

***Idaho Department of Water Resources
Open-File Report***



Summary of Canyon Creek Recharge Project – Spring 2017

By
Dennis Owsley

July 2017

Overview

The winter of 2016/2017 and the spring of 2017 provided above average amounts of precipitation in southern Idaho. Mountain Home Reservoir, near Mountain Home, Idaho, receives runoff water from the Canyon Creek watershed by way of the Feeder Canal (Figure 1). In the spring of 2017, water was also allowed to flow down the Canyon Creek channel because water in the watershed system was in excess of the reservoir capacity. The water flowing into the Canyon Creek channel was allowed to infiltrate into the subsurface through the porous media of the channel bottom and was diverted into two gravel pits in an attempt to provide recharge to the aquifer system near the Mountain Home area.

Water flowed down Canyon Creek from February 9, 2017 until April 20, 2017, controlled by the head gate structures located approximately four miles north of the town of Mountain Home (Figure 1, Appendix A). The water flowed down the natural channel of Canyon Creek to the south/southwest, towards the Snake River. Prior to the crossing of the Canyon Creek channel and I-84, two diversions into gravel pits were utilized to divert additional water out of the Canyon Creek channel as an aquifer recharge mechanism. Several field observations noted that a significant amount of the water flowing under the I-84 crossing was returning to the Snake River.

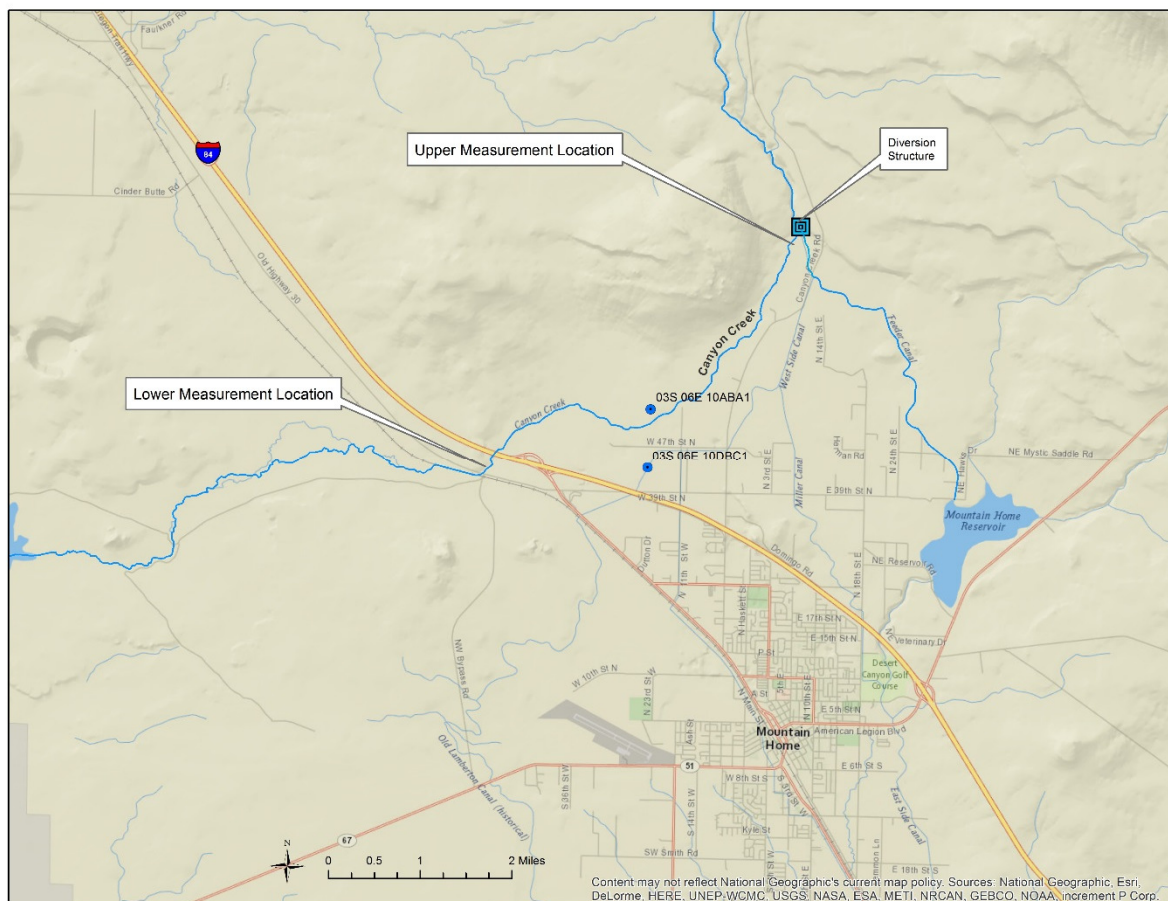


Figure 1. Map of Canyon Creek recharge area.

