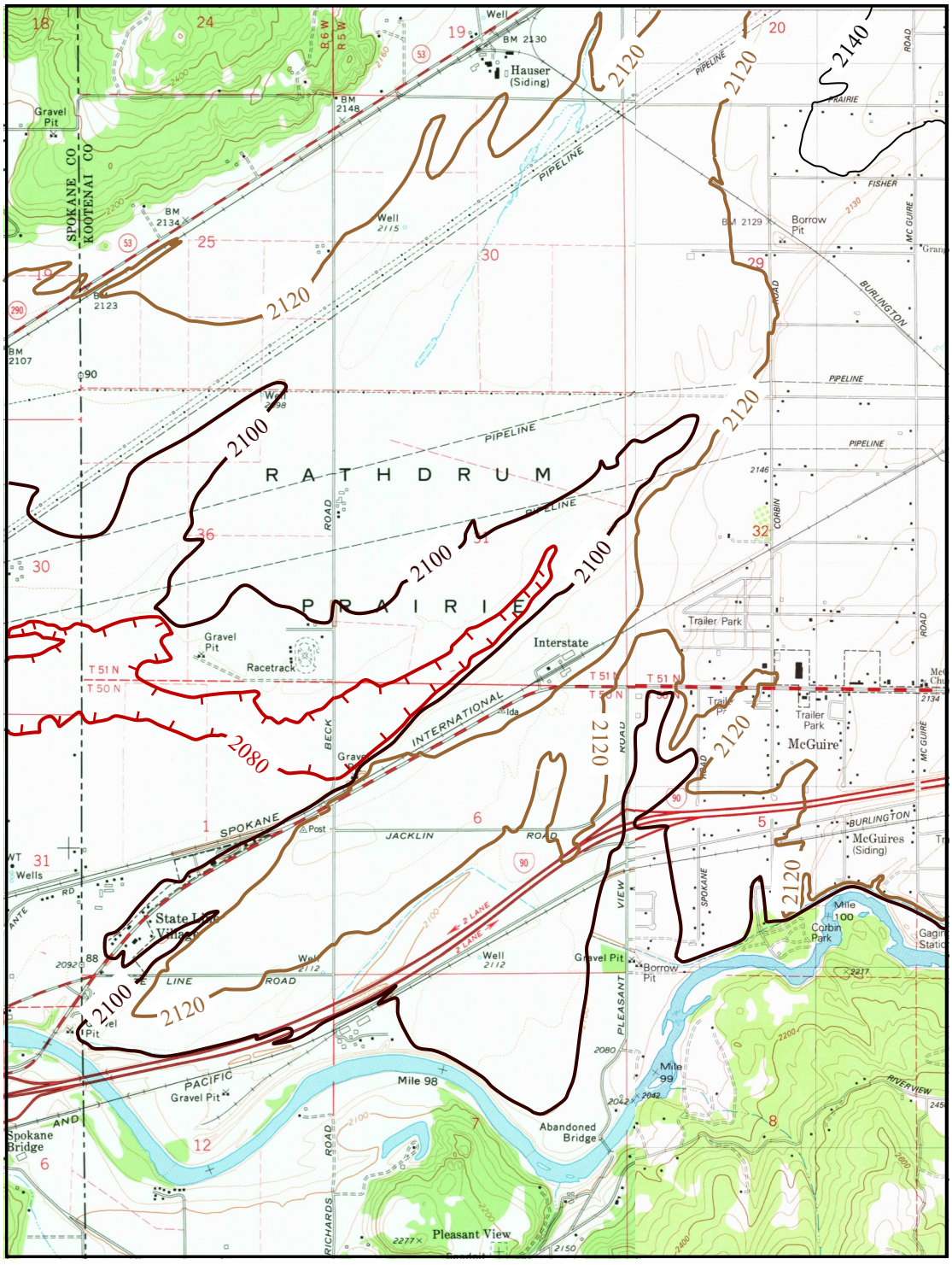


Exercises:

Using the map, driller's logs and seismic cross section provided on the following pages:

A. Plot the location of each well as described in the driller's logs using the PLLS.
B. Complete the table for each well with the following information:
    1. Determine the elevation of land surface at the location of each well.
    2. Determine the depth to static water level for each well from the driller's logs.
    3. Calculate the ground water elevation for each well and plot on the map.
C. Construct a ground water contour map
D. The results from a seismic survey completed in 1951 are shown in the attached figure. The approximate cross sectional surface area of the aquifer is indicated.
E. Calculate the following:
    1. Ground water flow direction
    2. Ground water gradient
    3. Ground water velocity
    4. Rate of ground water flow across the Idaho-Washington State line.

