

Memo

August 13, 2014

To: Allen Merritt, IDWR Southern Regional Manager

From: Ken Neely, Technical Hydrogeologist

RE: Relationship of ground water in the Grush well in Cassia County to the Snake River.

The area in this investigation is in southern Cassia County, Idaho. The Grush well is located in Township 14 South, Range 26 East, Section 1, SESENW, about 5.2 miles south of Malta and about 30 miles southeast of Burley (Figure 1). The well is located within the boundaries of the Raft River Critical Ground Water Area which was established by IDWR in 1963. The well is within the Trust Water Area of the Snake River Basin (Figure 2).

Grush #1 Well

The drilling date for the Grush #1 well is unknown, but it has to be prior to October 1981 based on an IDWR Memo dated January 29, 1992, which states "that the original applicants, the Wights, applied for use of an existing low temperature geothermal well... in October 1981". There is evidence indicating the well was drilled for exploration, but the well driller is unknown and there is no well report in IDWR's files. An IDWR Memo dated May 16, 1983, states that well is "approximately 5,000 feet deep and is cased to 630 feet". However, some other documentations report that the well is 6,787 deep and 12 inches in diameter. Reported water temperatures range from 150° F to 190° F. A lithologic log is included in the water right file at IDWR (Figure 3). However, the caption for this figure suggests that some of the lithologic entries are not accurate based on correlations with another deep well in the area.

Nearby Wells

There are a number of wells in the general vicinity of the Grush well (Figure 4). One well, which is listed in IDWR's Geothermal Database, is about ½ mile south of the Grush well. The reported temperature for this well is 145° F, but the well depth is unknown and no well driller's report has been found.

There are at least 12 wells within one mile of the Grush well, as determined by records in IDWR's Well Construction Database. Eleven of these wells have depths that range from 240 feet to 503 feet. Four of these wells had temperature data recorded on their well reports. Three wells had temperatures of 55° F and one well had a reported temperature of 69° F. One of the 12 wells is considerably deeper (1,050 feet). This well was drilled for Peter Grush in 2001, and is called the Grush West well. Grush West is located about 1/3 mile to the west of the Grush #1 well. The well produces from a water zone from 509 feet to 523 feet (Figure 5). There is no water temperature information on the well log. The lower 500+ feet of the Grush West well is predominately clay with minor sand and gravel.

IDWR Comments from the Water Rights File

An IDWR Memo from Frank Sherman dated January 26, 1983, states that the geothermal aquifer in this valley is connected to the shallow irrigation system, as demonstrated at the Raft River site, which is about 9.5 miles to the south. Mr. Sherman also noted that the well flows at the land surface, which "suggest an upward gradient with some geothermal recharge to the shallow system", however, "there are no obvious manifestations of interconnection (i.e., no hot springs or known faults)". Based on these

observations and a USGS computer model of the upper Raft River valley, Mr. Sherman concluded that the pumping of the well "should not cause measureable impacts on the irrigation system for 50 to 100 years".

An IDWR Memo from Glen Saxton dated May 16, 1983, stated that "although the deep geothermal aquifer is connected to the shallower system, there are no good aquifers in the 1000' to 1500' depth...."

In January 1992, Pam Skaggs, IDWR wrote a Memo regarding an application for ground water appropriation from the Grush #1 well, which at that time was owned by Mr. Melrose Burgess. Based on the fact that the previous application (43-07172) was approved using the conclusion that "there is no obvious connection with the shallower system", Ms. Skaggs concluded that "it would appear reasonable to approve Mr. Burgess' application 43-07308 with similar conditions."

Conclusions

Four observations indicate that the deep, low-temperature geothermal aquifer in the Grush #1 well is hydraulically separate from the shallow (<550 feet), cold water aquifer in the area, and thus the low-temperature geothermal aquifer is not tributary to the Snake River:

1. Local shallow cold water aquifers do not appear to be impacted by the geothermal aquifer. There are four shallow wells within about a mile of the Grush #1 well that have total depths less than 550 feet and have water temperature data. Only one of the wells had a reported value greater than the normal ambient temperature of 55° F. The lack of warm water in the shallow aquifers may be attributed to the existence of thick clays in the depths from about 550 feet to 1,050 feet as observed in the Grush West well. These clays are probably aquitards that prevent vertical movement of thermal ground water into the shallow system.
2. Flowing conditions in the Grush #1 well. The well is reported to be flowing but no flow rates were found in the water right file. It can be reasonably assumed that ground water flows from the well below 690 feet, which is where the bottom of the casing is, into any porous and permeable lithologic layers that are open to the well. It is unlikely that ground water flows from any of these recharged layers back into the well, even when the well is discharging, because of the high pressure being exerted from the well's water column.
3. The thermal gradient in the Grush #1 well exceeds the average gradient. The average thermal gradient is about 1.5°F per 100 feet (Freeze and Cherry, 1979). The Grush #1 well has a thermal gradient of 2.0°F per 100 feet based on the maximum reported temperature of 190° F, as recorded in a letter from Mr. Mel Schulte, IDWR, to owners Peter and Sylvia Grush, dated May 3, 1994.
4. Previous appropriation decisions by IDWR staff on the Grush #1 well. IDWR approved two applications for withdrawals from the Grush #1 well in the past based on the conclusion that the shallow cold water aquifers would not be depleted by discharge from the well.