Surface Water Measurements

The Idaho Department of Water Resources (IDWR) measured flow rates in Canyon Creek with a handheld SonTek Flow Tracker or StreamPro Acoustic Doppler Current Profiler (ADCP) ten times on a weekly basis from February through April 2017. A suitable location for measuring flow was found approximately 50 yards downstream from the diversion structures (Appendix A). This same cross section was used for all upstream flow measurements (Table 1).

Table 1. Measured flow rates from Canyon Creek during spring 2017.

Date	Measured Flow Upstream (CFS)	Measured Flow Downstream (CFS)	Calculated Diversion (CFS)	Calculated Diversion (AF)	Comments
2/9/2017	200	N/A	56.1	556	Estimated Flow
2/16/2017	4	N/A	0.0	0	pulled remaining boards
2/22/2017	185	N/A	51.4	816	
3/1/2017	47	N/A	8.3	115	
3/8/2017	36	N/A	4.9	68	
3/15/2017	116	N/A	29.9	415	
3/22/2017	265	N/A	76.4	1061	
3/29/2017	137	105	36.4	506	
4/6/2017	185	131	51.4	714	
4/12/2017	69.4	52	15.2	211	boards back in place
4/20/2017	1	N/A	0.0	0	boards back in place
				4460	

A suitable location for measuring flow on the downstream portion of the study area was found approximately 200 yards downstream of the crossing of I-84 and the Canyon Creek channel. Three measurements were collected at the downstream location to help estimate the total amount of water being diverted or lost to the aquifer system upstream of the I-84 crossing. A suitable measurement location was not located near the mouth of Canyon Creek and the Snake River, although several visual observations of flow were conducted to estimate the amount of water returning to the Snake River. Based on these estimates, the majority of the water that was seen flowing under the I-84 crossing was discharging into the Snake River as it appeared very little infiltration was occurring between the I-84 crossing and the Snake River.

Although physical measurements were only conducted on a weekly basis, a comparison to the hydrograph from the USGS gage site on Canyon Creek approximately 5 miles upstream from the diversion structure indicates that the hand measurements generally agree (minus the diversion to Mountain Home Reservoir) with the hydrograph from USGS site 13159800 (Figure 2).

