Monitoring Report for the

San Juan Spanish Valley Special Service District

Spanish Valley, Utah

May, 2019

Prepared for:
San Juan Spanish Valley SSD,
The Utah Division of Water Rights,
& Spanish Valley Stakeholders

Prepared by:

CASCADE
WATER RESOURCES

CONTENTS

1.0 Introduction 1
2.0 Existing Wells & Drilling Activity on SJSVSSD Water Right 1
3.0 Extractions on SJSVSSD Water Right 1
4.0 Water Elevation 4
5.0 Discussion of Water Elevation Monitoring 7
6.0 Planned Activity for 2019 11
7.0 Recommended Changes to Monitoring plan 11

FIGURES

Figure 1. SJSVSSD Monitoring Plan Location Map……2
Figure 2. SJSVSSD Approved Points of Diversion……3
Figure 3. Change in Potentiometric Surface from March 2018 to March 2019……8
Figure 4. Change in Water Elevation 1986 to 2019……10

APPENDICES

APPENDIX A: SITLA Behind the Rocks Well Report
APPENDIX B: March 2018 & March 2019 Water Level Data
APPENDIX C: May 1st, 2018 NRCS Utah Water Supply Outlook Report for Southeastern Utah
APPENDIX D: April 1st , 2019 NRCS Utah Water Supply Outlook Report for Southeastern Utah

1.0 INTRODUCTION

As part of a Memorandum Decision for the San Juan Spanish Valley Special Service District (SJSVSSD) water right a37400, monitoring and reporting of water elevation data in the Spanish Valley/Moab City area is a requirement. In an April 2018 report submitted to the Utah Division of Water Rights (DWRi), a framework for the monitoring and reporting was set forth and agreed on by the DWRi. Data will be collected from March to March each year and then reported to the DWRi by end of July. Figure 1 shows the location of the Monitoring plan and the wells involved.

2.0 EXISTING WELLS & DRILLING ACTIVITY ON SJSVSSD WATER RIGHT

Figure 2 shows the location of all of the well points of diversion on change application a37400. When the change application was filed, only one site had an existing well, the informal name given this well is the SITLA Behind the Rocks Well. This well was pump tested in September of 2017 by SJSVSSD. Refer to Appendix A for the report on the pump testing. As of the time of this report there has been no further activity on this site.

From December 2017 to March 2018 a new well with the informal name of SJSVSSD Well 1 was drilled, constructed, developed, & pump tested. Refer to Figure 1 or 2 for the location of this well. All work completed on this well was done in accordance to the guidelines set forth by DWRi and the Utah Division of Drinking Water (DDW). A report on this well has previously been submitted to DWRi. SJSVSSD plans on having this well in production in Fall or Winter of 2019.

3.0 EXTRACTIONS ON SJSVSSD WATER RIGHT

During the testing of the SITLA Behind the Rocks Well an estimated 0.62 acre feet was extracted from the aquifer.

To date the only extractions from SJSVSSD Well 1 have been during the DWRi mandated open hole testing and the DDW mandated 24-hour test. The extractions were 0.31 acre-ft in December of 2017, 5.8 acre-ft in January of 2018, and 2.12 acre-ft in March of 2018.

The graph below depicts the extractions from SJSVSSD Well 1, DWRi has approved up to 500 acre-ft. of extractions from SJSVSSD Well 1.

SITE KEY	SITE NAME	SITE KEY	SITE NAME	SITE KEY	SITE NAME
1	(D-25-21)26dcc-1	18	(D-26-22)15daa-2	34	(D-26-22)22ddc-2 formerly (D-26-22)27aaa- 1
2	(D-25-21)35ddc-1	19	(D-26-22)15dca-1		
3	(D-25-21)35cdc-1	20	(D-26-22)15cca-1	35	(D-26-22)26cba-1
4	(D-26-21)2acc-1	21	(D-26-22)15ddc-1	36	(D-26-22)26dba-1 formerly (D-26-22)26ddb- 1
5	(D-26-21)2bdd-1	22	(D-26-22)15bdb-1		
6	(D-26-21)1caa-1	23	(D-26-22)22daa-1	37	(D-26-22)26dda-1
7	(D-26-21)1dbb-3	24	(D-26-22)22aab-2	38	(D-26-22)26dbd-1
8	(D-26-21)1ddb-1	25	(D-26-22)22aab-1	39	SHUMWAY
9	(D-26-22)7aca-1	26	(D-26-22)23bba-1	40	(D-26-22)35dcb-1
10	(D-26-22)17aaa-2	27	(D-26-22)21aL10-1 formerly (D-26-22)16ddd- 3	41	**SJSVSSD WELL 1**
11	(D-26-22)17aba-3			42	(D-27-23)6baa-1
12	(D-26-22)15bbb-1	28	(D-26-22)22aac-1	43	SPIELMAN
13	(D-26-22)17aad-3	29	(D-26-22)22abc-1	44	(D-26-22)1bbc-1
14	(D-26-22)15acb-1	30	(D-26-22)20dL86-1	45	(D-27-23)6cad-1
15	(D-26-22)15acc-1	31	(D-26-22)22dad-1	46	(D-27-23)23caa-1
16	(D-26-22)15bcc-2	32	(D-26-22)22cab-1	47	**SITLA Behind the Rocks Well [(D-27-22)26dda-1]**
17	(D-26-22)17cab-1	33	(D-26-22)23cdd-1		

(1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12) (13) (14) (15) (16) (17) (18) (19) (20) (21) (22) (23) (24) (25) (26) (27) (28) (29) (30) (31) (32) (33) (34) (35) (36) (37) (38) (39) (40) (41) (42) (43) (44) (45) (46)

(41) SJSVSSD Well 1

(47) SITLA Behind the Rocks Well [(D-27-22)26dda- 1]

Moab

MOAB VALLEY

SPANISH VALLEY

HUNTER CANYON

BEHIND THE ROCKS

BRIDGER JACK MESA

BLACK RIDGE

WILSON MESA

KANE SPRINGS CANYON

POLE CANYON

BLACK CANYON

Kens Lake

Spanish Valley Study Area

SJSVSSD Existing Well

Groundwater Monitoring Location

SJSVSSD 2019 Monitoring Report

Figure 1.

Location of Monitoring Wells

Drawn By:
G3 Mapping
Rich Emerson
rich@g3mapping.com

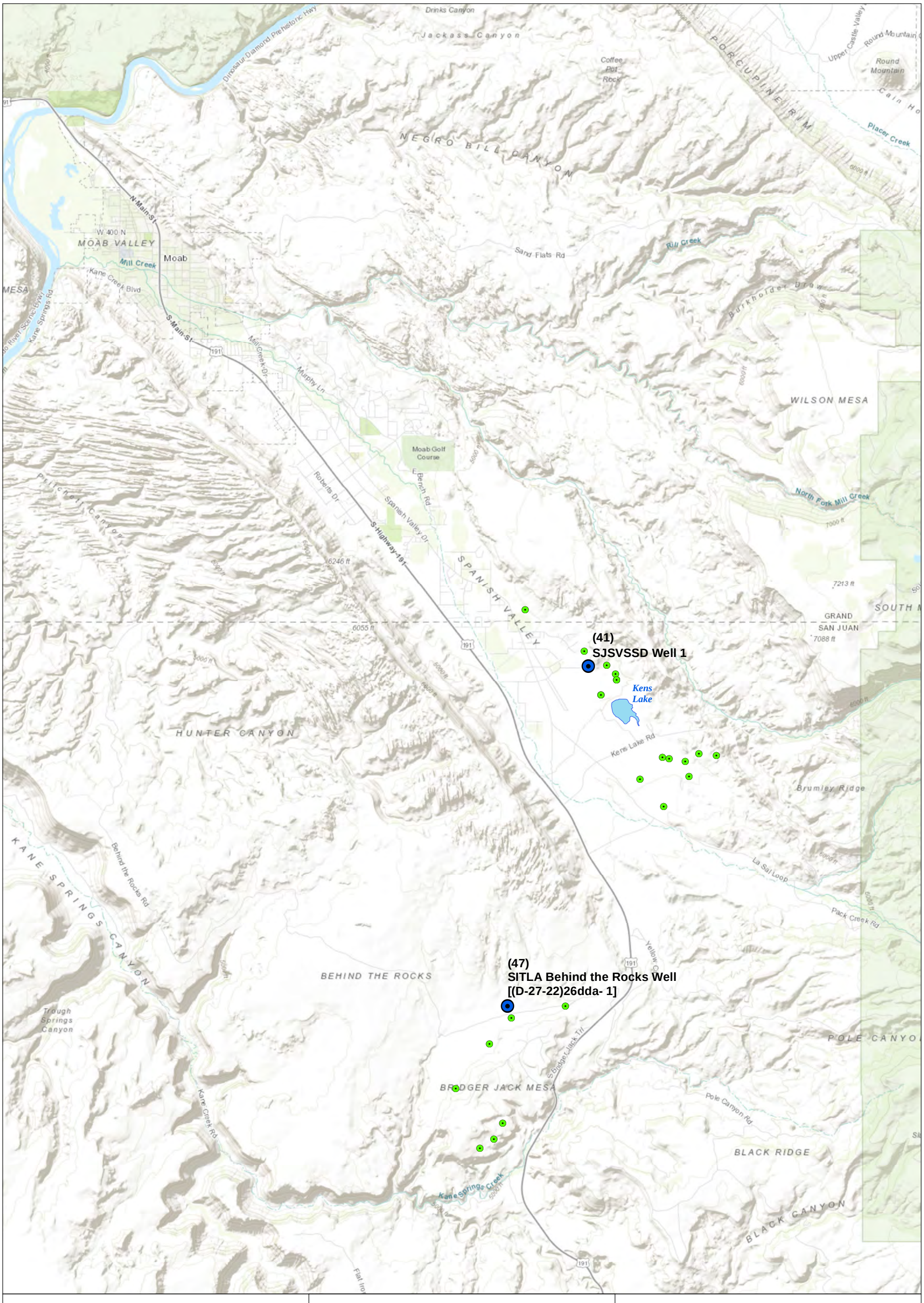
Project Manager:
John Files

Date: May 2019

0 2 Miles

1:100,000

CASCADE WATER RESOURCES



SJSVSSD Existing Well

SJSVSSD POD

SJSVSSD 2019 Monitoring Report

Figure 2.

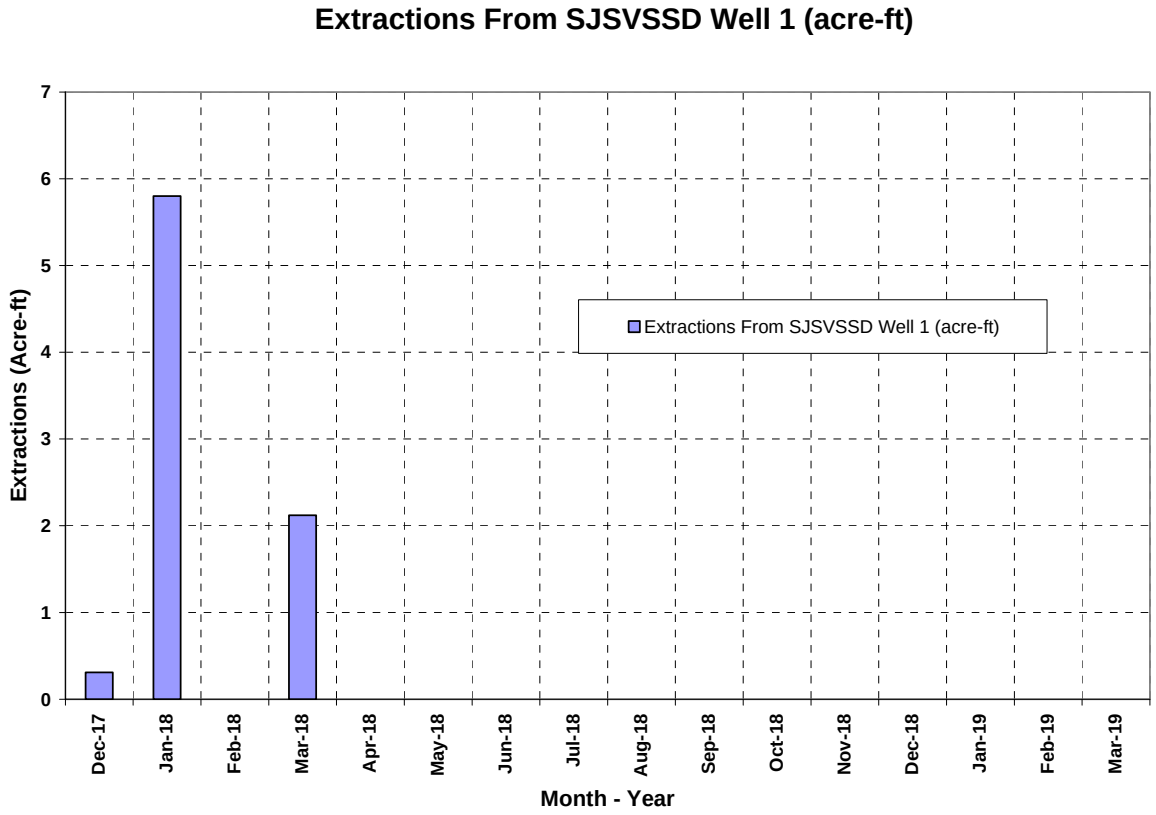
SJSVSSD Existing Wells and Points of Diverson

0 2 Miles

1:100,000

Drawn By: G3 Mapping Rich Emerson rich@g3mapping.com	Project Manager: John Files
	Date: May 2019