Compare results with USGS 2004 ground water contour map of Spokane-Valley Rathdrum Prairie at http://www.deq.state.id.us/water/prog_issues/_ground_water/rathdrum_prairie_aquifer/reports_publications.cfm



Scale
1-inch = 3,000 feet

0 1 2 3
Thousands of feet

Well	Ground Surface Elevation	Depth to Water	Stickup	Ground Water Elevation

USE TYPEWRITER OR BALL POINT PEN

State of Idaho
Department of Water Administration

WELL DRILLER'S REPORT

State law requires that this report be filed with the State Reclamation Engineer within 30 days after completion or abandonment of the well.

ENT'D

Department of Water Administration 1971

1. WELL OWNER

Name Harold McKim

Address Box 217, Post Falls, Idaho

Owner's Permit No. 95-71-N-73

2. NATURE OF WORK

☒ New well ☐ Deepened ☐ Replacement

☐ Abandoned (describe method of abandoning)

3. PROPOSED USE

☒ Domestic ☐ Irrigation ☐ Test

☐ Municipal ☐ Industrial ☐ Stock

4. METHOD DRILLED

☒ Cable ☐ Rotory ☐ Dug ☐ Other

5. WELL CONSTRUCTION

Diameter of hole 8 inches Total depth 262 feet

Casing schedule: ☒ Steel ☐ Concrete

Thickness	Diameter	From	To
0.250 inches	~~8~~ inches	feet	feet
inches	8 inches	Plus 1 feet	162 feet
inches	inches	feet	feet
inches	inches	feet	feet
inches	inches	feet	feet

Was a packer or seal used? ☐ Yes ☒ No

Perforated? ☒ Yes ☐ No

How perforated? ☐ Factory ☒ Knife ☐ Torch

Size of perforation ¼ inches by 1½ inches

Number	From	To
180 perforations	142 feet	160 feet
perforations	feet	feet
perforations	feet	feet

Well screen installed? ☐ Yes ☒ No

Manufacturer's name

Type Model No.

Diameter Slot size Set from feet to feet

Diameter Slot size Set from feet to feet

Gravel packed? ☐ Yes ☒ No Size of gravel

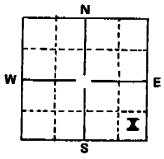
Placed from feet to feet

Surface seal? ☒ Yes ☐ No To what depth 18 feet

Material used in seal ☒ Cement grout ☐ Puddling clay

6. LOCATION OF WELL

Sketch map location must agree with written location.



95

County Kootenai

SE ¼ SE ¼ Sec. 36, T. 51 N, R. 6 E/W

7. WATER LEVEL

Static water level 125 feet below land surface

Flowing? ☐ Yes ☒ No G.P.M. flow

Temperature ° F. Quality

Artesian closed-in pressure p.s.i.

Controlled by ☐ Valve ☐ Cap ☐ Plug

8. WELL TEST DATA

☐ Pump ☒ Bailer ☐ Other

Discharge G.P.M.	Draw Down	Hours Pumped
25	1	1

9. LITHOLOGIC LOG

Hole Diam.	Depth From	Depth To	Material	Water Yes	Water No
8	0	1'	Top Soil		
8	1'	5'	Large gravel		
8	5'	18'	Boulders		
8	18'	21'	Coursesand & large gravel		
8	21'	25'	Boulders		
8	25'	28'	Course sand & large gravel		
8	28'	32'	Course gravel		
8	32'	35'	Boulders		
8	35'	40'	Course sand & gravel		
8	40'	45'	Boulders		
8	45'	59'	Course sand & gravel		
8	59'	61'	Course gravel		
8	61'	64'	Boulders & large gravel		
8	64'	66'	Course sand & gravel		
8	66'	69	Boulders		
8	69'	74'	Course gravel		
8	74'	99'	Large gravel		
8	99'	111'	Course sand & gravel		
8	111'	117'	Course gravel		
8	117'	125	Course sand & gravel	-2-	
8	125'	150'	Course gravel 3/4 to 1½"	X	
8	150'	162'	Course sand & gravel		

00712

10.