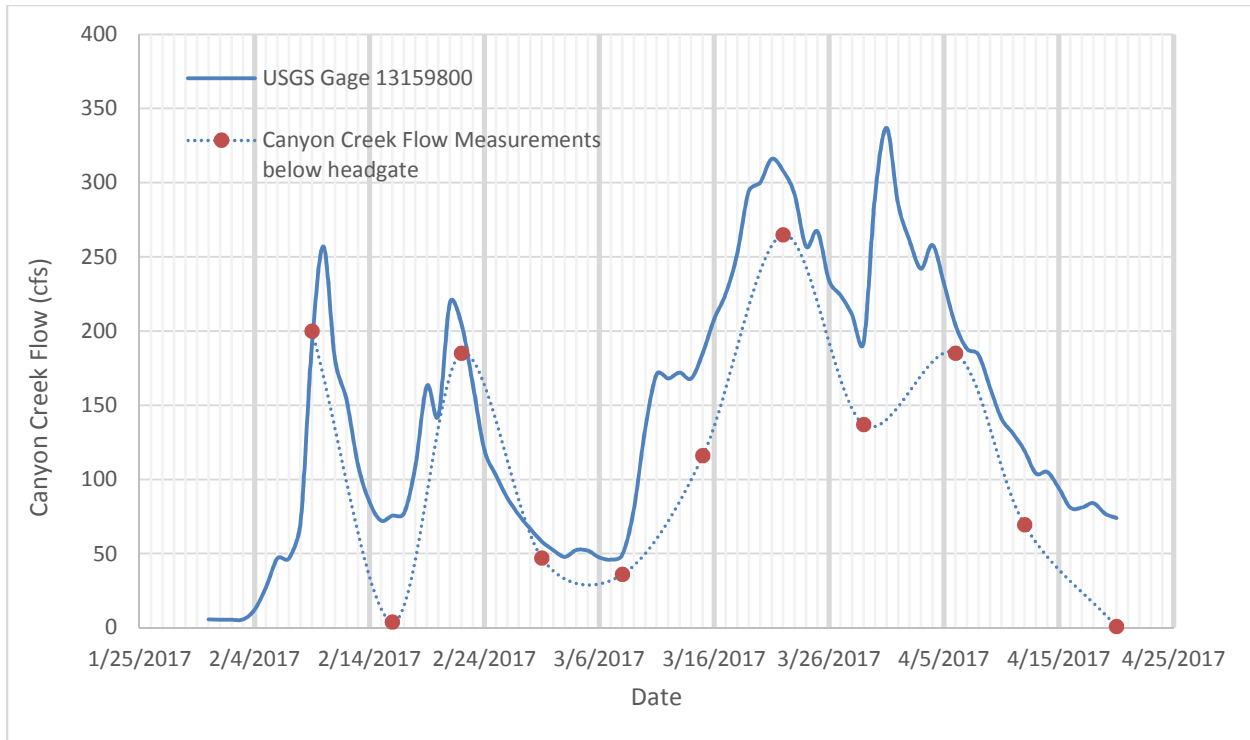


Figure 2. Hydrograph from USGS Gage #13159800 and measurements on Canyon Creek.

The total amount of water that was diverted or infiltrated into the subsurface is estimated based on the differences of three sets of measurements that were collected on the upstream and downstream sections of Canyon Creek. The three sets of measurements on the creek varied significantly in flow rates and provided a good coverage of the flows measured throughout the duration of runoff. The three sets of flow measurements were plotted to determine if any relationship existed between the upstream and downstream flow rates (Figure 3). Based on the plot of the limited data, a linear trend was observed with an R^2 of 0.96, indicating a strong correlation of the data points. Using the equation derived from the linear trend line of the three data sets, the total amount to water diverted above the I-84 crossing was estimated. Based on the duration of the flows, the measurements taken, and the assumptions based on the relationship between the upstream and downstream measurements, an estimated total volume of water that was diverted into the gravel pits or infiltrated into the subsurface was approximately 4,460 acre-feet (AF).

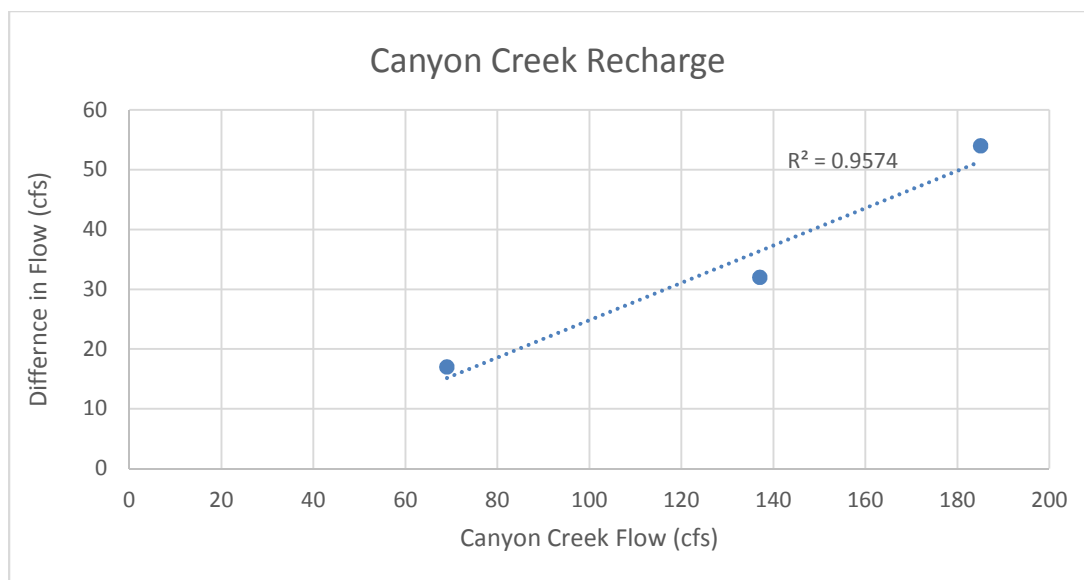


Figure 3. Plot of downstream Canyon Creek measurements versus difference in flows.

In an attempt to verify the assumptions made to estimate the total volume of water diverted into the gravel pits, or infiltrated into the subsurface, a comparison of the estimated flow rates were compared to physical measurements collected by a private consulting firm conducted within the same timeframe as the IDWR measurements. The SPF Water Engineering consulting firm collected two sets of measurements into the gravel pits on March 20 and 29, 2017. Based on these measurements and the timeframe of the flow conditions, SPF estimated a total diversion of approximately 4,455 AF, similar to the 4,460 AF IDWR estimate.