CASCADE WATER RESOURCES



4.0 WATER ELEVATION

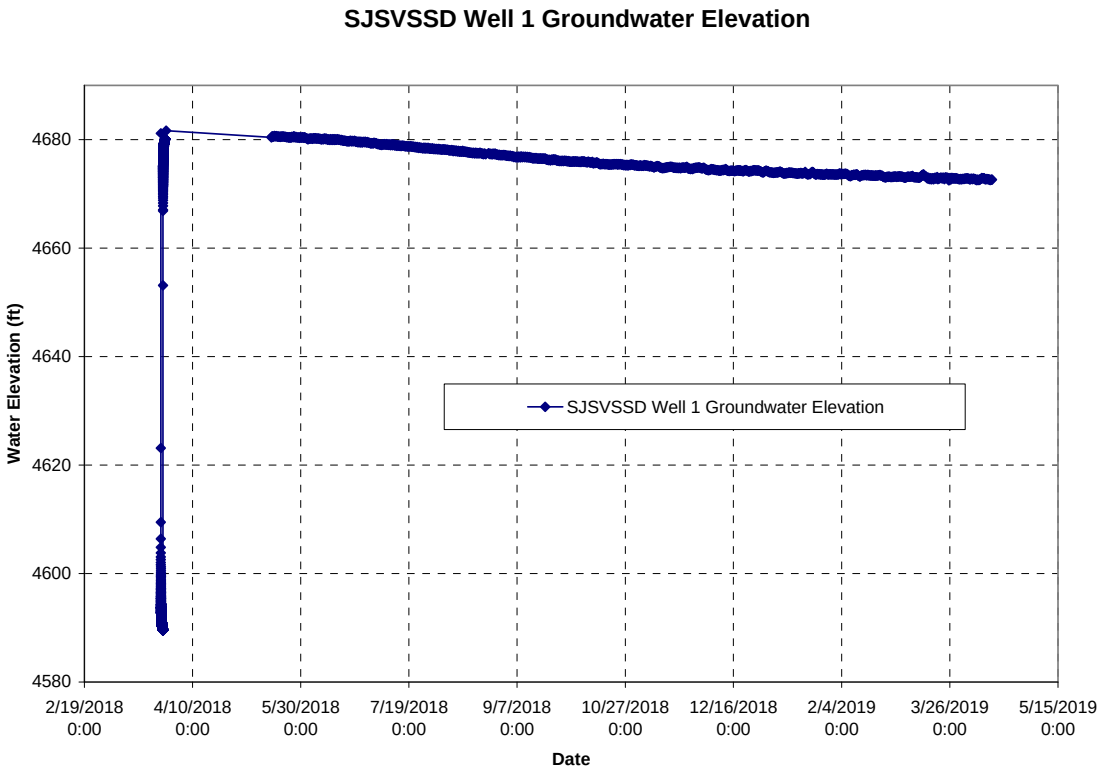
SJSVSSD monitors Well 1 and three nearby private wells with transducers that are logging at a minimum a reading every 6 hours. These wells are the Spielman, Shumway, and BLM wells. The USGS checks the water level in wells in its monitoring plan once a year in March. As the transducer data can give an insight into the local trends near Well 1, recharge periods, recharge influences, and pumping influences it can be valuable data and will be presented within this document.

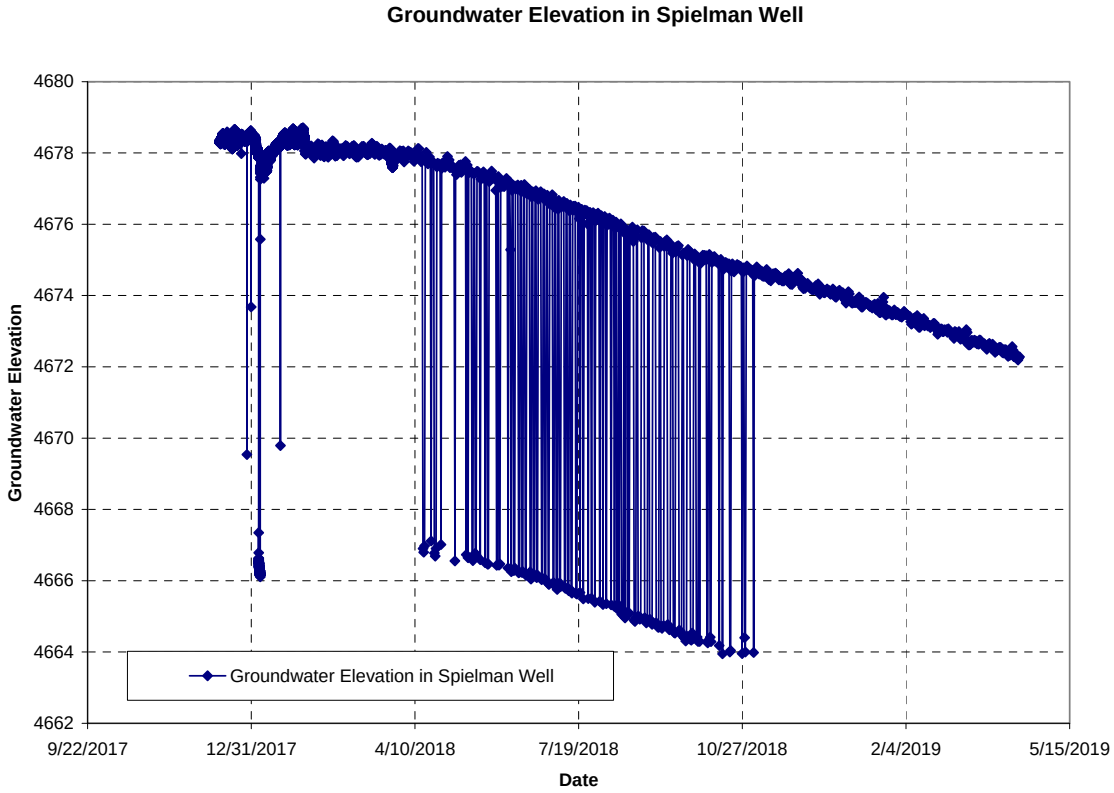
Below is a table of the change in water level of the wells monitored with transducers;

Well ID	Change in Elevation March 2018 to March 2019
SJSVSSD Well 1	-8.85
Spielman Well	-5.56
Shumway Well	-4.6*
BLM Well	-14.49

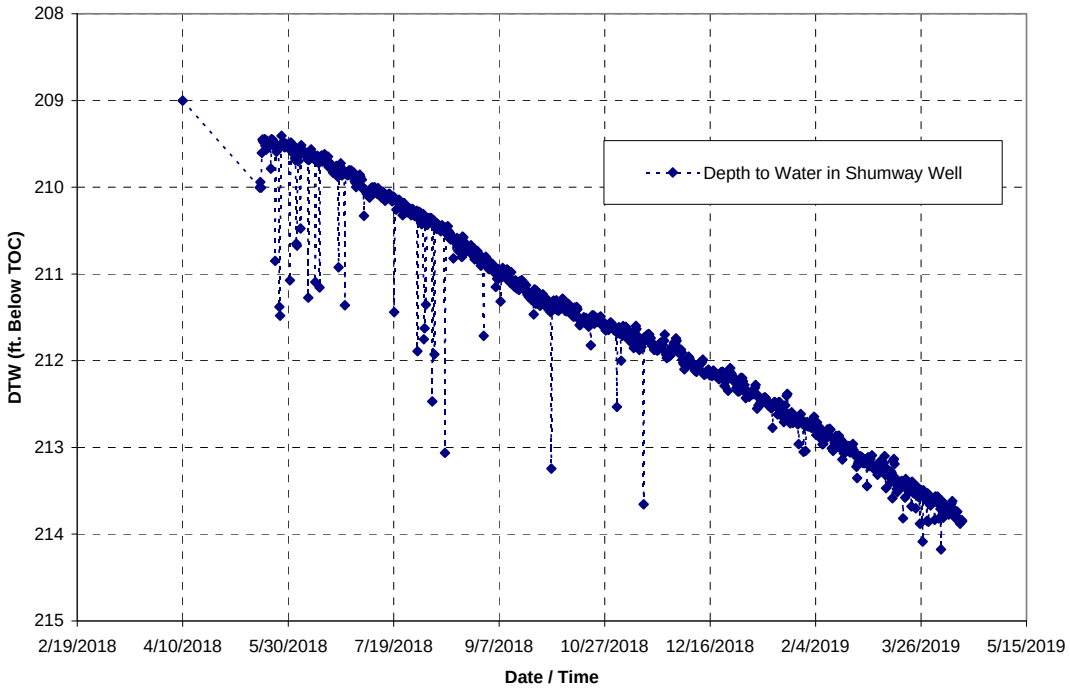
*Shumway transducer installed in early April of 2018

Below are the time series of the water level or elevation in each well.

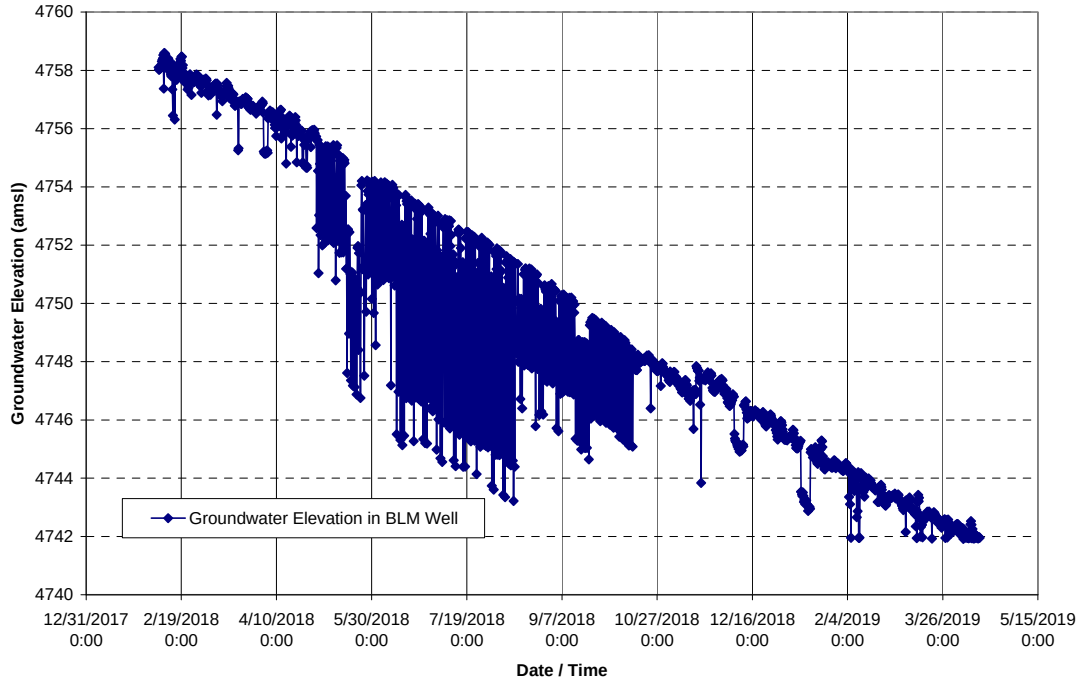

SJSVSSD Well 1 Groundwater Elevation
Water Elevation (ft)
4680
4660
4640
4620
4600
4580
SJSVSSD Well 1 Groundwater Elevation
2/19/2018 0:00
4/10/2018 0:00
5/30/2018 0:00
7/19/2018 0:00
9/7/2018 0:00
10/27/2018 0:00
12/16/2018 0:00
2/4/2019 0:00
3/26/2019 0:00
5/15/2019 0:00
Date


Groundwater Elevation in Spielman Well
Groundwater Elevation
4680
4678
4676
4674
4672
4670
4668
4666
4664
4662
Groundwater Elevation in Spielman Well
9/22/2017
12/31/2017
4/10/2018
7/19/2018
10/27/2018
2/4/2019
5/15/2019
Date

Depth to Water in Shumway Well



Groundwater Elevation in BLM Well



To graphically show the change in water level from the time of the start of the monitoring plan in 2018, a change in potentiometric surface elevation map has been created showing the change in water level from March 2018 to March 2019. The USGS water levels are only taken once a year in March, where as the transducer data is reading a minimum of every 6 hours, levels were used from March 31st, 2019. Figure 3 presents this data. The values used to create this map are included in Appendix B.

The contour intervals given on the map are;

-10' to -15' (red shaded)
-5 to -14.99 (orange shaded)
-1 to -4.99 (yellow shaded)
0 to -.99 (green numbers)
.01 to 1.0 (blue numbers)

The values from negative 1 foot to positive 1 foot were not contoured as they are likely more representative of regional changes and not local influence and it was not feasible to draw these changes with a closed contour.

As the 2018 and 2019 data is just a snapshot of the long term trends of the Valley, a long-term USGS time series has been added to the plot to give an idea of the long-term, pre-SJSVSSD Well 1 trends.

5.0 DISCUSSION OF WATER ELEVATION MONITORING

As there were no known changes in extractions from the wells in the Kens Lake area for the March 2018 to March 2019 area, the declines have to be attributed to a decline in recharge for the 2017-2018 water year (Oct-Apr).

The May 1st, 2018 NRCS Utah Water Supply Outlook Report for Southeastern Utah which includes Spanish Valley had the following data for the 2017-2018 water year (Oct-Apr);

"Snowpack in the Southeastern Utah is much below normal at 0% of normal, compared to 0% last year. Precipitation in April was much below average at 31%, which brings the seasonal accumulation (Oct-Apr) to 46% of average. Soil moisture is at 64% compared to 74% last year. Reservoir storage is at 49% of capacity, compared to 92% last year. Forecast streamflow volumes range from 4% to 42% of average. The surface water supply index is 9% for Moab."

The NRCS Southeastern Report is included in Appendix C

(1) 0.53
(2) -0.41
(3) -0.41
(4) -1.11
(5) -0.04
(6) -0.08
(8) 0.24
(9) -1.06
(13) 0.48
(17) 0.5
(26) -2.21
(27) -0.32
(30) -0.4
(31) -2.15
(32) -2.33
(34)
(36) -3.93
(39) -4.85
(40) -5.04
(41) SJSVSSD Well 1 -8.88
(42) -11.22
(43) -5.56
(45) -14.49
(47) -0.03

Long term trend of water levels in central Spanish Valley
USGS was unable to measure the water level in this well in 2019

Water level change 2018 - 2019

- -15 - -10.00
- -9.99- -5.00
- -4.99 - -1.00
- -15.00 - -10.00
- -9.99 - -5.00
- -4.99 - -1.00
- -0.99 - 0.00
- 0.01 - 0.99

SJSVSSD 2019 Monitoring Report

Figure 3.