Work started Sept. 20,1971 finished Oct.6, 1971

11. DRILLER'S CERTIFICATION

This well was drilled under my supervision and this report is true to the best of my knowledge.

ZINKGRAF WELL DRILLING CO. 59

Driller's or Firm's Name Number

E. 1606 Sharp, Spokane, Wa. 99203

Address

Carl R. Zinkgraf Oct. 15, 1971

Signed By Date

USE ADDITIONAL SHEETS IF NECESSARY FORWARD THE WHITE, BLUE, AND PINK COPIES TO THE DEPARTMENT

IDAHO Department of Environmental Quality

Form 238-7
1/78

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES

WELL DRILLER'S REPORT

USE TYPEWRITER OR BALLPOINT PEN

State law requires that this report be filed with the Director, Department of Water Resources within 30 days after the completion or abandonment of the well.

1. WELL OWNER

Name Fred R. Hasz

Address N. 5750 Beck Rd., Post Falls, Ida.

Owner's Permit No. 95-80-N-17

2. NATURE OF WORK

☒ New well ☐ Deepened ☐ Replacement
☐ Abandoned (describe method of abandoning) _____

3. PROPOSED USE

☒ Domestic ☐ Irrigation ☐ Test ☐ Municipal
☐ Industrial ☐ Stock ☐ Waste Disposal or Injection
☐ Other _____ (specify type)

4. METHOD DRILLED

☒ Rotary ☐ Air ☐ Hydraulic ☐ Reverse rotary
☐ Cable ☐ Dug ☐ Other _____

5. WELL CONSTRUCTION

Casing schedule: ☒ Steel ☐ Concrete ☐ Other _____

Thickness		Diameter		From		To	
.250	inches	6	inches +	1½	feet	180	feet
	inches		inches		feet		feet
	inches		inches		feet		feet
	inches		inches		feet		feet

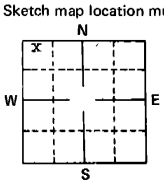
Was casing drive shoe used? ☒ Yes ☐ No
Was a packer or seal used? ☐ Yes ☒ No
Perforated? ☐ Yes ☒ No
How perforated? ☐ Factory ☐ Knife ☐ Torch
Size of perforation _____ inches by _____ inches

Number		From		To	
	perforations		feet		feet
	perforations		feet		feet
	perforations		feet		feet

Well screen installed? ☐ Yes ☒ No
Manufacturer's name _____
Type _____ Model No. _____
Diameter ____ Slot size ____ Set from _____ feet to _____ feet
Diameter ____ Slot size ____ Set from _____ feet to _____ feet
Gravel packed? ☐ Yes ☐ No ☐ Size of gravel _____
Placed from _____ feet to _____ feet
Surface seal depth 21' Material used in seal: ☒ Cement grout ☐ Puddling clay ☐ Well cuttings
Sealing procedure used: ☐ Slurry pit ☐ Temp. surface casing ☒ Overbore to seal depth
Method of joining casing: ☐ Threaded ☒ Welded ☐ Solvent Weld ☐ Cemented between strata
Describe access port _____

6. LOCATION OF WELL

Sketch map location must agree with written location.



Subdivision Name _____
Lot No. _____ Block No. _____
County ~~XXXXXXXX~~ Kootenia
NW ¼ NW ¼ Sec. 31, T. 51 N/S, R. 5 E/W.

7. WATER LEVEL

Static water level 132 feet below land surface.
Flowing? ☐ Yes ☒ No G.P.M. flow _____
Artesian closed-in pressure _____ p.s.i.
Controlled by: ☐ Valve ☐ Cap ☐ Plug
Temperature _____ °F. Quality _____

8. WELL TEST DATA

☐ Pump ☐ Bailer ☒ Air ☐ Other _____

Discharge G.P.M.	Pumping Level	Hours Pumped
40	132 no draw down	2

9. LITHOLOGIC LOG

Hole Diam.	Depth From	Depth To	Material	Water Yes	Water No
8	0	2	top soil		x
"	2	14	sand & large gravel		x
"	14	16	a boulder		x
"	16	21	large gravel		x
6	21	28	large gravel		x
"	28	30	sand, gravel w/silt		x
"	30	63	gravel 2 in. minus w/silt		x
"	63	78	cobble stones		x
"	78	80	gravel 1 in. minus		x
"	80	100	pea gravel		x
"	100	110	gravel large 4 & 5 in. minus		x
"	110	116	cobble stines		x
"	116	126	pea gravel		x
"	126	132	sand / silt		x
"	132	158	washed gravel	x	
"	158	161	1 boulder	x	
"	161	180	washed gravel 1½ in. minus	x	

RECEIVED JUL 7 1980 Department of Water Resources

RECEIVED JUN 27 1980 Department of Water Resources Northern District Office

10.