Ground Water Monitoring

IDWR monitored the aquifer responses to the runoff event by equipping two nearby ground water wells (03S 06E 10ABA1 and 03S 06E 10DBC1) with pressure transducers (Figure 1). Both wells are less than 0.5 miles from Canyon Creek and are open to the aquifer less than 100 feet below land surface. The wells are about 2.5 miles downstream from the diversion structure.

Only one year of historic pressure transducer data are available from the wells which limits the amount of analysis that can be conducted. A normalization of the data to evaluate aquifer response from Canyon Creek seepage could not be conducted because data is lacking. Therefore, all conclusions and inferences regarding aquifer responses in the two wells monitored are based on the relatively short record of pressure transducer data collected for this project.

Aquifer responses to the Canyon Creek seepage are apparent in the hydrographs from both wells monitored during the runoff event. The well closest to Canyon Creek, 03S 06E 10ABA1, is approximately 600 feet from the Canyon Creek channel. This well is 622 feet deep, with an open interval extending from 42 feet to 622 feet below land surface (Appendix B).

The hydrograph from well 03S 06E 10ABA1 exhibited a similar trend to that of the Canyon Creek flows and showed a water level rise of approximately 22 feet at the peak of the runoff flows (Figure 4). To

account for the rising water level trend prior to the runoff, a trend was established for the three month period prior to the runoff and was forecasted to show the predicted water level at a later time. Based on this prediction, the water level in 03S 06E 10ABA1 was approximately 12 feet higher nearly two months after the runoff event concluded.

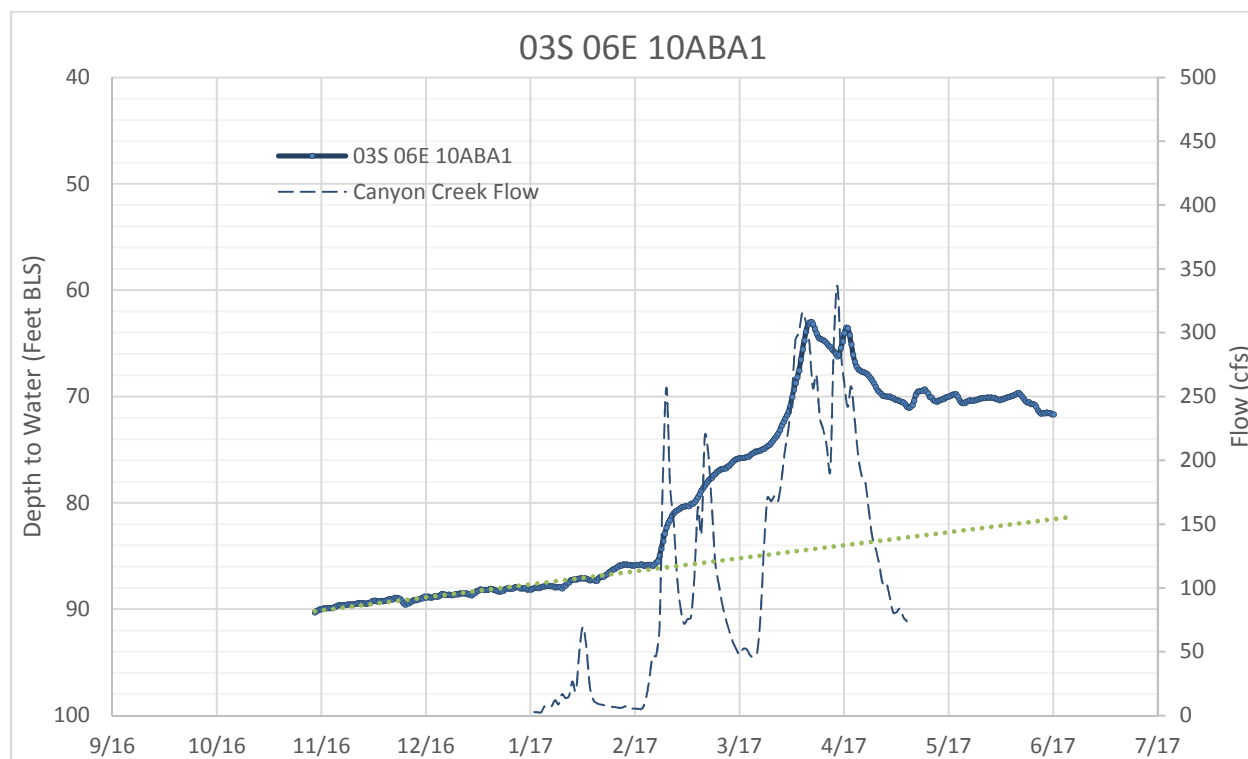


Figure 4. Hydrograph of well 03S 06E 10ABA1 and Canyon Creek flow data during the spring of 2017.