Water Level Change 2018 - 2019

Drawn By:
G3 Mapping
Rich Emerson
rich@g3mapping.com

Project Manager:
John Files

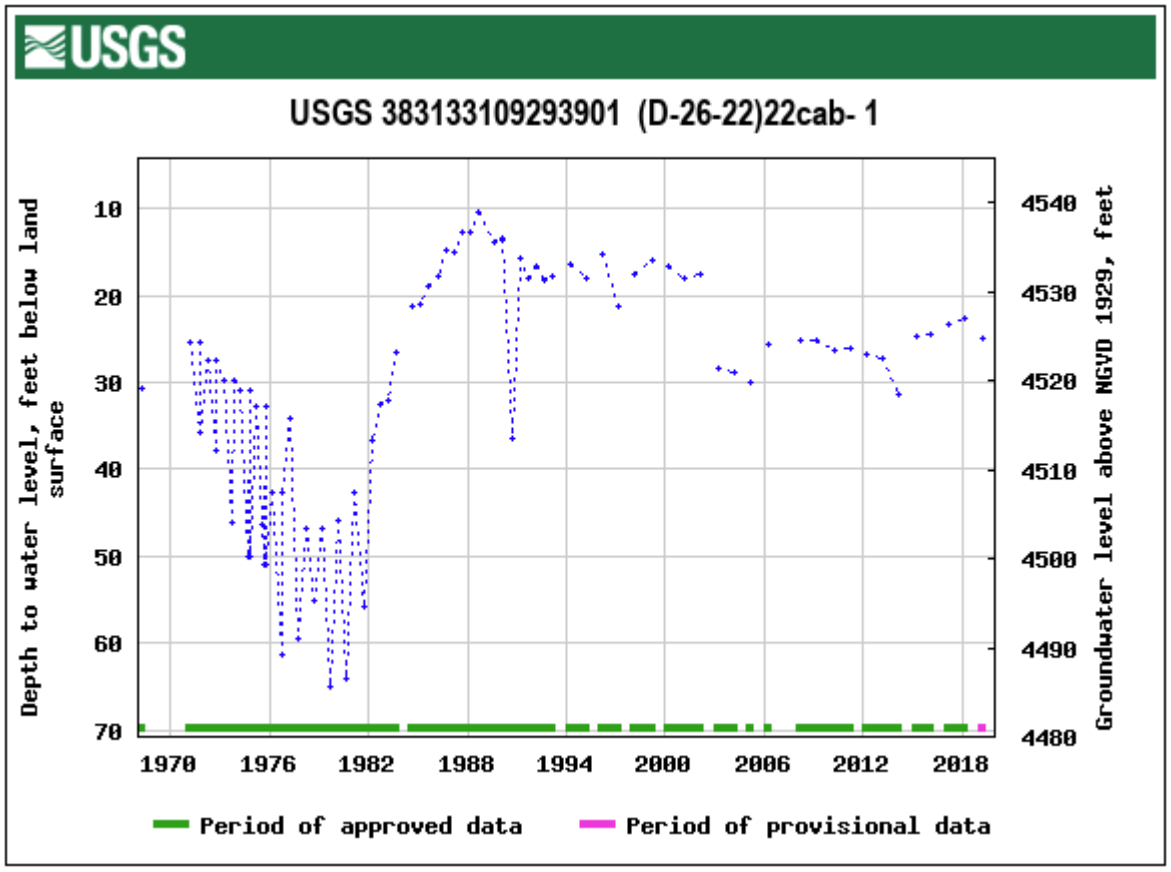
Date: May 2019

0 2 Miles

1:100,000

CASCADE WATER RESOURCES

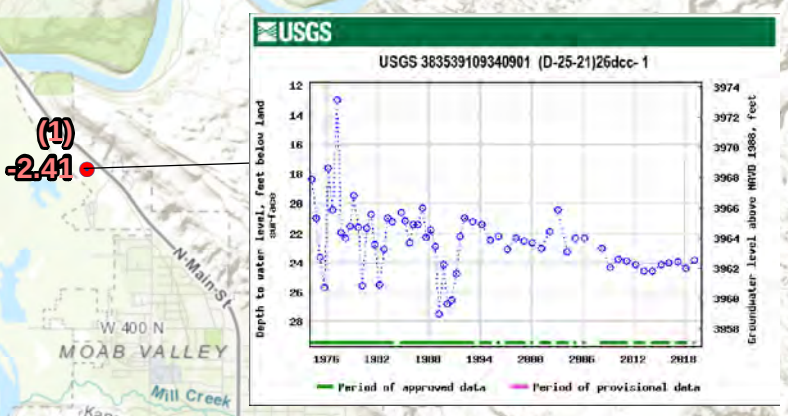
When the distribution of change in elevation is studied, it appears the wells closest to Kens lake have seen the largest decline and the farther away from Kens Lake the less decline. It has been hypothesized that the loss from Kens Lake recharges the local aquifers, the 2018-2019 data seems to support this theory. Figure 4 is a map of the long term trends from USGS monitoring. This data shows a large increase in the water table post construction of Kens Lake. Below is the time series also depicted on Figure 3. This plot also shows the drop from 2018 to 2019.

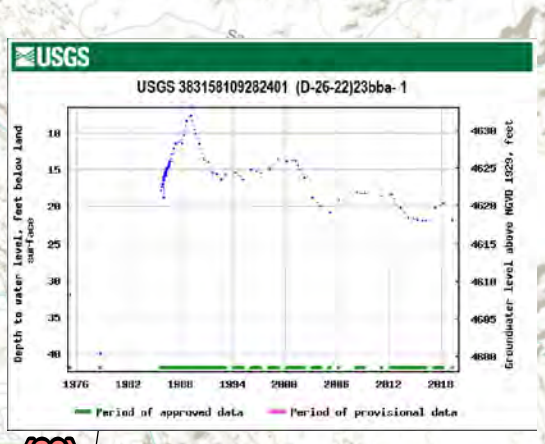


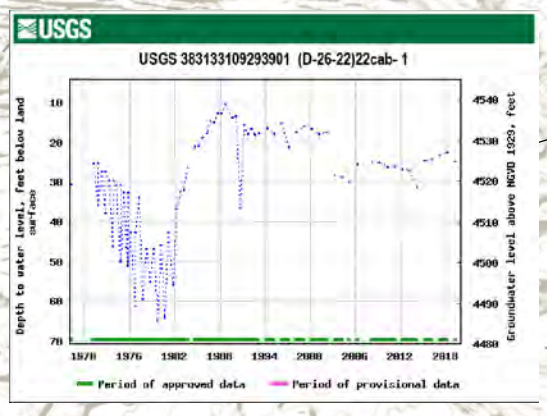
This plot demonstrates the recharge from Kens Lake post construction, then a slow return to "equilibrium".

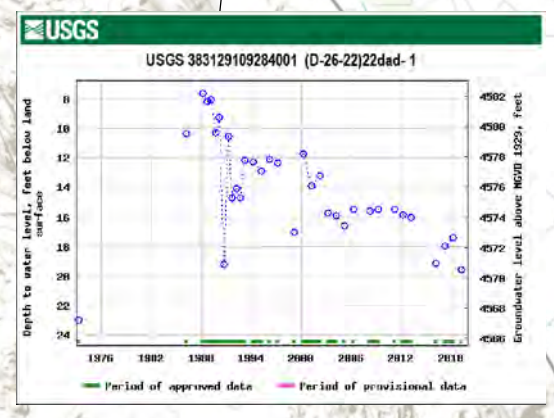
As of the end of March 2019, Kens Lake was still at only 23% of capacity and well under the previous years at this time of 59% from last year. Below is the April 1, 2019 summary from the NRCS, the entire report is included in Appendix D.

" Snowpack in the Southeastern Utah is much above normal at 203% of normal, compared to 45% last year. Precipitation in March was much above average at 228%, which brings the seasonal accumulation (Oct-Mar) to 159% of average. Soil moisture is at 59% compared to 45% last year. Reservoir storage is at 23% of capacity, compared to 59% last year. Forecast streamflow volumes range from 145% to 293% of average. The surface water supply index is 94% for Moab."









(1)
-2.41

(26)
-6.62

(32)
-7.07

(31)
-9.15

(41)
SJSVSSD Well 1
(41)

Drinks Canyon
Jackass Canyon
Dinosaur Diamond Prehistoric Hwy
Coffee Pot Rock
PORCUPINE RIM
Upper Castle Valley
Round Mountain
Cain Ho
Placer Creek
EGRO BILL CANYON
N Main St
W 400 N
MOAB VALLEY
Mill Creek
Kane Creek Blvd
MESA
Kane Springs Rd
S Main St
191
Mill Creek Dr
Murphy Ln
Rill Creek
Burkholder Draw
WILSON MESA
Roberts Dr
Spanish Valley Dr
S Highway 191
6246 ft
SPANISH VALLEY
North Fork Mill Creek
7000 ft
7213 ft
GRAND
SAN JUAN
7088 ft
6055 ft
HUNTER CANYON
Kens Lake
Kens Lake Rd
Brumley Ridge
La Sal Loop
Pack Creek Rd
KANE SPRINGS CANYON
Behind the Rocks Rd
BEHIND THE ROCKS
Trough Springs Canyon
Yellow Cir
S Bridger Jack Trl
POLE CANYO
BRIDGER JACK MESA
Pole Canyon Rd
Kane Creek Rd
Kane Springs Creek
BLACK RIDGE
BLACK CANYON
Flat Iron

Water Leval Change 1986 -2019
SJSVSSD Well 1

SJSVSSD 2019 Monitoring Report

Figure 4.

Water Level Change 1986 - 2019

Drawn By:
G3 Mapping
Rich Emerson
rich@g3mapping.com

Project Manager:
John Files

Date: May 2019

0 2 Miles

1:100,000

CASCADE WATER RESOURCES

This would seem to indicate that recharge for the Kens Lake area and Spanish Valley has not started as of the end of March 2019. This will mean that data collected in March 2019 to March 2020 will be important in the long term planning and understanding of the aquifer and how recharge refills Kens Lake and the local aquifers.

6.0 PLANNED ACTIVITY FOR 2019

SJSVSSD currently has completed a storage tank and is in the process of installing transmission and distribution lines in its service area. SJSVSSD currently has approximately 220 planned hook ups, many of these hook ups have individual wells that will no longer be used for culinary water. The estimated time for beginning of water service and pumping on SJSVSSD Well 1 is Fall of 2019.

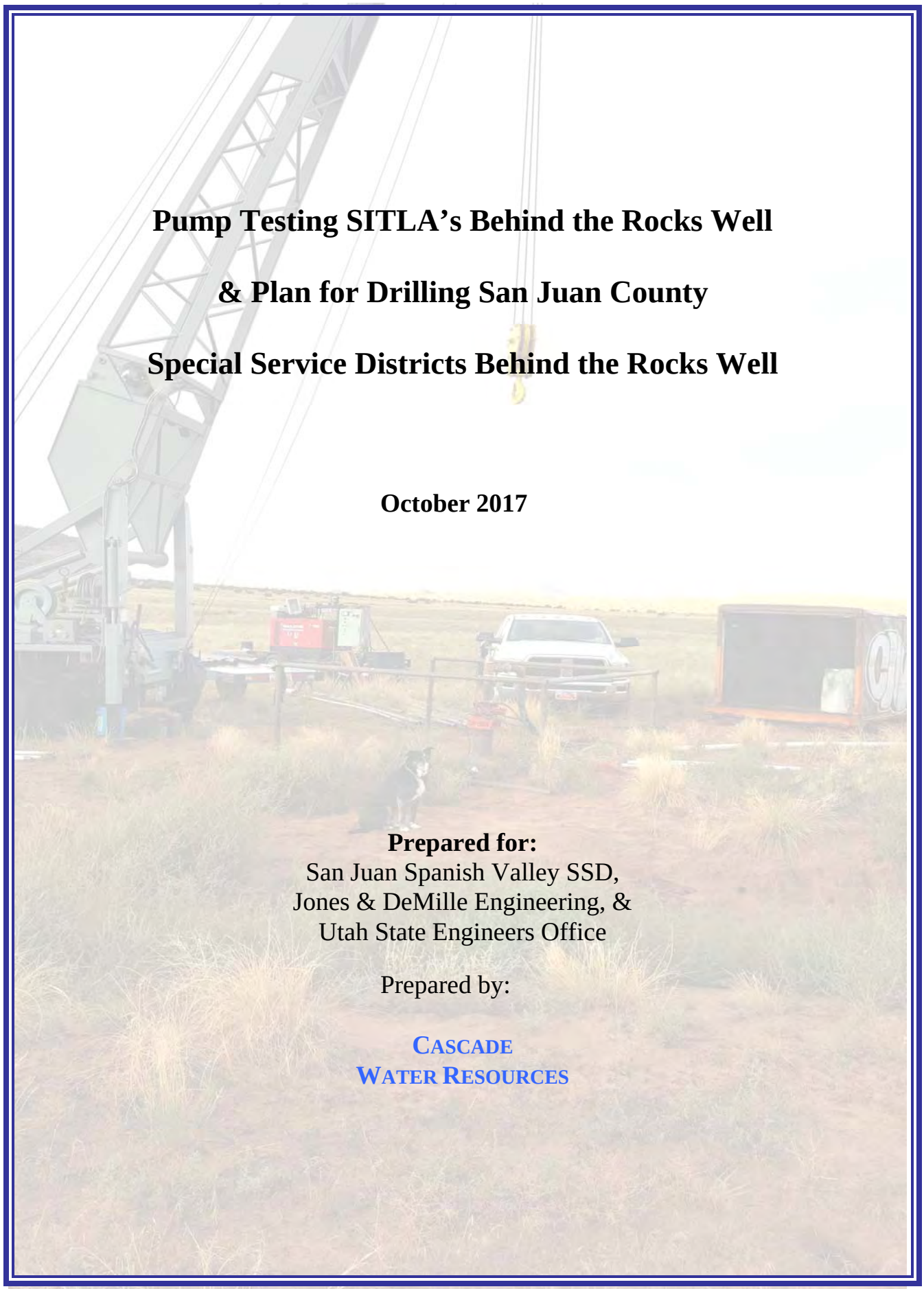
Currently there are no additional planned wells or testing for other POD's for 2019.