Work started 5/22/80 finished 6/5/80

11. DRILLERS CERTIFICATION

I/We certify that all minimum well construction standards were complied with at the time the rig was removed.

Firm Name E.A. NOLAN DRLG. CO. Firm No. 105
Address 601 S. Pines Rd. Spokane, Wa. 99216 Date 6/9/80
Signed by (Firm Official) _____
and
(Operator) _____

APPROVED

USE ADDITIONAL SHEETS IF NECESSARY — FORWARD THE WHITE COPY TO THE DEPARTMENT

IDAHO Department of Environmental Quality

Form 238-7
9/82

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES

USE TYPEWRITER OR BALLPOINT PEN

WELL DRILLER'S REPORT

State law requires that this report be filed with the Director, Department of Water Resources within 30 days after the completion or abandonment of the well.

1. WELL OWNER

Name Jacklin Seed Co

Address POST FALLS Idaho

Owner's Permit No. 95-08572

95-88-2-004

2. NATURE OF WORK

☑ New well ☐ Deepened ☐ Replacement
☐ Abandoned (describe abandonment procedures such as materials, plug depths, etc. in lithologic log)

3. PROPOSED USE

☑ Domestic ☐ Irrigation ☐ Test ☐ Municipal
☐ Industrial ☐ Stock ☐ Waste Disposal or Injection
☐ Other _____ (specify type)

4. METHOD DRILLED

☐ Rotary ☐ Air ☐ Hydraulic ☐ Reverse rotary
☑ Cable ☐ Dug ☐ Other _____

5. WELL CONSTRUCTION

Casing schedule: ☑ Steel ☐ Concrete ☐ Other _____

Thickness	Diameter	From	To
.250 inches	10 inches +	2 feet	150 feet
.365 inches	10 inches	150 feet	170 feet
_____ inches	_____ inches	_____ feet	_____ feet
_____ inches	_____ inches	_____ feet	_____ feet

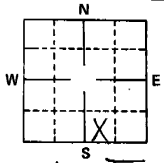
Was casing drive shoe used? ☑ Yes ☐ No
Was a packer or seal used? ☐ Yes ☑ No
Perforated? ☐ Yes ☑ No
How perforated? ☐ Factory ☐ Knife ☐ Torch
Size of perforation _____ inches by _____ inches

Number	From	To
_____ perforations	_____ feet	_____ feet
_____ perforations	_____ feet	_____ feet
_____ perforations	_____ feet	_____ feet

Well screen installed? ☑ Yes ☐ No
Manufacturer's name Johnson
Type Telescope Model No. _____
Diameter 10 Slot size 80 Set from 170 feet to 190 feet
Diameter ___ Slot size ___ Set from ___ feet to ___ feet
Gravel packed? ☐ Yes ☑ No ☐ Size of gravel _____
Placed from _____ feet to _____ feet
Surface seal depth 20' Material used in seal: ☑ Cement grout
☐ Bentonite ☐ Puddling clay ☐ _____
Sealing procedure used: ☐ Slurry pit ☑ Temp. surface casing
☐ Overbore to seal depth
Method of joining casing: ☐ Threaded ☑ Welded ☐ Solvent Weld
☐ Cemented between strata
Describe access port _____

6. LOCATION OF WELL

Sketch map location must agree with written location.



Subdivision Name _____
Lot No. _____ Block No. _____
County Kootenai
SW ¼ SE ¼ Sec. 6, T. 50 N/S, R. 5 E/W

7. WATER LEVEL

Static water level 139 feet below land surface.
Flowing? ☐ Yes ☐ No G.P.M. flow _____
Artesian closed-in pressure _____ p.s.i.
Controlled by: ☐ Valve ☐ Cap ☐ Plug
Temperature ___ °F. Quality _____
Describe artesian or temperature zones below.