Monitoring well 03S 06E 10DBC1 is approximately 0.5 miles south of Canyon Creek, 220 feet deep, and open to the aquifer system from 70 feet to 220 feet below ground surface (Appendix B). This well is less than 0.25 miles from several irrigation wells, and the influence of the pumping of these irrigation wells can be seen in the corresponding hydrograph (Figure 5).

An analysis of the hydrograph of well 03S 06E 10DBC1 also indicated an apparent aquifer response to the Canyon Creek flows. To account for the rising water level observed prior to the runoff event, a linear trend based on the three months prior to the runoff event was extended into the future. Using this assumed trend line as a baseline for comparison, the water level in well 03S 06E 10 DBC1 was approximately 22 feet higher at the conclusion of the runoff event and 15 feet higher approximately two months later. It should be noted that water levels in this well were impacted by the pumping of nearby irrigation wells, which limits the analysis and resulting conclusions drawn from the dataset.

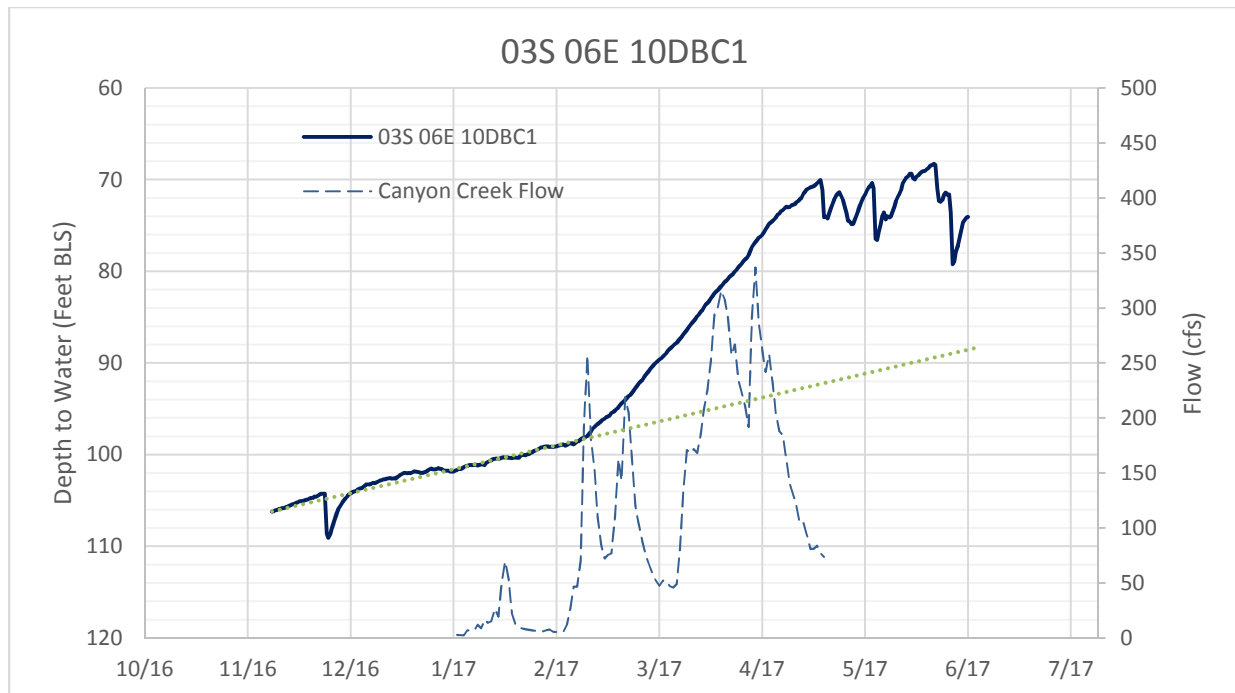


Figure 5. Hydrograph of well 03S 06E 10DBC1 and Canyon Creek flow data during the spring of 2017.

Conclusions

In the spring of 2017, approximately 16,874 AF of water flowed down the Canyon Creek channel below the diversion structure for the Feeder Canal to the Mountain Home Reservoir. Approximately 4,460 acre-feet of water was recharged either thru the seepage in the Canyon Creek channel or into gravel pits. The aquifer response was monitored and hydrographs were created for the two nearby ground water wells. An increase in water levels is apparent in both hydrographs that correlate to the duration and volume of water diverted. Both wells indicated an increase of approximately 22 feet from baseline conditions during peak flow. Additional data and monitoring are required to make any further determinations regarding the benefits to the aquifer associated with these events.