7.0 RECOMMENDED CHANGES TO MONITORING PLAN

There are no changes to the monitoring plan recommended at this time. The transducer in the BLM well is at the non-pumping static water level when the data was downloaded in April, 2019. Beeman Drilling has been contracted to reset the sounding tube so the transducer can be lowered and data can continue to be collected in this well.

APPENDIX A:

SITLA Behind the Rocks Well Report



Pump Testing SITLA's Behind the Rocks Well

& Plan for Drilling San Juan County

Special Service Districts Behind the Rocks Well

October 2017

Prepared for:
San Juan Spanish Valley SSD,
Jones & DeMille Engineering, &
Utah State Engineers Office

Prepared by:

CASCADE
WATER RESOURCES

CONTENTS

1.0 Introduction 1
1.1 Water Right and Location 1
2.0 Well Geology & Construction 1
3.0 Pump Testing 1
3.1 Constant Rate Test 3
3.2 Aquifer Test Analysis 5
3.3 Water Quality 5
4.0 Safe Yield 5
5.0 Work Plan for Drilling New Well 6
5.1 Estimated Drawdown from the New Behind the Rocks Well 7
5.2 Drilling and Testing of the Behind the Rocks Well 10
6.0 Conclusions and Monitoring Plan 10

FIGURES

Figure 1. Well Location Map..……..……2
Figure 2. Forward Predicted Drawdown on Aerial Imagery Basemap.…….……8
Figure 3. Forward Predicted Drawdown on Geologic Basemap,,...……..…...…….9
Figure 4. Estimated Behind the Rocks Well Construction Diagram.....…...……..…….12

APPENDICES

APPENDIX A: AQTESOLV Plot
Well Driller's Logs from Bridger Jack Mesa with Unit Descriptions
APPENDIX B: Keating/Brown Well Driller's Log
Conveyance of Keating Water Right
Theis Estimation of Drawdown for the Keating/Brown Well

1.0 INTRODUCTION

This report includes the recent pump test information of the existing SITLA Behind the Rocks Well. Included in the pump test portion of the report are estimates of aquifer parameters and a forward model to estimate the potential drawdown cone of a higher producing well for the San Juan Spanish Valley Special Service District (SJSVSSD).

This report also details a path forward for the drilling and testing of a new well in the same location as outlined by the State Engineer in the Memorandum Decision for the SJSVSSD change application a37400.

1.1 Water Right and Location

The existing well is located on SITLA Water Right 05-2988. The well is located generally in the Behind the Rocks area of San Juan County. SJSVSSD also has an approved water right on the location, a37400 (base right 09-2349). The location of the well is shown on Figure 1.

2.0 WELL GEOLOGY & CONSTRUCTION

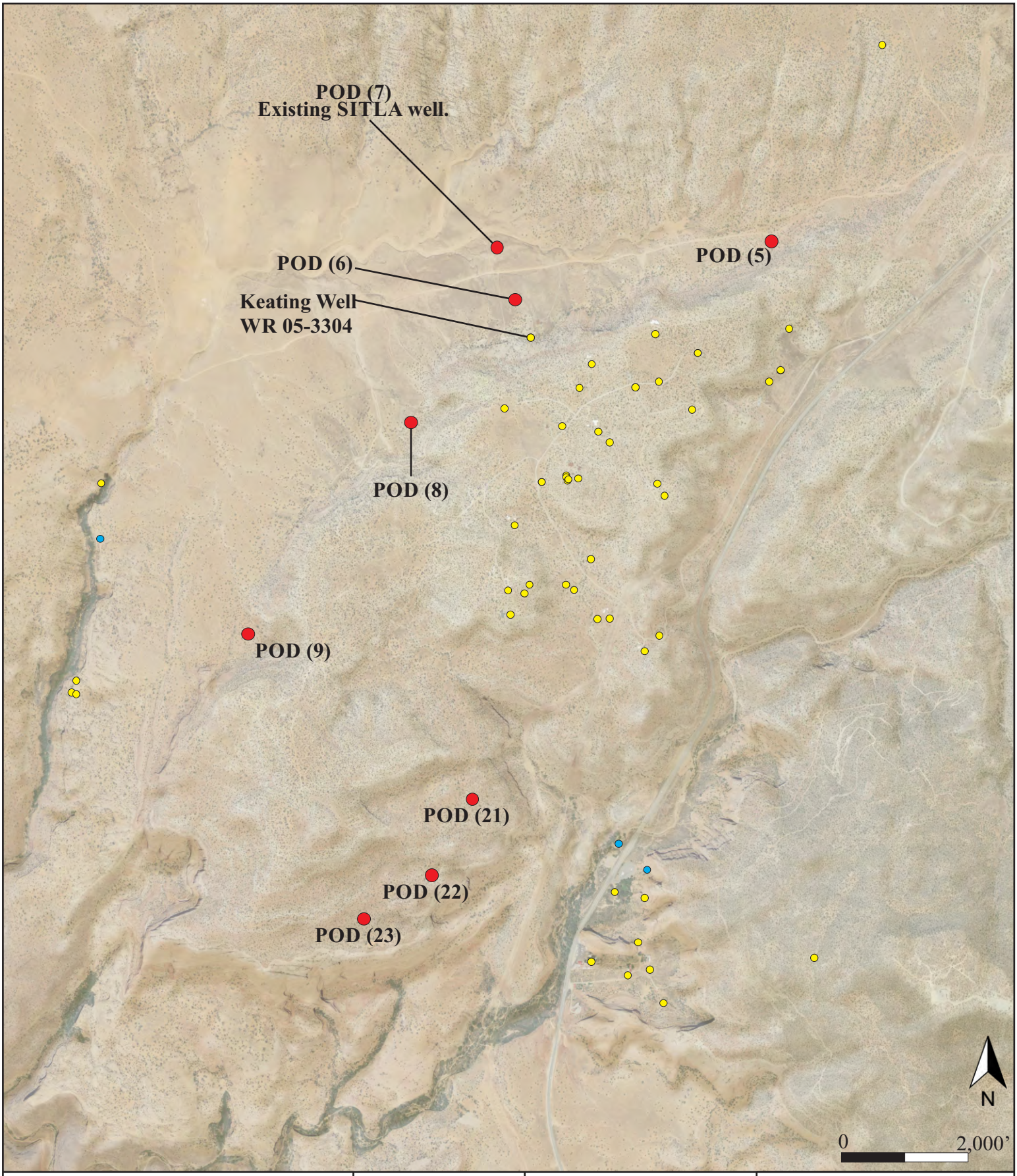
There is no well log for the current well. Included in the well file for 05-2988 is a proof that indicates a 10-inch well, drilled to a depth of 300 feet. It is not known if the well is cased, screened, perforated, or an open hole. In September of 2017, Beeman Well Services moved onto the site, pulled the existing pump and sounded the well. The well had fill in it to a depth of 200 feet and a water level of 162 feet below ground level.

The geology is unknown, but it is inferred from the surrounding surface geology to have been drilled through a thin layer of alluvial material into the Carmel Formation. The estimated depth of the Carmel Formation here is 80 to 150 feet. It is assumed that the producing section of this hole is below the Carmel Formation in the Navajo Sandstone. The local geology can be seen on Figure 3.

3.0 PUMP TESTING

As this well only has 38 feet of saturation, Beeman Well Service first set a smaller pump to make sure the water level did not draw down to the pump intake immediately. The well was pumped for approximately 25 minutes at 25 gpm and stabilized. The flow was increased to 42 gpm, the maximum for the pump. The water level again quickly stabilized at 172 feet. The well was pumped for a total of 3 hours and according to the manual readings recorded by the pump crew, the water level did not appear to draw down at all.

After the preliminary test, a larger pump was installed with the intake at approximately 192 feet and a transducer that was set to record every minute. With the pump intake set at 192, an approximate safe pumping level was determined to about 185 feet. During the constant rate testing the water level would not be allowed to drop below this depth.



a37400 PODs
Other PODs
Springs
1 inch = 2,000 ft

CASCADE WATER RESOURCES

San Juan Spanish Valley Special Service District

Date: October 2017
Project Manager: John Files
File: SJSSD_Fig1.pdf

Figure 1: Location Map of Existing Wells in the Back of the Rocks Area

Cartography:
maps@bluesunGeographics.com

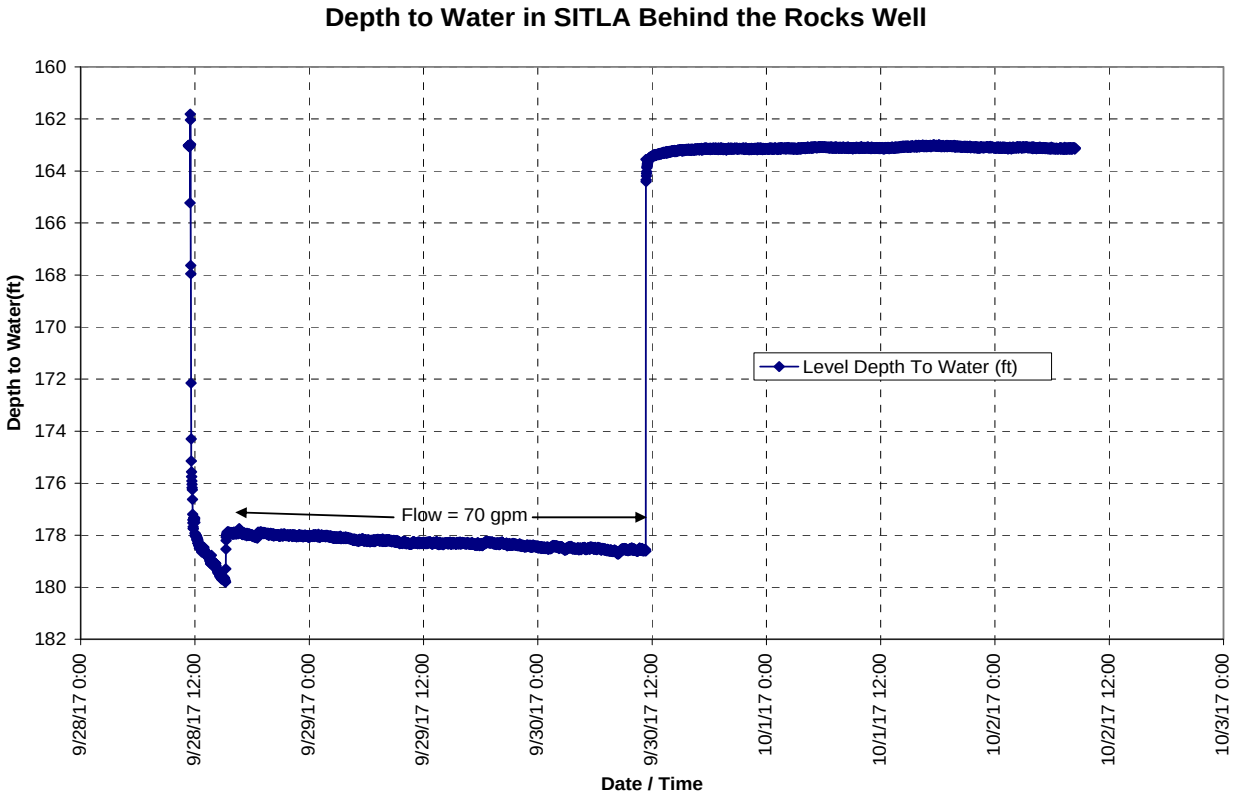
3.1 Constant Rate Test

The SITLA well was pumped for a total of 48 hours. The flow was started low at approximately 50 gpm and was bumped up using a VFD while monitoring the water level in order to determine a safe flow rate. During this process, the water levels had an interesting initial response when the flows were increased. When the flows were increased, there was an initial rise in the water level instead of the expected decline. After the first 3 to 6 minutes, the water level did begin to decline. A possible explanation for the initial rise in the water level is the water could be pulling through the fill inside the well and then sealing again. The water was very silty each time the flow was turned up.

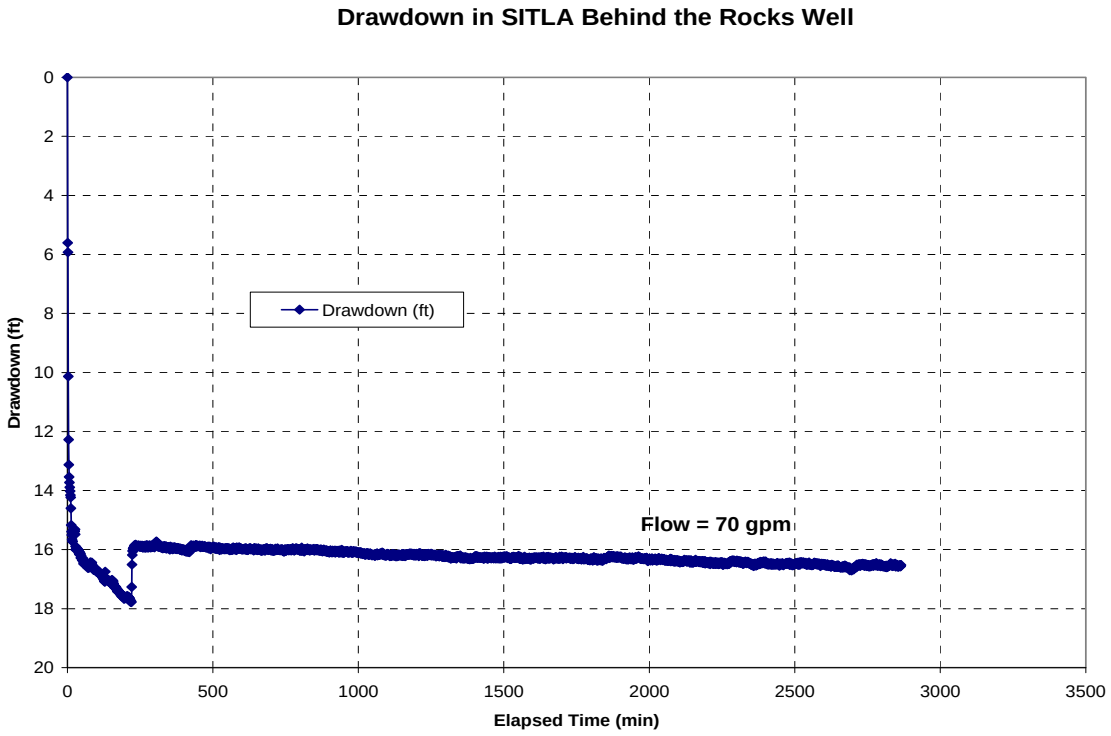
At a flow of 75 gpm, it appeared the well was in danger of drawing down too far, therefore at 220 minutes the flow was set to 70 gpm, where it stayed for the remainder of the test.