8. WELL TEST DATA

☐ Pump ☐ Bailer ☐ Air ☐ Other _____

Discharge G.P.M.	Pumping Level	Hours Pumped

9. LITHOLOGIC LOG

Bore Diam.	Depth From	Depth To	Material	Water Yes	Water No
14	0	20	Gravel & cobbles		✓
10	20	60	cobbles & gravel		✓
	60	80	gravel & Bowlders		✓
	80	139	gravel & cobbles		✓
	139	190	Gravel & Sand	✓	

JUL 22 1988
Department of Water Resources

10.

Work started 5-18-88 finished 6-18-88

11. DRILLERS CERTIFICATION

I/We certify that all minimum well construction standards were complied with at the time the rig was removed.

Firm Name H2O Well Service Firm No. 448
Address Hayden Lake Idaho Date 6-21-88
Signed by (Firm Official) John Wheeler
and
(Operator) Earl Fitts

USE ADDITIONAL SHEETS IF NECESSARY — FORWARD THE WHITE COPY TO THE DEPARTMENT

IDAHO Department of Environmental Quality

Form 238-7
6/02

IDAHO DEPARTMENT OF WATER RESOURCES
WELL DRILLER'S REPORT

Office Use Only
Well ID No.
Inspected by
Twp ____ Rge ____ Sec ____
____ 1/4 ____ 1/4 ____ 1/4
Lat: : : Long: : :

1. WELL TAG NO. D 54620
DRILLING PERMIT NO. ~~NO~~ 85316169
Water Right or Injection Well No.

2. OWNER:
Name G.A.B. Inc.
Address P.O. Box 459
City Post Falls State Id Zip 83877

3. LOCATION OF WELL by legal description:
You must provide address or Lot, Blk, Sub. or Directions to well.
Twp. 50 North ☑ or South ☐
Rge. 6 East ☐ or West ☑
Sec. 1 SE 1/4 (1st letter) SW 1/4 (2nd letter) SW 1/4 (3rd letter)
Gov't Lot ____ County Kootenai
Lat: : : Long: : :
Address of Well Site 6902 West Seltice Way
(Give at least name of road – Distance to Road or Landmark) City State line
Lt. ____ Blk. ____ Sub. Name ____

4. USE:
☐ Domestic ☐ Municipal ☑ Monitor ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other ____

5. TYPE OF WORK check all that apply (Replacement etc.)
☑ New Well ☐ Modify ☐ Abandonment ☐ Other ____

6. DRILL METHOD:
☑ Air Rotary ☐ Cable ☐ Mud Rotary ☐ Other ____

7. SEALING PROCEDURES

Seal Material	From	To	Weight / Volume	Seal Placement Method
Bentonite Chips	2	107	2,850 lbs.	Pour thru Casing

Was drive shoe used? ☐Y ☑N Shoe Depth(s) ____
Was drive shoe seal tested? ☐Y ☑N How? ____

8. CASING/LINER:

Diameter	From	To	Gauge	Material	Casing	Liner	Welded	Threaded
2"	.5	110	Sch 40	PVC	☑	☐	☐	☑
					☐	☐	☐	☐
					☐	☐	☐	☐

Length of Headpipe ____ Length of Tailpipe ____
Packer ☐Y ☑N Type ____

9. PERFORATIONS/SCREENS PACKER TYPE
Perforation Method Factory
Screen Type & Method of Installation Johnson

From	To	Slot Size	Number	Diameter	Material	Casing	Liner
110'	130'	.010		2"	Sch 40 PVC	☑	☐
						☐	☐
						☐	☐

10. FILTER PACK

Filter Material	From	To	Weight / Volume	Placement Method
10/20 SAND	107	133	950 lbs.	Pour thru Casing

11. STATIC WATER LEVEL OR ARTESIAN PRESSURE:
115 ft. below ground Artesian pressure ____ lb.
Depth flow encountered 115 ft. Describe access port or control devices: ____

12. WELL TESTS:
☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Yield gal./min.	Drawdown	Pumping Level	Time

Water Temp. 54° F Bottom hole temp. 54° F
Water Quality test or comments: ____
Depth first Water Encounter 115'

13. LITHOLOGIC LOG: (Describe repairs or abandonment)

Bore Dia.	From	To	Remarks: Lithology, Water Quality & Temperature	Water Y	Water N
8"	0	133	Sandy gravel w/cobbles wet 115'	✓	