Appendix A -- Field photos



Photo 1. Diversion structure at the confluence of Canyon Creek and the Mountain Home Canal. Photo taken on 4/20/2017.



Photo 2. Head gate structure on the Mountain Home Canal. Photo taken on 2/9/2017.



Photo 3. Measurement cross section on Canyon Creek. Photo taken on 2/22/2017.



Photo 4. Diversion into gravel pit. Photo taken on 4/20/2017.



Photo 5. Check dam at Canyon Creek diversion. Photo taken on 3/1/2017.



Photo 6. Check dam at Canyon Creek diversion structure. Photo taken on 4/20/2017



Photo 7. Canyon Creek channel near the downstream measurement location. Photo taken on 4/20/17.

Appendix B – Driller's reports

03S 06E 10ABA1

USE TYPEWRITER OR
BALL POINT PENState of Idaho
Department of Water Resources

WELL DRILLER'S REPORT

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

Location Corrected by IDWR To:

T03S R06E Sec. 10 NENWNE

By: mciscell 2012-08-28

1. WELL OWNER Name <u>DOMINGO AGUIRRE</u> Address <u>MTN HOME, ID.</u> Owner's Permit No. _____	7. WATER LEVEL Static water level <u>87</u> feet below land surface Flowing? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No G.P.M. flow _____ Temperature _____ ° F. Quality _____ Artesian closed-in pressure _____ p.s.i. Controlled by <input type="checkbox"/> Valve <input type="checkbox"/> Cap <input type="checkbox"/> Plug																																																																																																																																									
2. NATURE OF WORK <input checked="" type="checkbox"/> New well <input type="checkbox"/> Deepened <input type="checkbox"/> Replacement <input type="checkbox"/> Abandoned (describe method of abandoning) _____	8. WELL TEST DATA <input checked="" type="checkbox"/> Pump <input type="checkbox"/> Bailer <input type="checkbox"/> Other <table border="1"> <thead> <tr> <th>Discharge G.P.M.</th> <th>Draw Down</th> <th>Hours Pumped</th> </tr> </thead> <tbody> <tr> <td>540</td> <td>204</td> <td>60 min</td> </tr> <tr> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table>	Discharge G.P.M.	Draw Down	Hours Pumped	540	204	60 min																																																																																																																																			
Discharge G.P.M.	Draw Down	Hours Pumped																																																																																																																																								
540	204	60 min																																																																																																																																								
3. PROPOSED USE <input type="checkbox"/> Domestic <input type="checkbox"/> Irrigation <input type="checkbox"/> Test <input type="checkbox"/> Other (specify type) _____ <input type="checkbox"/> Municipal <input type="checkbox"/> Industrial <input checked="" type="checkbox"/> Stock <input type="checkbox"/> Waste Disposal or Injection	9. LITHOLOGIC LOG <table border="1"> <thead> <tr> <th rowspan="2">Hole Diam.</th> <th colspan="2">Depth</th> <th rowspan="2">Material</th> <th rowspan="2">Water Yes No</th> </tr> <tr> <th>From</th> <th>To</th> </tr> </thead> <tbody> <tr> <td>16"</td> <td>0</td> <td>11</td> <td>Soil & Gravel</td> <td></td> </tr> <tr> <td>4</td> <td>11</td> <td>51</td> <td>Gray Sand</td> <td></td> </tr> <tr> <td></td> <td>51</td> <td>93</td> <td>Brown Sand</td> <td></td> </tr> <tr> <td></td> <td>93</td> <td>129</td> <td>Gray Sand</td> <td></td> </tr> <tr> <td></td> <td>129</td> <td>133</td> <td>Brown Sand & Gravel</td> <td></td> </tr> <tr> <td></td> <td>133</td> <td>159</td> <td>Brown Sand</td> <td></td> </tr> <tr> <td></td> <td>159</td> <td>163</td> <td>Brown Sand</td> <td></td> </tr> <tr> <td></td> <td>163</td> <td>167</td> <td>Brown Sand</td> <td></td> </tr> <tr> <td></td> <td>167</td> <td>191</td> <td>Brown Sand some Gravel</td> <td></td> </tr> <tr> <td></td> <td>191</td> <td>228</td> <td>Gray Sand</td> <td></td> </tr> <tr> <td></td> <td>228</td> <td>240</td> <td>Brown Sand</td> <td></td> </tr> <tr> <td></td> <td>240</td> <td>320</td> <td>Brown Sand Gravel</td> <td></td> </tr> <tr> <td></td> <td>320</td> <td>345</td> <td>Brown Sand</td> <td></td> </tr> <tr> <td></td> <td>345</td> <td>355</td> <td>Brown Sand some clay</td> <td></td> </tr> <tr> <td></td> <td>355</td> <td>395</td> <td>Brown Clay with Gravel</td> <td></td> </tr> <tr> <td></td> <td>395</td> <td>403</td> <td>Brown Clay Gravel</td> <td></td> </tr> <tr> <td></td> <td>403</td> <td>445</td> <td>Black Sand some Clay</td> <td></td> </tr> <tr> <td></td> <td>445</td> <td>460</td> <td>Yellow Clay Shale</td> <td></td> </tr> <tr> <td></td> <td>460</td> <td>510</td> <td>Yellow Clay Red Cement</td> <td></td> </tr> <tr> <td></td> <td>510</td> <td>530</td> <td>Yellow Clay Black Sand</td> <td></td> </tr> <tr> <td></td> <td>530</td> <td>570</td> <td>Black Sand some Blue Clay</td> <td></td> </tr> <tr> <td></td> <td>570</td> <td>575</td> <td>Black Sand some Clay Brown</td> <td></td> </tr> <tr> <td></td> <td>575</td> <td>580</td> <td>Blue Clay Reddish</td> <td></td> </tr> <tr> <td></td> <td>580</td> <td>606</td> <td>Blue Clay some Gravel</td> <td></td> </tr> <tr> <td></td> <td>606</td> <td>618</td> <td>Black & Blue Sand some Clay</td> <td></td> </tr> <tr> <td></td> <td>618</td> <td>622</td> <td>Blue Clay</td> <td></td> </tr> </tbody> </table>	Hole Diam.	Depth		Material	Water Yes No	From	To	16"	0	11	Soil & Gravel		4	11	51	Gray Sand			51	93	Brown Sand			93	129	Gray Sand			129	133	Brown Sand & Gravel			133	159	Brown Sand			159	163	Brown Sand			163	167	Brown Sand			167	191	Brown Sand some Gravel			191	228	Gray Sand			228	240	Brown Sand			240	320	Brown Sand Gravel			320	345	Brown Sand			345	355	Brown Sand some clay			355	395	Brown Clay with Gravel			395	403	Brown Clay Gravel			403	445	Black Sand some Clay			445	460	Yellow Clay Shale			460	510	Yellow Clay Red Cement			510	530	Yellow Clay Black Sand			530	570	Black Sand some Blue Clay			570	575	Black Sand some Clay Brown			575	580	Blue Clay Reddish			580	606	Blue Clay some Gravel			606	618	Black & Blue Sand some Clay			618	622	Blue Clay	
Hole Diam.	Depth		Material	Water Yes No																																																																																																																																						
	From	To																																																																																																																																								
16"	0	11	Soil & Gravel																																																																																																																																							