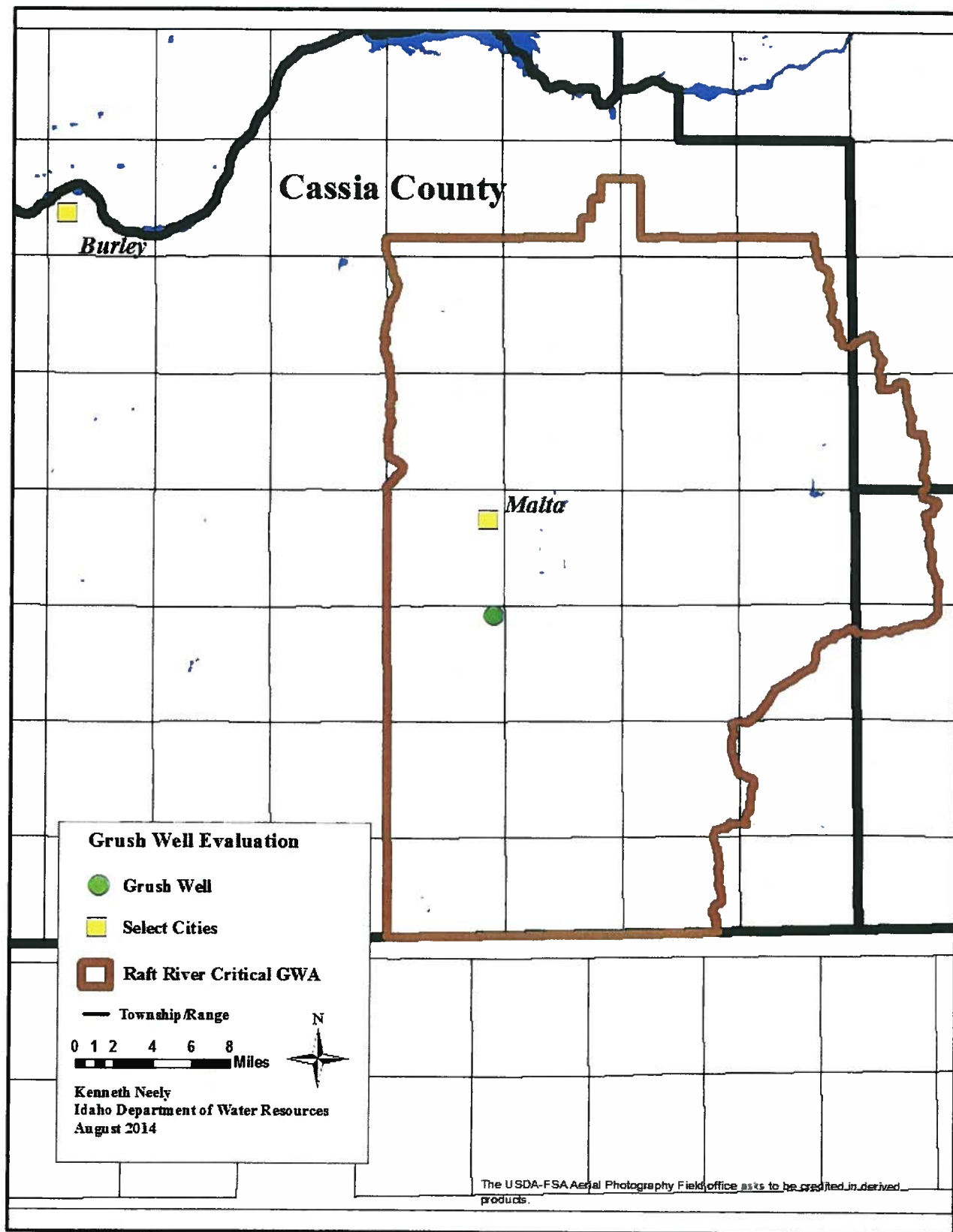


Figure I. Location Map for the Grush #1 Well

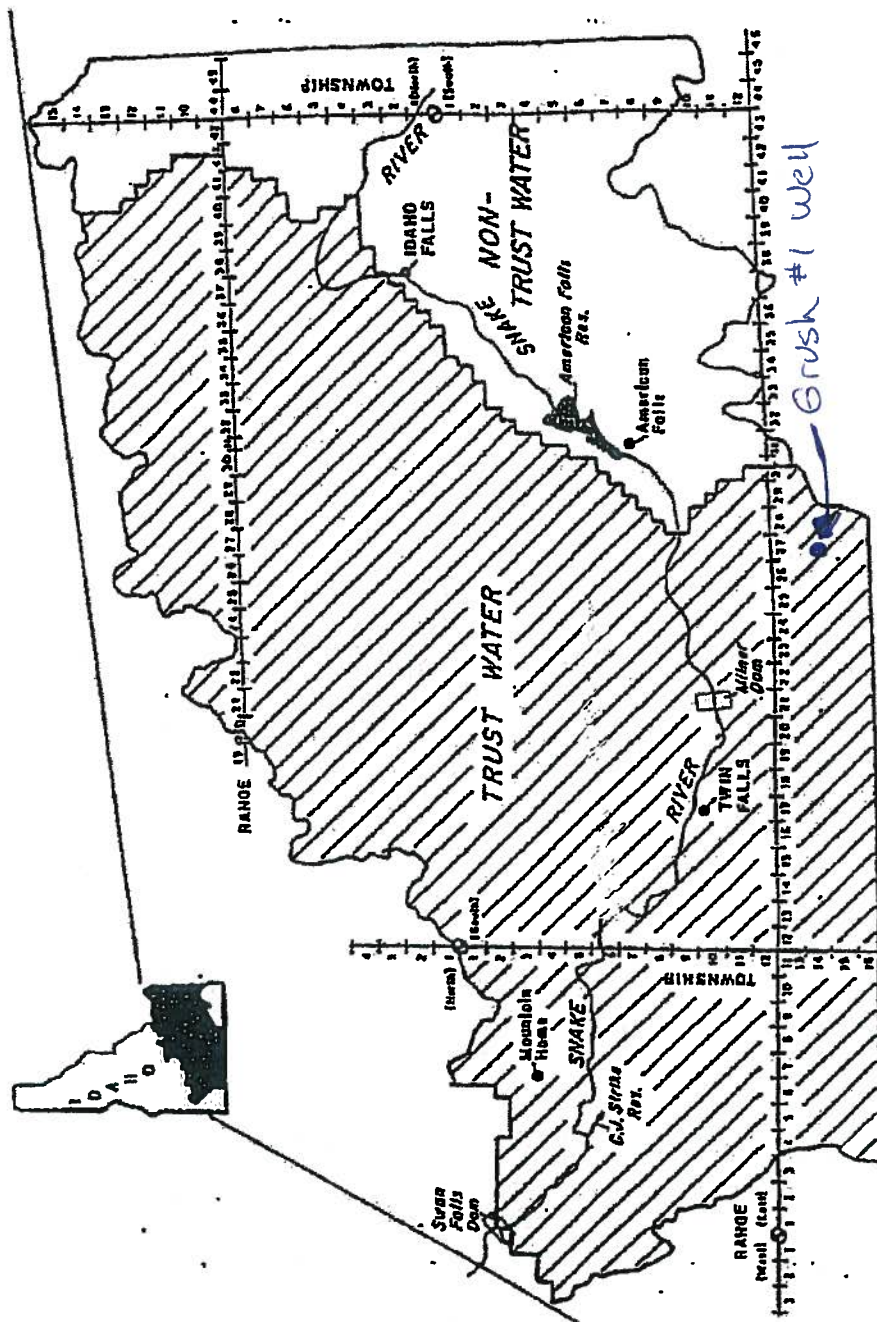