3.1.1 Water Level Data

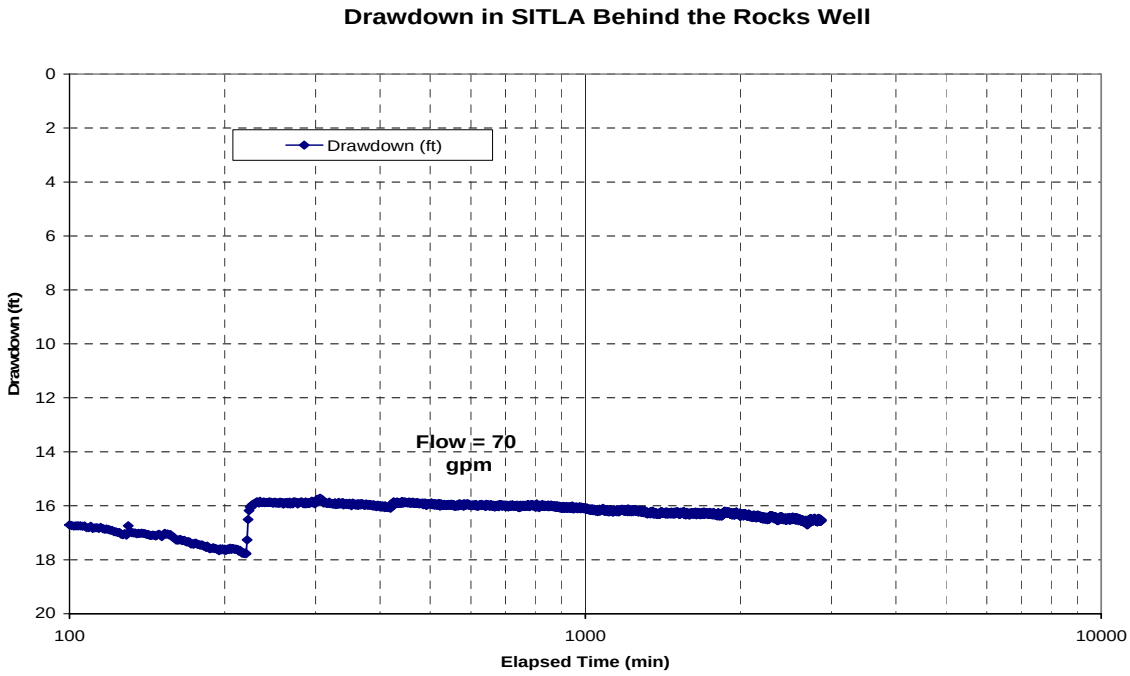
Below is a plot of the water levels during the testing as recorded by the transducer.



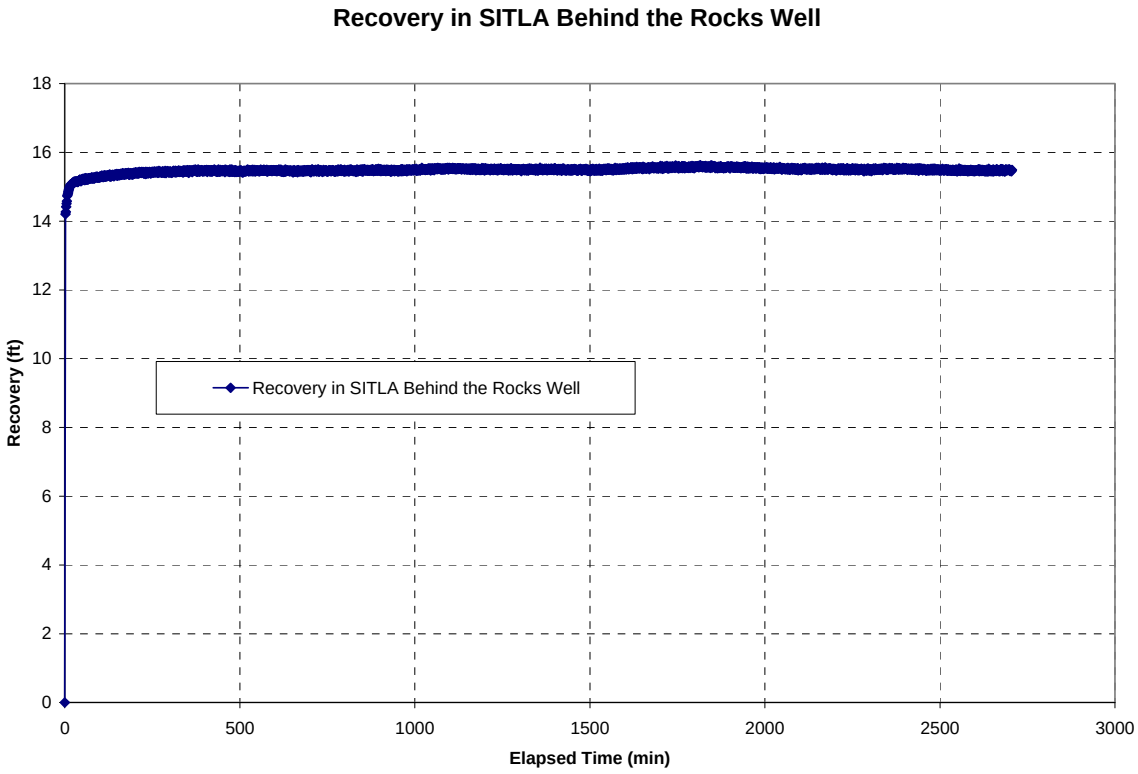
During the testing of the well, the water level drew down from 162 feet and stabilized at approximately 178 Feet. Below is a plot of the drawdown observed in the well.



Below is a semi-log plot of the same drawdown data. As the flow was adjusted 220 minutes into the test, the semi-log plot starts at 100 minutes.



The well recovered to within 2.5 feet of static within the first minute of recovery. This is indicative of an inefficient well. The majority of the drawdown in the well is related to efficiency issues and is not aquifer related. The efficiency could be related to the well construction or to the water moving through the fill in the well to recharge the area where the pump is set. Below is the recovery data for the well.



3.2 Aquifer Test Analysis

This test data was analyzed using the Theis solution for an unconfined aquifer in the AQTESOLV groundwater software program. As the well had efficiency issues, the early time data that was related to well efficiency was not used as the primary focus of this analysis is to study the aquifer, not the well. The curve fit was very good for the test. The AQTSOLV results plot is included in Appendix A. The calculated transmissivity of the aquifer in this location is approximately 4,290 ft^2/day.

3.3 Water Quality

No samples were taken during the testing for analysis, however the field parameters where checked several times and yielded a conductivity of 420 us/sec and a pH of 7.4.

4.0 SAFE YIELD

The Division of Drinking Water (DDW) definition of a safe yield is 2/3 the pump tested flow of a new well in a 24-hour test. With the 48-hour test completed at 70 gpm this would put the safe DDW

safe yield at 46 gpm. However, the purpose of the test was not to determine the DDW safe yield of this well, but to determine the safe yield of the aquifer at this location. The saturated thickness of only 38 feet in this well made testing at an actual safe yield impossible.

At this location the Navajo Sandstone is very transmissive when compared to the majority of the wells that have been tested in the Behind the Rocks/Bridger Jack Mesa area. Wells that have been tested have specific capacities below 1.0 gpm/ft. However, many of the wells that were not tested did have comments on the driller's logs indicating that the Navajo and Wingate sandstones were very good producing aquifers. Many of the comments were, "lost circulation", "highly fractured", not able to airlift, air being lost in fractures". These comments are indicative of highly transmissive aquifers.

The most significant unknown in this area is the actual thickness of the Navajo Sandstone and its connection to the underlying formations. Well logs that have called out formations on Bridger Jack Mesa indicate a Navajo Sandstone thickness ranging from 150 to 500 feet. It should be noted that the geology in driller's logs is not always reliable, and in some cases, wells that are only two hundred feet apart indicate completely different geologic units. Well logs from the area that include the Navajo Sandstone unit called out are included in Appendix A. Based on the information in the area well logs, a conservative estimate for the thickness of the Navajo Sandstone here is about 250 feet.

With the above in mind two safe yield estimates are made for a properly constructed well within the Navajo Sandstone in this area.

1. Short-term and long-term: The short-term safe yield would be a flow the well can safely pump for a few weeks during the high demand time of the year. Water levels of the nearby irrigation and city wells should be monitored during this time.
2. The long-term safe yield would be the estimated safe yield on an annual basis.

The **short-term safe yield would be 250 gpm**. The short-term means the well can be pumped for short durations, usually under two weeks and would need time to recover prior to pumping the well again. The **long-term safe yield world be 150 gpm**. Both estimates are very conservative given the transmissivity of the aquifer. However, not knowing the precise thickness of the Navajo Sandstone here or the connection to the underlying formations, it would be best to err on the low side. If the actual thickness of the producing aquifer is found to be thicker than 250 feet the safe yield of the aquifer could be in the 400 to 600 gpm range.

The safe yield will be reviewed after the new well is drilled and tested. In addition, after the new well is installed the safe yield can be reviewed each year after pumping and the water level data is analyzed. If adjustments to the long-term safe yield need to be made they can be completed after each year of pumping.

5.0 WORK PLAN FOR DRILLING NEW WELL

As per the "conditions" listed in the Memorandum Decision by the State Engineer on the change application; a pathway forward needs to be outlined in order for a start card to be issued. In the case of this location, there are no wells within 1,000 feet that would require a framework of mitigation. There are several wells and senior underground water rights within 3,000 feet of the new well site. The closest well is approximately 1,600 feet to the south. The log for this well is included in Appendix B. This well has two water rights in current good standing; 05-2598 for 0.45 acre/ft owned by Scott Brown and 05-3304 for 5.73 acre/ft owned by Scott Keating. It should be noted that an

unprocessed conveyance has been submitted for the Keating right as it appears the property now has new owners, William and Judith Perry. The conveyance is included in Appendix B.

5.1 Estimated Drawdown from the New Behind the Rocks Well

Two methods were used to estimate the potential drawdown in the area from pumping a new well at the Behind the Rocks Well location. First, the forward predicting model application in AQTESOLV for Theis unconfined aquifers was used to calculate drawdown contours for the area. Second, individually for the Brown/Keating Well, the Theis Equation drawdown calculator provided by the Utah Division of Water Rights website was used. The input for both models is below;

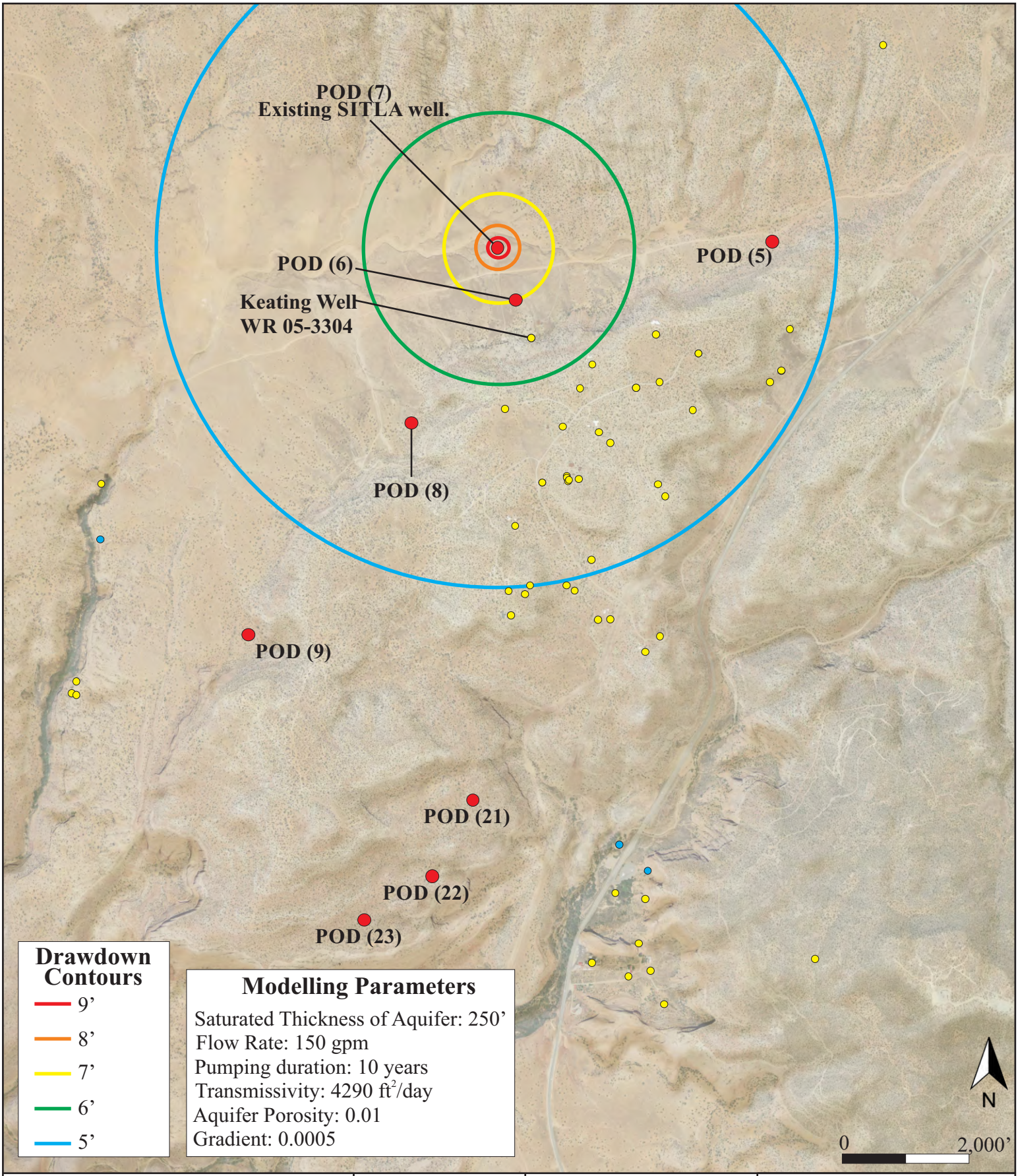
Flow = 150 gpm
Transmissivity = 4,290 ft^2/day
Saturated Thickness = 250 feet
Aquifer Storativity = .01 to .001 (Different coefficients were used as tests, but they did not result in significant contour changes)

There are significant limitations to this method of forward predictive modeling, the most significant is that the Theis solution based models do not take into account recharge and its results are based on a simplified homogeneous aquifer of infinite extent of a constant transmissivity. In addition, the local aquifer is likely fault/fracture controlled and much of the water is derived from the secondary porosity of these fractures. Given these limitations, the AQTESOLV model was only ran for 10 years, as the recharge is now known. However, this method of modeling is a very good predictive guide to the general drawdown and usually over-predicts drawdown, so it is a solid conservative method to use.