4	11	51	Gray Sand																																																																																																																																							
	51	93	Brown Sand																																																																																																																																							
	93	129	Gray Sand																																																																																																																																							
	129	133	Brown Sand & Gravel																																																																																																																																							
	133	159	Brown Sand																																																																																																																																							
	159	163	Brown Sand																																																																																																																																							
	163	167	Brown Sand																																																																																																																																							
	167	191	Brown Sand some Gravel																																																																																																																																							
	191	228	Gray Sand																																																																																																																																							
	228	240	Brown Sand																																																																																																																																							
	240	320	Brown Sand Gravel																																																																																																																																							
	320	345	Brown Sand																																																																																																																																							
	345	355	Brown Sand some clay																																																																																																																																							
	355	395	Brown Clay with Gravel																																																																																																																																							
	395	403	Brown Clay Gravel																																																																																																																																							
	403	445	Black Sand some Clay																																																																																																																																							
	445	460	Yellow Clay Shale																																																																																																																																							
	460	510	Yellow Clay Red Cement																																																																																																																																							
	510	530	Yellow Clay Black Sand																																																																																																																																							
	530	570	Black Sand some Blue Clay																																																																																																																																							
	570	575	Black Sand some Clay Brown																																																																																																																																							
	575	580	Blue Clay Reddish																																																																																																																																							
	580	606	Blue Clay some Gravel																																																																																																																																							
	606	618	Black & Blue Sand some Clay																																																																																																																																							
	618	622	Blue Clay																																																																																																																																							
4. METHOD DRILLED <input checked="" type="checkbox"/> Cable <input type="checkbox"/> Rotary <input type="checkbox"/> Dug <input type="checkbox"/> Other																																																																																																																																										
5. WELL CONSTRUCTION Diameter of hole <u>16"</u> inches Total depth <u>622'</u> feet Casing schedule: <input checked="" type="checkbox"/> Steel <input type="checkbox"/> Concrete <table border="1"> <thead> <tr> <th>Thickness</th> <th>Diameter</th> <th>From</th> <th>To</th> </tr> </thead> <tbody> <tr> <td>250 inches</td> <td>16 inches</td> <td>0 feet</td> <td>43 feet</td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table> Was casing drive shoe used? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Was a packer or seal used? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Perforated? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No How perforated? <input type="checkbox"/> Factory <input type="checkbox"/> Knife <input type="checkbox"/> Torch Size of perforation _____ inches by _____ inches <table border="1"> <thead> <tr> <th>Number</th> <th>From</th> <th>To</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table> Well screen installed? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> 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? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Size of gravel _____ Placed from _____ feet to _____ feet Surface seal depth <u>45</u> Material used in seal <input type="checkbox"/> Cement grout <input type="checkbox"/> Pudding clay <input checked="" type="checkbox"/> Well cuttings Sealing procedure used <input type="checkbox"/> Shovel pit <input checked="" type="checkbox"/> Temporary surface casing	Thickness	Diameter	From	To	250 inches	16 inches	0 feet	43 feet																					Number	From	To																																																																																																											
Thickness	Diameter	From	To																																																																																																																																							
250 inches	16 inches	0 feet	43 feet																																																																																																																																							
Number	From	To																																																																																																																																								