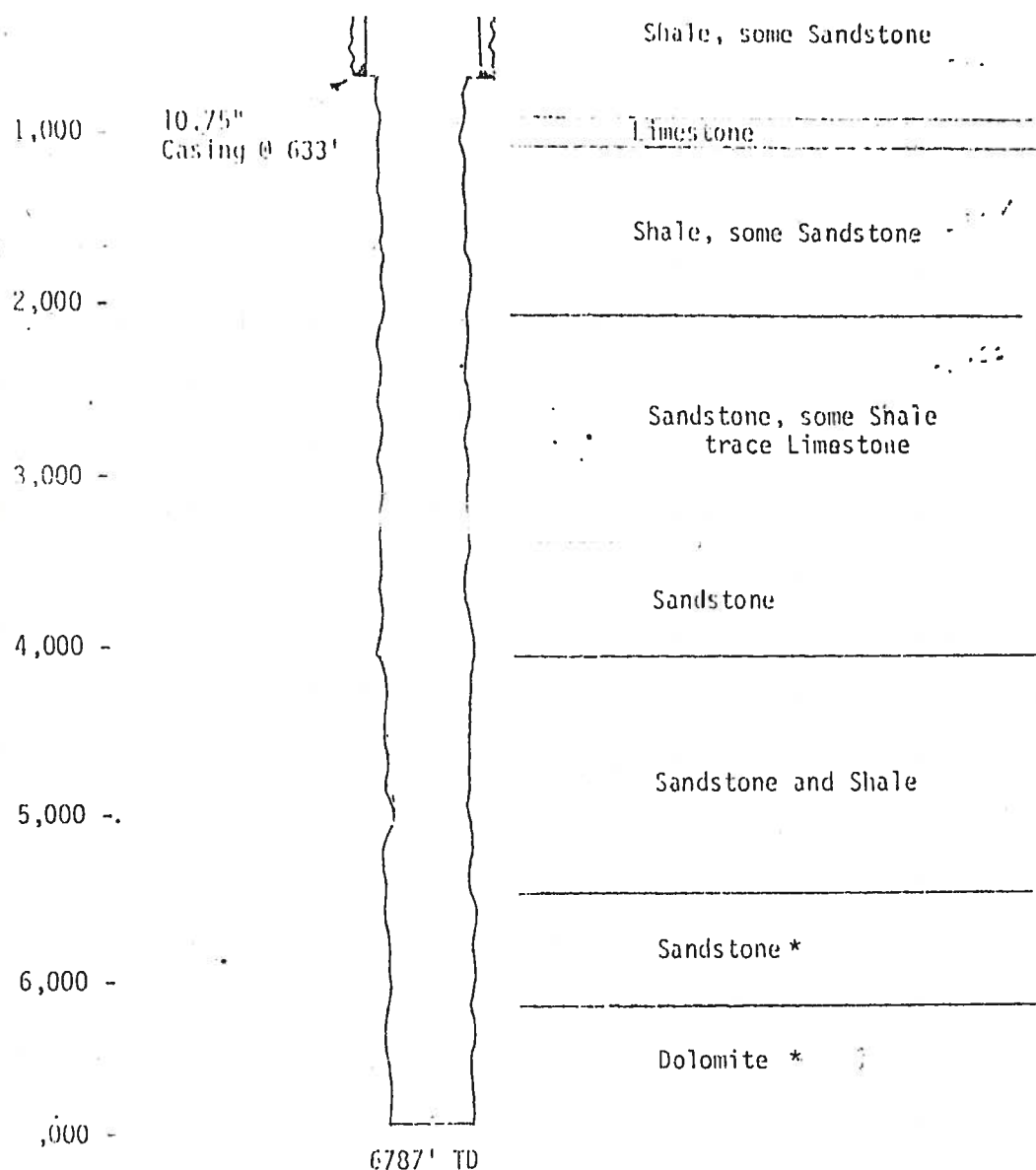


Figure 2. Trust water areas of the Snake River Basin.