The contours produced from the AQTESOLV forward modeling scenario are presented on Figures 2 and 3. Figure 2 plots the drawdown contours on recent aerial imagery and Figure 3 plots the drawdown contours on the UGS La Sal 30 x 60 geologic map. The contours only extend out to 5 feet of drawdown due to the limitations listed above. In addition to the limitations above there may be either positive or negative boundaries associated with secondary porosity created by fracturing, and the extent of the fracture zone is not known. Using the AQTESOLV predictive modeling, the Keating/Brown Well falls in between the 6 and 7 foot drawdown contours.

Using the second method of just the distance/drawdown Theis calculator, after 10 years the estimated drawdown was 5.10 feet in the Keating/Brown well. The results from this method are included in Appendix B.

Based on the preliminary data from the pump test, some drawdown is expected in the closest well to the Behind the Rocks Well site. However, the drawdown should not be significant enough to impair the pumping of the water rights associated with the well. The predictive modeling can be confirmed this during the testing described in the next section. Unfortunately, given the thin extent of the saturated thickness in the existing well, the aquifer could not be stressed enough to test drawdown in the Keating/Brown well during the recent test.



a37400 PODs
Other PODs
Springs

1 inch = 2,000 ft

CASCADE WATER RESOURCES

San Juan Spanish Valley Special Service District

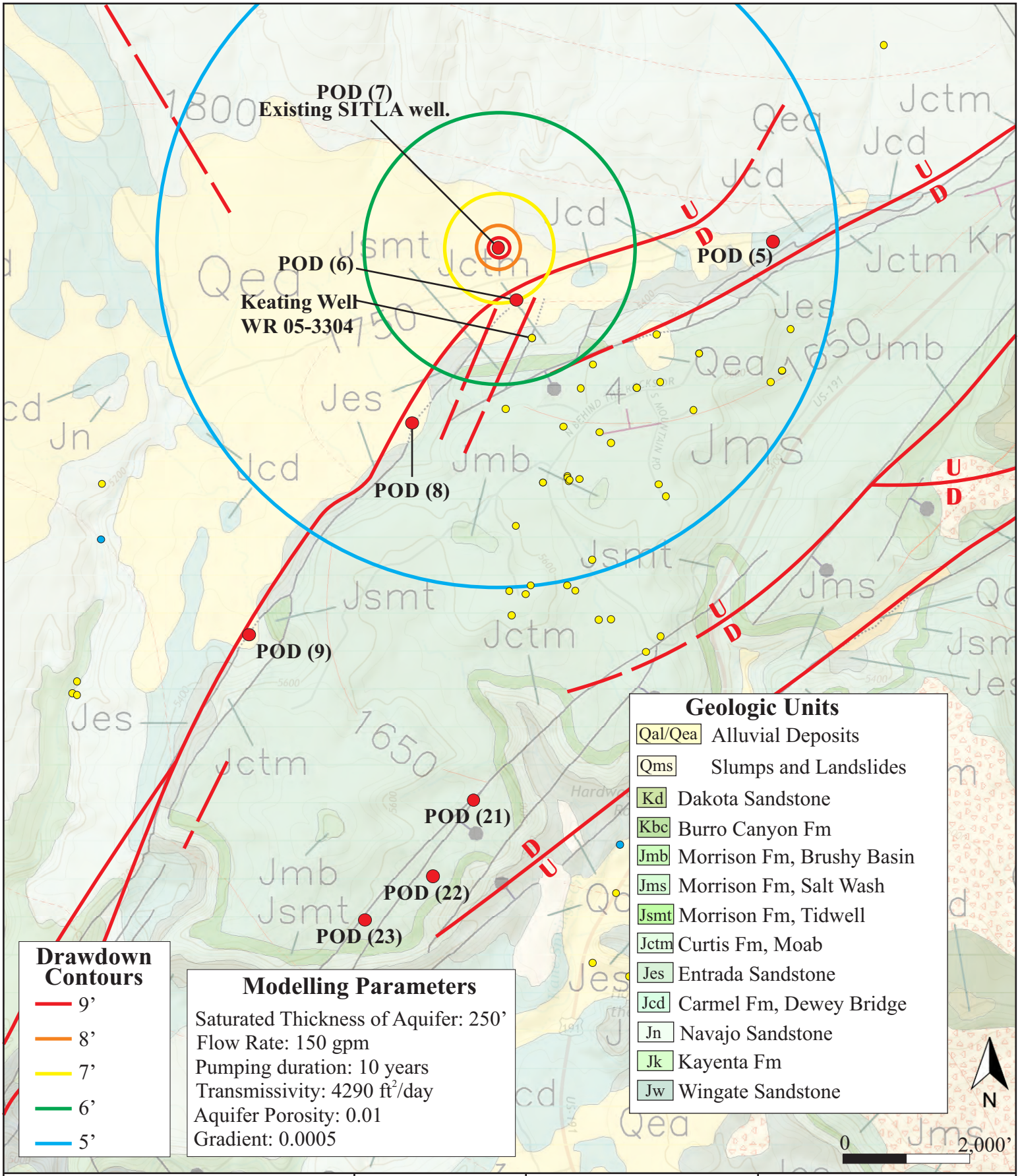
Date: October 2017

Project Manager: John Files

File: SVWSE_Fig2.pdf

Figure 2: Location map of existing wells showing potential drawdown contours after 10 years of pumping POD 7

Cartography:
maps@bluesunGeographics.com



a37400 PODs

Other PODs

RED faults superimposed from Mount Peale-4 Quad San Juan County, Utah 1954, 1:24,000

Springs

1 inch = 2,000 ft

CASCADE WATER RESOURCES

San Juan Spanish Valley Special Service District

Date: October 2017

Project Manager: John Files

File: SJSSD_Fig3.pdf

Figure 3: Location map of existing wells showing potential drawdown contours after 10 years of pumping POD 7

Cartography:
maps@bluesunGeographics.com

5.2 Drilling and Testing of the Behind the Rocks Well

As the saturated thickness of the aquifer is not known, an 8" to 10" diameter pilot hole will be drilled prior to reaming the final hole for well construction. Drilling the pilot hole will define the geology of the site and will give the thickness of the Navajo Sandstone. If the Navajo Sandstone section is thin here, the pilot hole may continue into the undying formations. If hole conditions permit or if the option to put a temporary sleeve for a pump into the well can be done safely, a long-term pump test of the open hole will be completed. The test is expected to run from 48 hours to 7 days depending on the data collected. During the drilling and testing of the open hole if the owners permit, a transducer will be placed in the Keating/Brown well before the start of drilling activities.

Data collected during the drilling and testing of the pilot hole will determine the size of well that will be completed at this location. The estimated diameter of the final well will be 10" to 14". Figure 4 is the estimated well construction of the New Behind the Rocks Well.

Drilling a well is a dynamic process and plans can change depending on geology, hydrology, hole conditions, and mechanical limitations. The final well construction for any site can change given these unpredictable issues. All data collected during drilling and testing will be used to develop the final well construction and testing plan.

After the well is completed, a pump test will be performed at what is determined to be the safe yield. The well is expected to be tested at flow rates between 150 to 300 gpm. Though if conditions permit, higher flow rates may be possible. This should allow for the aquifer to be stressed enough to record drawdown in the Keating/Brown well. Which in turn, provides the information to better model future drawdown of this well and its influence on other well owners in the area.

The well will be constructed to the Utah Division of Drinking Water standards, and all permitting and reporting required by DDW will be completed before and after the drilling of the well. This includes the Preliminary Evaluation Report and Drinking Water Source Protection Plans. In addition to the DDW reports, a report on the drilling, construction, development, and aquifer testing will be prepared for the Division of Water Rights. This report will update the estimated future drawdown of the well and identify wells in the area, if any, that may be interfered with by the pumping of this well. If rights are identified that are impaired by the pumping of this well, a mitigation agreement that includes replacement water for the impaired rights will be adopted for the potentially interfered with rights.

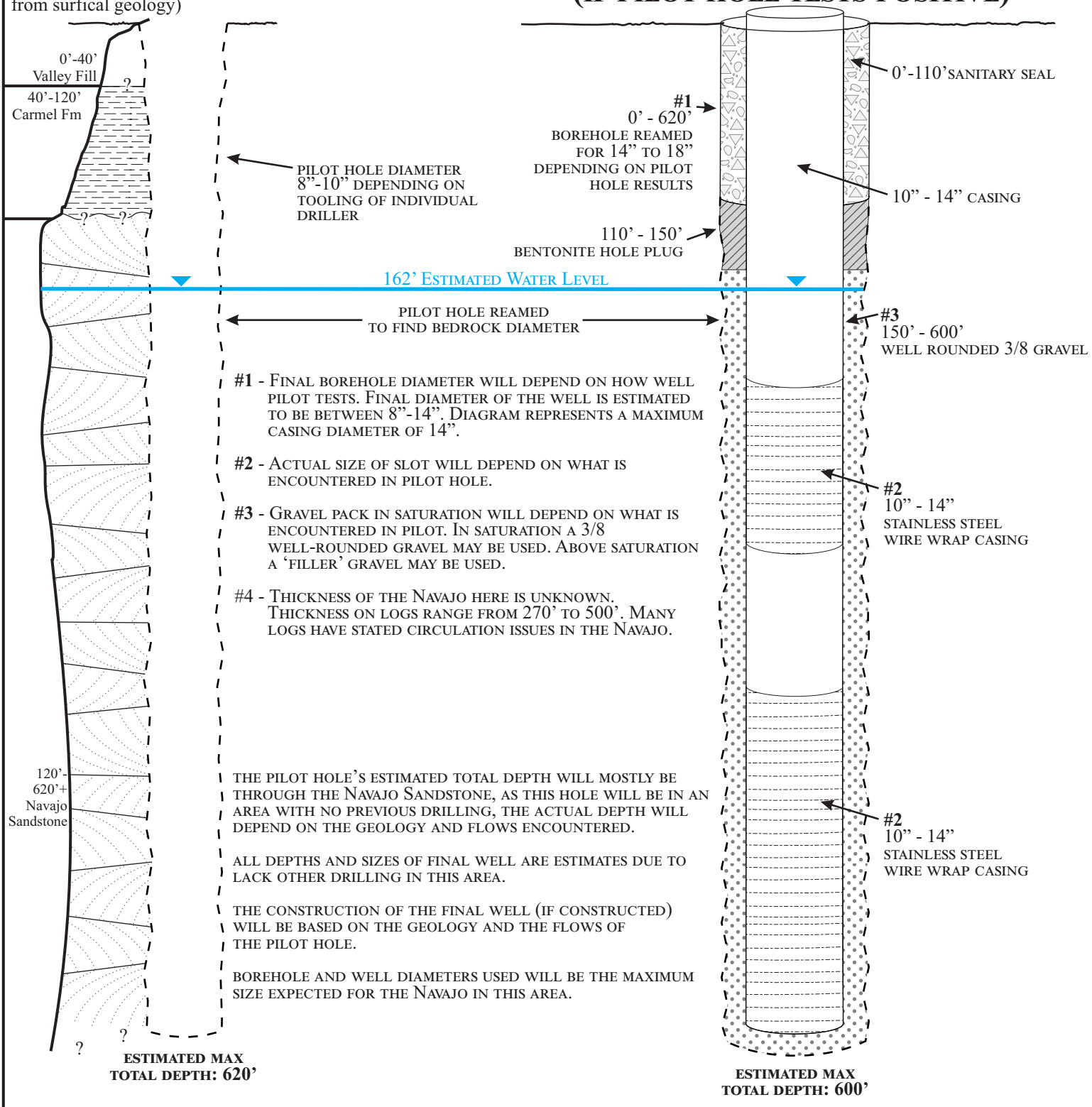
6.0 CONCLUSIONS AND MONITORING PLAN

Preliminary testing of the current Behind the Rocks Well site indicate a a relatively good aquifer that can be responsibly developed without significantly interfering with any nearby water rights. If this well site is developed, and after the final reporting on all the aquifer parameters and the estimated drawdown is known, a long-term monitoring plan will be developed to ensure that there are no long-term negative impacts on surrounding wells and the overall water balance in the Spanish Valley/Moab area.

Pilot Hole

Borehole Geology
(contacts estimated from surfical geology)

Estimated Contruction of the San Juan County SSD Behind the Rocks Well (if pilot hole tests positive)



#1 - Final borehole diameter will depend on how well pilot tests. Final diameter of the well is estimated to be between 8"-14". Diagram represents a maximum casing diameter of 14".

#2 - Actual size of slot will depend on what is encountered in pilot hole.

#3 - Gravel pack in saturation will depend on what is encountered in pilot. In saturation a 3/8 well-rounded gravel may be used. Above saturation a 'filler' gravel may be used.

#4 - Thickness of the Navajo here is unknown. Thickness on logs range from 270' to 500'. Many logs have stated circulation issues in the Navajo.

The pilot hole's estimated total depth will mostly be through the Navajo Sandstone, as this hole will be in an area with no previous drilling, the actual depth will depend on the geology and flows encountered.

All depths and sizes of final well are estimates due to lack other drilling in this area.

The construction of the final well (if constructed) will be based on the geology and the flows of the pilot hole.

Borehole and well diameters used will be the maximum size expected for the Navajo in this area.