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SEP 18 2008
IDWR/North
ENTERED

Completed Depth 130 (Measurable)
Date: Started 6/9/08 Completed 6/11/08

14. DRILLER'S CERTIFICATION
I/We certify that all minimum well construction standards were complied with at the time the rig was removed.
Company Name Envirowest Exp Firm No. 485
Principal Driller ____ Date 9-15-08
and
Driller or Operator II ____ Date 9/11/08
Operator I ____ Date ____
Principal Driller and Rig Operator Required.
Operator I must have signature of Driller/Operator II.

SON dew 01

FORWARD WHITE COPY TO WATER RESOURCES

IDAHO Department of Environmental Quality

Form 238-7
1994

IDAHO DEPARTMENT OF WATER RESOURCES
WELL DRILLER'S REPORT

Use Typewriter or Ball Point Pen

RECEIVED
APR 27 1994
Department of Water Resources

Renumbered by Region 1 092282

1. DRILLING PERMIT NO. 95-.94 N .50 ~~000~~.
Other IDWR No. 95-08860

2. OWNER:
Name POE ASPHALT
Address PO BOX 449
City LEWISTON State ID Zip 83501

3. LOCATION OF WELL by legal description:
Sketch map location must agree with written location.

N / W / E / S

Twp. 51 North X or South ☐
Rge. 05 East ☐ or West X
Sec. 21 30 1/4 SW 1/4 SW 1/4
Gov't Lot ____ County KOOTENAI

Address of Well Site (STATELINE)-BECK RD. City
(Give at least name of road + Distance to Road or Landmark)

Lt. ____ Blk. ____ Sub. Name ____

4. PROPOSED USE:
X Domestic ☐ Municipal ☐ Monitor ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other Industrial

5. TYPE OF WORK
X New Well ☐ Modify or Repair ☐ Replacement ☐ Abandonment

6. DRILL METHOD
☐ Mud Rotary X Air Rotary ☐ Cable ☐ Other ____

7. SEALING PROCEDURES

SEAL/FILTER PACK Material	From	To	AMOUNT Sacks or Pounds	METHOD
BENTONITE	0	40	100 GALS	SLURRY POURED

Was drive shoe used? Y ☐ N ☐
Was drive shoe seal tested? Y ☐ N ☐ How? ____

8. CASING/LINER:

Diameter	From	To	Gauge	Material	Casing	Liner	Welded	Threaded
8	+3	178	250	STEEL	X	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐

Length of Headpipe ____ Length of Tailpipe ____

9. PERFORATIONS/SCREENS
☐ Perforations Method ____
X Screens Screen Type STAINLESS STEEL

From	To	Slot Size	Number	Diameter	Material	Casing	Liner
178	188	100	2-5'	8"		☐	☐
						☐	☐
						☐	☐

10. STATIC WATER LEVEL OR ARTESIAN PRESSURE:
124' ft. below ground Artesian pressure ____ lb.
Depth flow encountered ____ ft. Describe access port or control devices:
SWSW 30 51N 5W

11. WELL TESTS:
☐ Pump ☐ Bailer X Air ☐ Flowing Artesian

Yield gal./min.	Drawdown	Pumping Level	Time
300+			

Water Temp. ____ Bottom hole temp. ____
Water Quality test or comments: ____

12. LITHOLOGIC LOG: (Describe repairs or abandonment)

Bore Dia.	From	To	Remarks: Lithology, Water Quality & Temperature	Water Y	Water N
10	0	48	SAND & GRAVEL W/COBBLE W/ LIGHT BROWN SOILS		
10	48	72	SAND & GRAVEL COARSE CLEAN		
10	72	115	SAND & GRAVEL MEDIUM		
10	115	131	SAND & GRAVEL FINE W/LIGHT BROWN SOILS SEEMS		
10	131	188	GRAVEL COARSE CLEAN SOME FINES 3/4 MINIS MATERIALS	300+	

RECEIVED
APR 15 1994
NORTHERN REGION
IDWR

FEB 09 1995

Completed Depth ____ (Measurable)
Date: Started 03/21/94 Completed 03/24/94

13. DRILLER'S CERTIFICATION
I/We certify that all minimum well construction standards were complied with at the time the rig was removed.