These lithologies are from the well mud log. Based on Raft River geothermal well data, the mud log lithologies are likely erroneous. The basal sandstone is most probably the PC metamorphic schist and quartzite. The dolomite is probably PC quartz monzonite. However, Paleozoic limestones (dolomite) are found in the Strevell area, but absent in the Raft River wells.

Figure 3. Grush #1 well lithologic record.

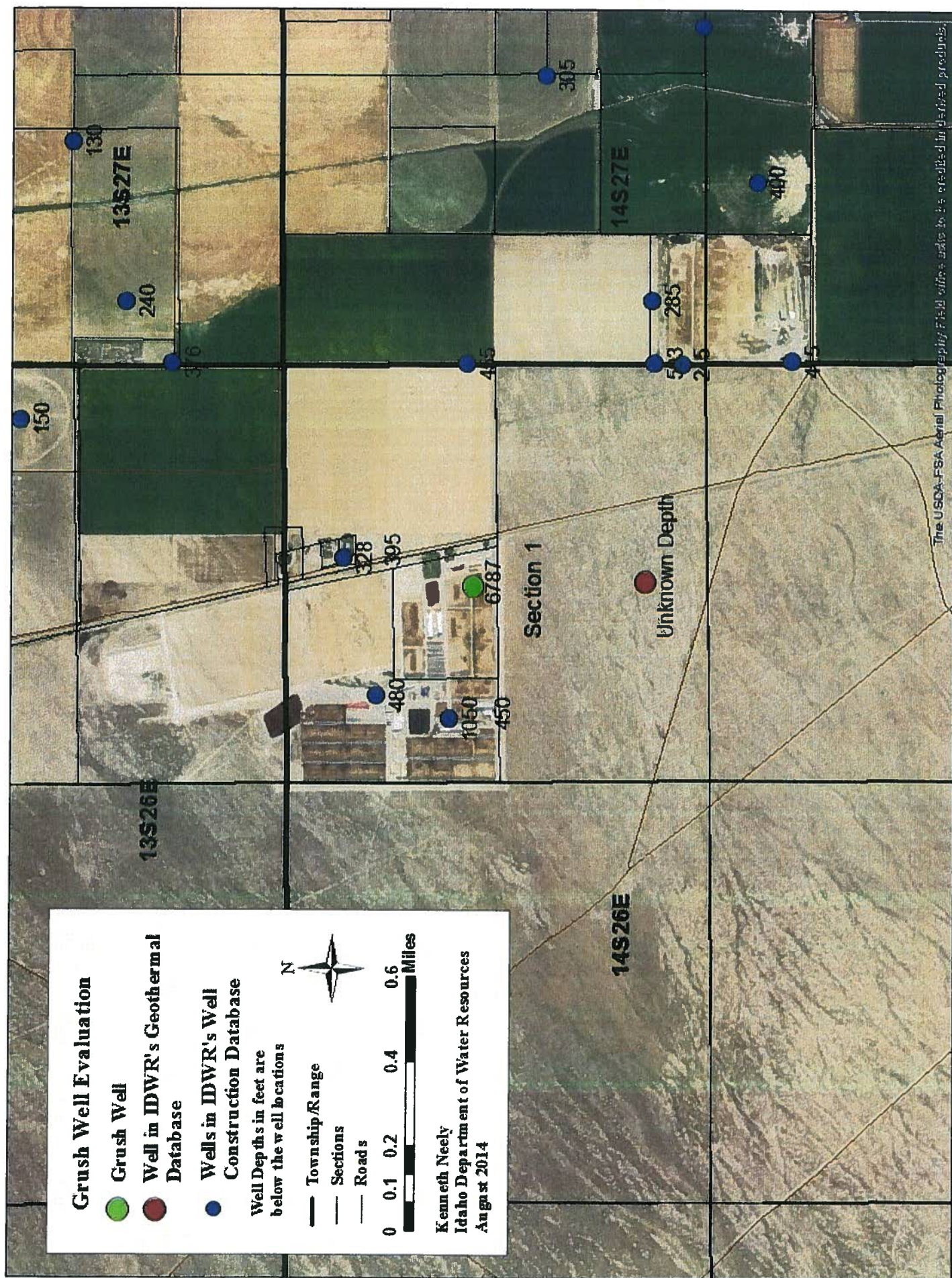


Figure 4. Locations of the Grush well, and nearby wells,

Basin 43

ID 339893

Form 238-7
11/97App 845134
Per 767896IDAHO DEPARTMENT OF WATER RESOURCES
WELL DRILLER'S REPORT

Office Use Only			
Inspected by _____			
Twp _____	Rge _____	Sec _____	
1/4 _____	1/4 _____	1/4 _____	
Lat: _____	Long: _____	_____	