CASCADE WATER RESOURCES

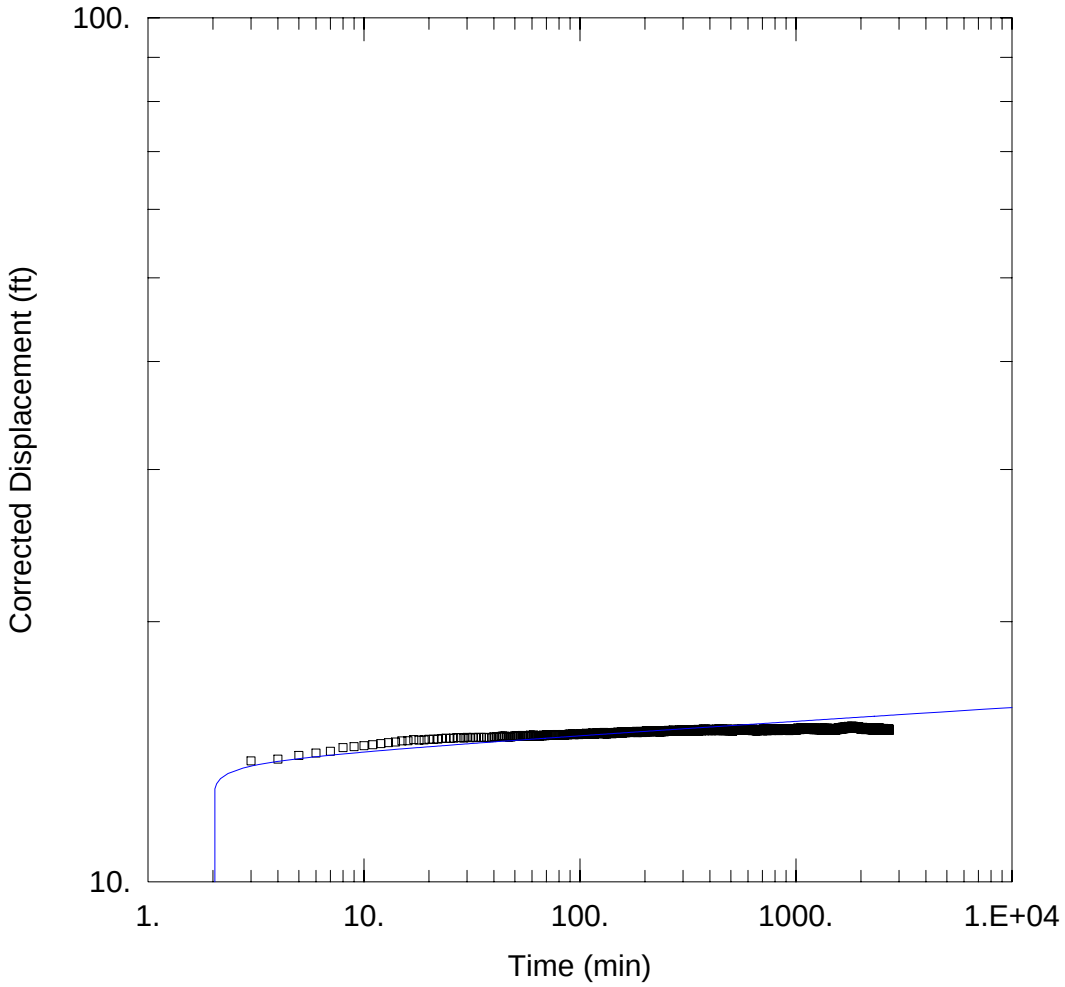
Project Manager: John Files
Date: October 2017
File: SJC_Fig4.pdf
Drawn By:
maps@BluesunGeoGraphics.com

San Juan Spanish Valley Special Service District

Figure 4: Spanish Valley Well #1 Proposed Well Construction Diagram

APPENDIX A:

AQTESOLV Plot
Well Driller's Logs from Bridger Jack Mesa with Unit Descriptions



BEHIND THE ROCKS RECOVERY

Data Set:
Date: 10/02/17 Time: 19:23:08

PROJECT INFORMATION

Company: Cascade Water Resources
Client: San Juan County Spanish Valley
Test Location: Behind the Rocks
Test Well: Behind the Rocks Well
Test Date: Sept. 2017

AQUIFER DATA

Saturated Thickness: 250. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW 1	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
▫ OW 1	0.001	0.001

SOLUTION

Aquifer Model: Unconfined Solution Method: Theis

T = 4291.5 ft^2/day S = 7.454E-18

RECEIVED
NOV 2 3 2005
WATER RIGHTS
SALT LAKE

WELL DRILLER'S REPORT
State of Utah
Division of Water Rights

For additional space, use "Additional Well Data Form" and attach

Well Identification WIN: 34827

Non-Production Well: 0505024M00

Owner *Note any changes*

Thomas Robertson
513 W. Cedar Place
Louisville, CO 80027

Contact Person/Engineer: _____

Well Location *Note any changes*

N 690 W 963 from the S4 corner of section 36, Township 27S, Range 22E, SL B&M

Location Description: (address, proximity to buildings, landmarks, ground elevation,local well #)

Drillers Activity Start Date: Oct 6 - 05 Completion Date: Oct 21 - 05

Check all that apply: [X] New [ ] Repair [ ] Deepen [ ] Clean [ ] Replace [ ] Public Nature of Use: _____

If a replacement well, provide location of new well. _____ feet north/south and _____ feet east/west of the existing well.

DEPTH (feet) FROM	TO	BOREHOLE DIAMETER (in)	DRILLING METHOD	DRILLING FLUID
0	30	12"	Air Rotary	—
31	700	6"	Air Rotary	water soap

Well Log

DEPTH (feet) FROM	TO	WATER	PERMEABLE High	PERMEABLE Low	UNCONSOLIDATED CLAY	SILT	SAND	GRAVEL	COBBLES	BOULDER	OTHER	CONSOLIDATED ROCK TYPE	COLOR	DESCRIPTION AND REMARKS (e.g., relative %, grain size, sorting, angularity, bedding, grain composition density, plasticity, shape, cementation, consistancy, water bearing, ordor, fracturing, minerology, texture,degree of weathering, hardness, water quality, etc.)
0	2						X					Top Soil	Brown	
3	180											Sand Stone	Brown	Morison Formation
181	680											Sand Stone	Tan/Brown	Navajo Sandstone Formation
681	700											Sandstone	Red/Tan/Brown	Wingate Formation

499 = 181

Static Water Level

Date Oct 21 05 Water Level 360 feet Flowing? [ ] Yes [X] No

Method of Water Level Measurement Water meter If Flowing, Capped Pressure _____ PSI

Point to Which Water Level Measurement was Referenced Top of Casing Elevation _____

Height of Water Level reference point above ground surface 2 feet Temperature 50 degrees [ ] C [ ] F

Well Log

WL1

WELL DRILLER'S REPORT
State of Utah
Division of Water Rights

For additional space, use "Additional Well Data Form" and attach

Well Identification PROVISIONAL WELL: 96-05-002-P-03

RECEIVED
MAY 06 1996
WATER RIGHTS
SALT LAKE

Owner *Note any changes*
John Hauer
550 North Main Suite C
Moab, UT 84532

Contact Person/Engineer:

Well Location *Note any changes*
Moved to — South 1700 feet West 2800 feet from the NE Corner of SOUTH 900 feet WEST 2600 feet from the NE Corner of SECTION 36, TOWNSHIP 27S, RANGE 22E, SLB&M.

Location Description: (address, proximity to buildings, landmarks, ground elevation, local well #)

Drillers Activity Start Date: 4-24-96 Completion Date: 5-2-96

Check all that apply:
☒ New ☐ Repair ☐ Deepen ☐ Abandon ☐ Replace ☐ Public Nature of Use:

DEPTH (feet) FROM	TO	BOREHOLE DIAMETER (in)	DRILLING METHOD	DRILLING FLUID
0	18	9 7/8	Air Rotary	
18	58	7 7/8	Air Rotary	
58	900	6"	Air Rotary	Water + Foam

Well Log

DEPTH (feet) FROM	TO	WATER	PERMEABLE high	PERMEABLE low	UNCONSOLIDATED CLAY	SILT	SAND	GRAVEL	COBBLES	BOULDER	OTHER	CONSOLIDATED ROCK TYPE	COLOR	DESCRIPTIONS AND REMARKS (include comments on *water quality* if known.)
0	30		X									Sandstone	White Rd/Brn	upper Morrison
30	330			X								Shale Sandstone	Gn/Gy-White	Morrison
330	510		X									Sandstone	White	Entrada
510	580	X	X									Mudstone Siltstone	Rd/Brn	Lower Entrada (Carmel)
580	780		X									Sandstone	Lt Brn	Navajo
780	838		X									Sandstone	Rd/Brn	Kayenta
838	860		X									Sandstone	Brn	Wingate
860	866	X	X											Fractures - water
866	900	X	X									Sandstone	Brn	Wingate - Fractures - water

200' — 580 780 X

Static Water Level

Date 5-2-96 Water Level 510 feet Flowing? ☐ Yes ☒ No
Method of Water Level Measurement Tape If Flowing, Capped Pressure PSI
Point to Which Water Level Measurement was Referenced Surface
Height of Water Level reference point above ground surface 0 feet Temperature 66 ☐ °C ☒ °F

[redacted] Well Log [redacted]

Construction Information

DEPTH (feet) FROM	TO	CASING TYPE AND MATERIAL/GRADE	WALL THICK (in)	NOMINAL DIAM. (in)
+2	58	Steel	.250	6
0	500	Plastic	sch 40	4½

DEPTH (feet) FROM	TO	SCREEN ☐ PERFORATIONS ☒ SLOT SIZE OR PERF SIZE (in)	SCREEN DIAM. OR PERF LENGTH (in)	SCREEN TYPE OR NUMBER PERF (per round/interval)
500	540	1/16	4"	21 per Jt.
540	860	1/16	4"	14 per Jt.
860	880	1/16	4"	36
880	900	1/16	4"	21

Well Head Configuration: Welded Steel cap Access Port Provided? ☐ Yes ☒ No

Casing Joint Type: Glue Perforator Used: Saw

DEPTH (feet) FROM	TO	FILTER PACK / GROUT / PACKER / ABANDONMENT MATERIAL: ANNULAR MATERIAL, ABANDONMENT MATERIAL and/or PACKER DESCRIPTION	Quantity of Material Used (if applicable)	GROUT DENSITY (lbs./gal.,# bag mix, gal./sack etc.)
	100'	4½" x 6" packer set		
0	100'	Cement 4½ x 6"		
0	18'	Cement 6" x 10"		

Well Development / Pump or Bail Tests

Date	Method	Yield	Units Check One GPM	Units Check One CFS	DRAWDOWN (ft)	TIME PUMPED (hrs & min)
5-2-96	Air Lift	5-8	☒			3

Pump (Permanent)

Pump Description: _____ Horsepower: _____ Pump Intake Depth: _____ feet

Approximate maximum pumping rate: _____ Well disinfected upon completion? ☒ Yes ☐ No

Comments

Description of construction activity, additional materials used, problems encountered, extraordinary circumstances, abandonment / procedures. *Use additional well data form for more space.*

Cemented 6" Steel to 18' - Cemented 4½" plastic to 100'

Well Driller Statement

This well was drilled or abandoned under my supervision, according to applicable rules and regulations, and this report is complete and correct to the best of my knowledge and belief.

Name Balsley Well Service (Person, Firm, or Corporation – Print or Type) License No. 610

Signature Tracy Balsley (Licensed Well Driller) Date 5-3-96

WL1

WELL DRILLER'S REPORT
State of Utah
Division of Water Rights

For additional space, use "Additional Well Data Form" and attach

RECEIVED
MAR 20 1996
WATER RIGHTS
SALT LAKE

Well Identification PROVISIONAL WELL: 96-05-002-P-01

Owner *Note any changes*
John Hauer
550 North Main Suite C
Moab, UT 84532

Contact Person/Engineer:

Well Location *Note any changes*
SOUTH 450 feet WEST 2000 feet from the NE Corner of SECTION 36, TOWNSHIP 27S, RANGE 22E, SLB&M.

Location Description: (address, proximity to buildings, landmarks, ground elevation, local well #)

Drillers Activity Start Date: 3-9-96 Completion Date: 3-16-96

Check all that apply:
☒ New ☐ Repair ☐ Deepen ☐ Abandon ☐ Replace ☐ Public Nature of Use:

DEPTH (feet) FROM	TO	BOREHOLE DIAMETER (in)	DRILLING METHOD	DRILLING FLUID
0	19	9 7/8	Air Rotary	
19	800	6	Air Rotary	Water - Foam

Well Log

DEPTH (feet) FROM	TO	WATER	PERMEABLE high	PERMEABLE low	UNCONSOLIDATED CLAY	SILT	SAND	GRAVEL	COBBLES	BOULDER	OTHER	CONSOLIDATED ROCK TYPE	COLOR	DESCRIPTIONS AND REMARKS (include comments on *water quality* if known.)
0	1		x		2	2	6						Rd/Brn	
1	34		x									Sandstone	White	
34	290		x									Morrison	Rd/Grn	Shale w/ sandstone layers
290	480		x									Entrada	White	
480	800	x	x									Entrada	Brown.	- Bottom Rd/Brn. Fractures Between 600 - 760

Static Water Level

Date 3-16-96 Water Level 481 feet Flowing? ☐ Yes ☒ No

Method of Water Level Measurement Tape If Flowing, Capped Pressure PSI

Point to Which Water Level Measurement was Referenced Surface

Height of Water Level reference point above ground surface 0 feet Temperature 58 ☐ °C ☒ °F

[redacted] *Well Log* [redacted]

WL1

WELL DRILLER'S REPORT
State of Utah
Division of Water Rights

RECEIVED
APR 18 1996
WATER RIGHTS
SALT LAKE

For additional space, use "Additional Well Data Form" and attach

Well Identification PROVISIONAL WELL: 96-05-002-P-02

Owner *Note any changes*
John Hauer
550 North Main Suite C
Moab, UT 84532

Contact Person/Engineer:

Well Location *Note any changes*
SOUTH 2500 feet WEST 2600 feet from the NE Corner of SECTION 36, TOWNSHIP 27S, RANGE 22E, SLB&M.