Firm Name H20 WELL SERVICE INC Firm No. #448
Firm Official [signature] Date 4-8-94
and
Supervisor or Operator [signature] Date 4-5-94
(Sign once if Firm Official & Operator)

FORWARD WHITE COPY TO WATER RESOURCES

IDAHO Department of Environmental Quality

Form 238-7
8/90

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES

WELL DRILLER'S REPORT

State law requires that this report be filed with the Director, Department of Water Resources within 30 days after the completion or abandonment of the well.

USE TYPEWRITER OR BALLPOINT PEN

1. WELL OWNER

Name Stewart & Sylvia Coyne
Address E6180 Hauser Lk Rd. Post Falls 83854
Drilling Permit No. 95-91-N-132
Water Right Permit No. _____

2. NATURE OF WORK

☒ New well ☐ Deepened ☐ Replacement
☐ Well diameter increase
☐ Abandoned (describe abandonment procedures such as materials, plug depths, etc. in lithologic log)

3. PROPOSED USE

☒ Domestic ☐ Irrigation ☐ Test ☐ Municipal
☐ Industrial ☐ Stock ☐ Waste Disposal or Injection
☐ Other _____ (specify type)

4. METHOD DRILLED

☒ Rotary ☐ Air ☐ Hydraulic ☐ Reverse rotary
☐ Cable ☐ Dug ☐ Other _____

5. WELL CONSTRUCTION

Casing schedule: ☒ Steel ☐ Concrete ☐ Other _____

Thickness	Diameter	From	To
.250 inches	6 inches +	1 feet	184 feet
_____ inches	_____ inches	_____ feet	_____ feet
_____ inches	_____ inches	_____ feet	_____ feet
_____ inches	_____ inches	_____ feet	_____ feet

Was casing drive shoe used? ☒ Yes ☐ No
Was a packer or seal used? ☐ Yes ☒ No
Perforated? ☐ Yes ☐ No
How perforated? ☐ Factory ☐ Knife ☐ Torch ☐ Gun
Size of perforation _____ inches by _____ inches

Number	From	To
_____ perforations	_____ feet	_____ feet
_____ perforations	_____ feet	_____ feet
_____ perforations	_____ feet	_____ feet

Well screen installed? ☐ Yes ☒ No
Manufacturer's name _____
Type _____ Model No. _____
Diameter ____ Slot size ____ Set from _____ feet to _____ feet
Diameter ____ Slot size ____ Set from _____ feet to _____ feet
Gravel packed? ☐ Yes ☐ No ☐ Size of gravel _____
Placed from _____ feet to _____ feet
Surface seal depth 18 Material used in seal: ☐ Cement grout
☒ Bentonite ☐ Puddling clay ☐ _____
Sealing procedure used: ☐ Slurry pit ☐ Temp. surface casing
☒ Overbore to seal depth
Method of joining casing: ☐ Threaded ☒ Welded ☐ Solvent Weld
☐ Cemented between strata
Describe access port Well Cap

6. LOCATION OF WELL

Sketch map location must agree with written location.

N / W / E / S

Subdivision Name _____
Lot No. _____ Block No. _____

County Kootenai
NE¼ NW¼ Sec. 32, T. 51 N ☐ S ☐ R. 5 E ☐ W ☒

7. WATER LEVEL

Static water level 155 feet below land surface.
Flowing? ☐ Yes ☒ No G.P.M. flow _____
Artesian closed-in pressure _____ p.s.i.
Controlled by: ☐ Valve ☐ Cap ☐ Plug
Temperature _____ °F. Quality _____
Describe artesian or temperature zones below.

8. WELL TEST DATA

☐ Pump ☐ Bailer ☒ Air ☐ Other _____

Discharge G.P.M.	Pumping Level	Hours Pumped
20+	184	4

9. LITHOLOGIC LOG

Bore Diam.	Depth From	Depth To	Material	Water Yes	Water No
8	1	60	Large gravel		
6	60	184	Sand & gravel	X	

RECEIVED
SEP 09 1991
Department of Water Resources

10.