Well Log Form 1
4/75 8' 52'

099024

RECEIVED
NOV 11 1959
IrrigationWELL LOG AND REPORT OF THE
STATE RECLAMATION ENGINEER OF IDAHO

Permit No. 26 Well No. 1 County Elmore
 Owner Henry L. Seydel
 Address RFD Box 20 Mt Home Idaho
 Driller Richard Briggs - C.B. Eaton & Sons
 Address Wendell, Idaho
 Well location NW 1/4 SE 1/4 Sec. 10, T. 35 N. S. 6 E. E 1/4
 Size of drilled hole 18 inch

Locate well in section

NW 1/4	NE 1/4
SW 1/4	SE 1/4

Total depth of well 220'Give depth to standing water from the ground 100' Water temp. 60° Fahr.On "Pumping Test" delivery was — g.p.m. or — c.f.s. Drawdown was — feet.Size of pump and motor used to make test Baker tested 30 g.p.m.Length of time of test 2 hours — minutes.If flowing well, give flow — c.f.s. or — g.p.m. and of shut off pressure —If flowing well, described control works —

(TYPE AND SIZE OF VALVE, ETC.)

Water will be used for domestic Weight of casing per lineal foot —Thickness of casing 3.05 Casing material Pipe (STEEL, CONCRETE, WOOD, ETC.)Diameter, length and location of casing 18" O.D. 70.5' at top of well
(CASING 12" IN DIAMETER OR LESS, GIVE INSIDE DIAMETER)
(CASING OVER 12" IN DIAMETER, GIVE OUTSIDE DIAMETER)

CASING RECORD

Diam. Casing	From Feet	To Feet	Length	Remarks—seals, grouting, etc.
18" O.D.	0	70.5'	70.5'	

Number and size of perforations — located — feet to — feet from groundDate of commencement of well Aug 15 - 1959 Date of completion of well Sept 5, 1959

NW SE 5.10 35 4E

WELL LOG

From Foot	To Foot	Type of Material	Water-bearing Formation Above, Yes or No	Casing Perforated Above, Yes or No
0	3	Topsoil		
3	49	gravel - coarse		
49	52	Sand - water		
52	56	clay & gravel mixed		
56	65	gravel		
65	70	clay & gravel		
70	124	Salted Lava		
124	139	porous Lava		
139	150	Lava		
150	152	Sandstone		
152	168	Lava - impregnated with clay		
168	175	Lava		
175	180	Lava impregnated with clay		
180	182	Hard Sand		
182	187	Lava - clay		
187	195	porous Lava - clay		
195	200	Thin Salted porous Lava		
200	210	Lava Salted		
210	220	Lava & clay		

WELL DRILLER'S STATEMENT

This well was drilled under my supervision and the above information is true and correct to the best of my knowledge and belief.

Signed

By

Dated Sept 5, 1952License No. 26