1. WELL TAG NO. ~~XXXXXXXXXX~~ D0015051

DRILLING PERMIT NO. 767896

Other IDWR No. 43-25808

2. OWNER:

Name PETER J. GRUSH
 Address 2025 S HWY 81
 City MALTA IDAHO State _____ Zip 83343

3. LOCATION OF WELL by legal description:

Sketch map location must agree with written location.

N		Twp. <u>14</u>		North ☐	or	South ☒
E		Rge. <u>26</u>		East ☒	or	West ☐
S		Sec. <u>1</u>		1/4 <u>SW</u>	1/4 <u>NW</u>	1/4
W		Gov't Lot _____		County <u>CASSIA</u>		
		Lat: _____		Long: _____		
		Address of Well Site <u>2025 S 2170 E</u>		City <u>MALTA</u>		

(Show at least name of road + Distance to Road or Landmark)

LI. _____ 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/FILTER PACK			AMOUNT		METHOD
Material	From	To	Sacks or Pounds		
cement	0m	20	39sacks	overbore	

Was drive shoe used? ☒ Y ☐ N Shoe Depth(s) _____Was drive shoe seal tested? ☒ Y ☐ N How? bailer

8. CASING/LINER:

Diameter	From	To	Gauge	Material	Casing	Liner	Welded	Threaded
22/4	+1.5	862	250	steel	☒	☐	☒	☐

Length of Headpipe _____ Length of Tailpipe _____

9. PERFORATIONS/SCREENS

Perforations _____ Method MILLS
 Screens _____ Screen Type _____

From	To	Slot Size	Number	Diameter	Material	Casing	Liner
513	524	1/8	66	123/4	steel	☒	☐

10. STATIC WATER LEVEL OR ARTESIAN PRESSURE:

163 ft. below ground Artesian pressure _____ lb.
 Depth flow encountered _____ ft. Describe access port or control devices: 2" pipe

11. WELL TESTS:

☒ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Yield gal./min.	Drawdown	Pumping Level	Time
380	35 ft	198	27 hrs

Water Temp. _____ Bottom hole temp. _____

Water Quality test or comments: _____

12. LITHOLOGIC LOG: (Describe repairs or abandonment) Depth first Water Encounter _____

Bore Dia.	From	To	Remarks: Lithology, Water Quality & Temperature	Water
				Y N
16	0	20	large gravel	
12	20	52	large gravel	
	52	91	clay & gravel	
	91	117	sand & fine gravel	
	117	154	brown sandy clay	
	154	172	brown sandy & some gravel	
	172	261	brown sand	
	261	280	brown sandy clay	
	280	296	fine water sand x	
	296	332	brown sandy clay	
	332	341	water sand & fine gravel	
	341	385	brown sticky clay	
	385	397	course sand, fine grav.	
	397	451	brown sand & clay	
	451	458	course sand	
	458	482	brown sandy clay	
	482	485	course sand, gravel fine	
	485	509	brown sandy clay	
	509	523	course water sand & gravel x	
	523	539	conglomerate clays	
	539	577	brown & yellow clay	99'
	577	638	brown sandy clay	
	638	686	gray clay some gravel	
	686	694	water sand fine gravel	
	694	796	gray sticky clay	
	796	808	gray green sticky clay	223'
	808	917	gray sticky clay	
	917	1008	gray sticky clay, gravel	109'
	1008	1026	gray clay & sandstone	
	1026	1080	gray green sticky clay	124'

Completed Depth 1050 (Measurable)Date: Started 2-8-2001 Completed 4-7-2001

13. DRILLER'S CERTIFICATION

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

Company Name BOUCH WELL DRILLING INC Firm No. 161

Firm Official [Signature] Date 4-7-2001
 and
 Driller or Operator [Signature] Date [Signature]
 (Sign once if Firm Official & Operator)

FORWARD WHITE COPY TO WATER RESOURCES

Figure 5, Grush West Well Driller's Report