Work started 8-20-1991 finished 8-21-1991

11. DRILLERS CERTIFICATION

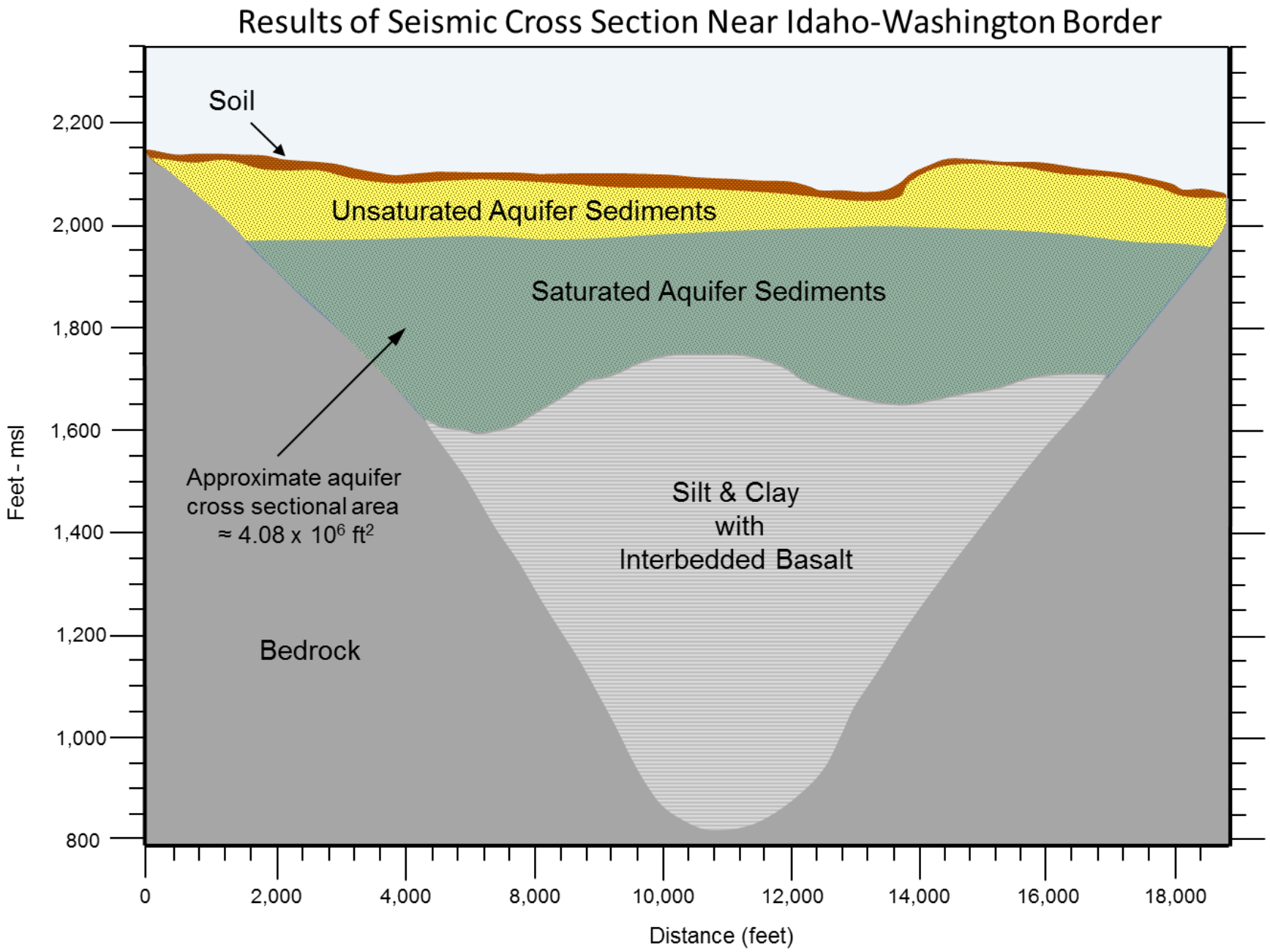
I/We certify that all minimum well construction standards were complied with at the time the rig was removed.

Firm Name Bronson Water Wells Firm No. 360
Address Spirit Lake, ID Date 8-23-1991
Signed by (Firm Official) _____
and
(Operator) _____

MICROFILMED
MAY 05 1992

USE ADDITIONAL SHEETS IF NECESSARY — FORWARD THE WHITE COPY TO THE DEPARTMENT

IDAHO Department of Environmental Quality



From: Seismic Cross Sections Across the Spokane River Valley and the Hillyard Trough, Idaho and Washington. USGS, 1953