Location Description: (address, proximity to buildings, landmarks, ground elevation, local well #)

Drillers Activity Start Date: 4-5-96 Completion Date: 4-13-96

Check all that apply:
☒ New ☐ Repair ☐ Deepen ☐ Abandon ☐ Replace ☐ Public Nature of Use:

DEPTH (feet) FROM	TO	BOREHOLE DIAMETER (in)	DRILLING METHOD	DRILLING FLUID
0	18	9 7/8"	Air Rotary	
18	820	6"	Air Rotary	Foam + Water

Well Log

DEPTH (feet) FROM	TO	WATER	PERMEABLE high	PERMEABLE low	UNCONSOLIDATED CLAY	SILT	SAND	GRAVEL	COBBLES	BOULDER	OTHER	CONSOLIDATED ROCK TYPE	COLOR	DESCRIPTIONS AND REMARKS (include comments on *water quality* if known.)
0	303			☒								Sandstone	Wh.te	sandstone/Rd + Grn. Shales - Morrison
303	435			☒								Entrada	Wh.te	Sandstone
435	555			☒								Entrada	Rd/Brn.	sandstone/silstone
555	820	☒		☒								Navajo	Lt/Brn.	Sandstone
														601' Fracture - water
														612' - 618' - 646' - Fractures water

2657

Static Water Level
Date 4-12-96 Water Level 497 feet Flowing? ☐ Yes ☒ No
Method of Water Level Measurement Tape If Flowing, Capped Pressure PSI
Point to Which Water Level Measurement was Referenced 0 - Surface
Height of Water Level reference point above ground surface 0 feet Temperature 50 ☐ °C ☒ °F

[redacted] *Well Log* [redacted]

Construction Information

DEPTH (feet) FROM	TO	CASING: CASING TYPE AND MATERIAL/GRADE	WALL THICK (in)	NOMINAL DIAM. (in)	DEPTH (feet) FROM	TO	SCREEN ☐ PERFORATIONS ☒ SLOT SIZE OR PERF SIZE (in)	SCREEN DIAM. OR PERF LENGTH (in)	SCREEN TYPE OR NUMBER PERF (per round/interval)
+2	19	Steel	.250	6					
15	480	Plastic	Sch. 40	4½	480	800	1/16"	6"	3

Well Head Configuration: Welded cap Access Port Provided? ☐ Yes ☒ No

Casing Joint Type: Glue Perforator Used: Saw

DEPTH (feet) FROM	TO	FILTER PACK / GROUT / PACKER / ABANDONMENT MATERIAL: ANNULAR MATERIAL, ABANDONMENT MATERIAL and/or PACKER DESCRIPTION	Quantity of Material Used (if applicable)	GROUT DENSITY (lbs./gal.,# bag mix, gal./sack etc.)
0	19	Cement		

Well Development / Pump or Bail Tests

Date	Method	Yield	Units Check One GPM	Units Check One CFS	DRAWDOWN (ft)	TIME PUMPED (hrs & min)
3-13-96	Air lift	2-3	☒			3 hrs

Pump (Permanent)

Pump Description: Horsepower: Pump Intake Depth: feet

Approximate maximum pumping rate: Well disinfected upon completion? ☒ Yes ☐ No

Comments Description of construction activity, additional materials used, problems encountered, extraordinary circumstances, abandonment / procedures. *Use additional well data form for more space.*

Well produced 2-3 g.p.m. with Air lift. - Pumped well should actually produce more water

Well Driller Statement

This well was drilled or abandoned under my supervision, according to applicable rules and regulations, and this report is complete and correct to the best of my knowledge and belief.

Name Balsley Well Service (Person, Firm, or Corporation – Print or Type) License No. 610

Signature Tracy Balsley (Licensed Well Driller) Date 3-18-96

Construction Information

DEPTH (feet) FROM	DEPTH (feet) TO	CASING: CASING TYPE AND MATERIAL/GRADE	CASING: WALL THICK (in)	CASING: NOMINAL DIAM. (in)	DEPTH (feet) FROM	DEPTH (feet) TO	SCREEN ☐ PERFORATIONS ☒: SLOT SIZE OR PERF SIZE (in)	SCREEN DIAM. OR PERF LENGTH (in)	SCREEN TYPE OR NUMBER PERF (per round/interval)
+2	18	steel	.250	6"					
4	820	Plastic sch 40		4½					
					600	820	⅛	6"	4 per Rd.

Well Head Configuration: Welded Steel Cap Access Port Provided? ☐ Yes ☒ No

Casing Joint Type: 6-Lug Perforator Used: Saw

DEPTH (feet) FROM	DEPTH (feet) TO	FILTER PACK / GROUT / PACKER / ABANDONMENT MATERIAL: ANNULAR MATERIAL, ABANDONMENT MATERIAL and/or PACKER DESCRIPTION	Quantity of Material Used (if applicable)	GROUT DENSITY (lbs./gal.,# bag mix, gal./sack etc.)
0	18	Cement		

Well Development / Pump or Bail Tests

Date	Method	Yield	Units Check One GPM	Units Check One CFS	DRAWDOWN (ft)	TIME PUMPED (hrs & min)
4-12-96	Air Lift	1-2	X			

Pump (Permanent)

Pump Description: Horsepower: Pump Intake Depth: feet

Approximate maximum pumping rate: Well disinfected upon completion? ☒ Yes ☐ No

Comments

Description of construction activity, additional materials used, problems encountered, extraordinary circumstances, abandonment / procedures. *Use additional well data form for more space.*

Fractures from 601' to T.D.

Well Driller Statement

This well was drilled or abandoned under my supervision, according to applicable rules and regulations, and this report is complete and correct to the best of my knowledge and belief.

Name Balsley Well Service (Person, Firm, or ~~Corporation~~ Print or Type) License No. 610

Signature Tracy Balsley (Licensed ~~Well Driller~~) Date 4-14-96

WL1

WELL DRILLER'S REPORT
State of Utah
Division of Water Rights

For additional space, use "Additional Well Data Form" and attach

Well Identification PROVISIONAL WELL: 96-05-002-P-03

RECEIVED
MAY 06 1996
WATER RIGHTS
SALT LAKE

Owner *Note any changes*
John Hauer
550 North Main Suite C
Moab, UT 84532

Contact Person/Engineer:

Well Location *Note any changes*
Moved to — South 1700 feet West 2800 feet
SOUTH 900 feet WEST 2600 feet from the NE Corner of SECTION 36, TOWNSHIP 27S, RANGE 22E, SLB&M.

Location Description: (address, proximity to buildings, landmarks, ground elevation, local well #)

Drillers Activity Start Date: 4-24-96 Completion Date: 5-2-96

Check all that apply:
☒ New ☐ Repair ☐ Deepen ☐ Abandon ☐ Replace ☐ Public Nature of Use:

DEPTH (feet) FROM	TO	BOREHOLE DIAMETER (in)	DRILLING METHOD	DRILLING FLUID
0	18	9 7/8	Air Rotary	
18	58	7 7/8	Air Rotary	
58	900	6"	Air Rotary	Water + Foam

Well Log

DEPTH (feet) FROM	TO	WATER	PERMEABLE high	PERMEABLE low	UNCONSOLIDATED CLAY	SILT	SAND	GRAVEL	COBBLES	BOULDER	OTHER	CONSOLIDATED ROCK TYPE	COLOR	DESCRIPTIONS AND REMARKS (include comments on *water quality* if known.)
0	30		X									Sandstone	White	upper Morrison
30	330			X								Shale Sandstone	Rd/Bn Gn/Gy-White	Morrison
330	510		X									Sandstone	White	Entrada
510	580	X	X									Mudstone Siltstone	Rd/Bn	Lower Entrada (Carmel)
580	780		X									Sandstone	Lt Bn.	Navajo
780	838		X									Sandstone	Rd/Bn	Kayenta
838	860		X									Sandstone	Bn	Wingate
860	866	X	X											Fractures - water
866	900	X	X									Sandstone	Bn	Wingate - Fractures - water

200'

Static Water Level

Date 5-2-96 Water Level 510 feet Flowing? ☐ Yes ☒ No
Method of Water Level Measurement Tape If Flowing, Capped Pressure PSI
Point to Which Water Level Measurement was Referenced Surface
Height of Water Level reference point above ground surface 0 feet Temperature 66 ☐ °C ☒ °F

Well Log

Construction Information

DEPTH (feet) FROM	TO	CASING TYPE AND MATERIAL/GRADE	WALL THICK (in)	NOMINAL DIAM. (in)
+2	58	Steel	.250	6
0	500	Plastic sch 40		4½

DEPTH (feet) FROM	TO	SCREEN ☐ PERFORATIONS ☒ SLOT SIZE OR PERF SIZE (in)	SCREEN DIAM. OR PERF LENGTH (in)	SCREEN TYPE OR NUMBER PERF (per round/interval)
500	540	1/16	4"	21 per Jt.
540	860	1/16	4"	14 per Jt.
860	880	1/16	4"	36
880	900	1/16	4"	21

Well Head Configuration: Welded Steel cap Access Port Provided? ☐ Yes ☒ No

Casing Joint Type: Glue Perforator Used: Saw

DEPTH (feet) FROM	TO	FILTER PACK / GROUT / PACKER / ABANDONMENT MATERIAL: ANNULAR MATERIAL, ABANDONMENT MATERIAL and/or PACKER DESCRIPTION	Quantity of Material Used (if applicable)	GROUT DENSITY (lbs./gal.,# bag mix, gal./sack etc.)
	100'	4½" x 6" packer set		
0	100'	Cement 4½ x 6"		
0	18'	Cement 6" x 10"		

Well Development / Pump or Bail Tests

Date	Method	Yield	Units Check One GPM	Units Check One CFS	DRAWDOWN (ft)	TIME PUMPED (hrs & min)
5-2-96	Air Lift	5-8	☒			3

Pump (Permanent)

Pump Description: _____ Horsepower: _____ Pump Intake Depth: _____ feet

Approximate maximum pumping rate: _____ Well disinfected upon completion? ☒ Yes ☐ No

Comments Description of construction activity, additional materials used, problems encountered, extraordinary circumstances, abandonment / procedures. *Use additional well data form for more space.*

Cemented 6" Steel to 18' - Cemented 4½" plastic to 100'

Well Driller Statement This well was drilled or abandoned under my supervision, according to applicable rules and regulations, and this report is complete and correct to the best of my knowledge and belief.

Name Balsley Well Service (Person, Firm, or Corporation – Print or Type) License No. 610

Signature Tracy Balsley (Licensed Well Driller) Date 5-3-96

WL1

WELL DRILLER'S REPORT
State of Utah
Division of Water Rights

For additional space, use "Additional Well Data Form" and attach

RECEIVED
MAR 20 1996
WATER RIGHTS
SALT LAKE

Well Identification PROVISIONAL WELL: 96-05-002-P-01

Owner *Note any changes*
John Hauer
550 North Main Suite C
Moab, UT 84532

Contact Person/Engineer:

Well Location *Note any changes*
SOUTH 450 feet WEST 2000 feet from the NE Corner of SECTION 36, TOWNSHIP 27S, RANGE 22E, SLB&M.

Location Description: (address, proximity to buildings, landmarks, ground elevation, local well #)

Drillers Activity Start Date: 3-9-96 Completion Date: 3-16-96

Check all that apply:
☒ New ☐ Repair ☐ Deepen ☐ Abandon ☐ Replace ☐ Public Nature of Use:

DEPTH (feet) FROM	TO	BOREHOLE DIAMETER (in)	DRILLING METHOD	DRILLING FLUID
0	19	9 7/8	Air Rotary	
19	800	6	Air Rotary	Water - Foam

Well Log

DEPTH (feet) FROM	TO	WATER	PERMEABLE high	PERMEABLE low	UNCONSOLIDATED CLAY	SILT	SAND	GRAVEL	COBBLES	BOULDER	OTHER	CONSOLIDATED ROCK TYPE	COLOR	DESCRIPTIONS AND REMARKS (include comments on *water quality* if known.)
0	1		x		2	2	6						Rd/Brn	
1	34		x									Sandstone	White	
34	290		x									Morrison	Rd/Grn	Shale w/ sandstone layers
290	480		x									Entrada	White	
480	800	x	x									Entrada	Brown.	- Bottom Rd/Brn. Fractures Between 600 - 760

Static Water Level

Date 3-16-96 Water Level 481 feet Flowing? ☐ Yes ☒ No

Method of Water Level Measurement Tape If Flowing, Capped Pressure PSI

Point to Which Water Level Measurement was Referenced Surface

Height of Water Level reference point above ground surface 0 feet Temperature 58 ☐ °C ☒ °F

Well Log

Construction Information

DEPTH (feet) FROM	TO	CASING: CASING TYPE AND MATERIAL/GRADE	WALL THICK (in)	NOMINAL DIAM. (in)	DEPTH (feet) FROM	TO	SCREEN ☐ PERFORATIONS ☒: SLOT SIZE OR PERF SIZE (in)	SCREEN DIAM. OR PERF LENGTH (in)	SCREEN TYPE OR NUMBER PERF (per round/interval)
+2	19	Steel	.250	6					
15	480	Plastic	Sch. 40	4½	480	800	1/16"	6"	3

Well Head Configuration: Welded cap Access Port Provided? ☐ Yes ☒ No

Casing Joint Type: Glue Perforator Used: Saw

DEPTH (feet) FROM	TO	FILTER PACK / GROUT / PACKER / ABANDONMENT MATERIAL: ANNULAR MATERIAL, ABANDONMENT MATERIAL and/or PACKER DESCRIPTION	Quantity of Material Used (if applicable)	GROUT DENSITY (lbs./gal.,# bag mix, gal./sack etc.)
0	19	Cement		

Well Development / Pump or Bail Tests

Date	Method	Yield	Units Check One GPM	Units Check One CFS	DRAWDOWN (ft)	TIME PUMPED (hrs & min)
3-13-96	Air lift	2-3	☒			3hrs

Pump (Permanent)

Pump Description: _____ Horsepower: _____ Pump Intake Depth: _____ feet

Approximate maximum pumping rate: _____ Well disinfected upon completion? ☒ Yes ☐ No

Comments

Description of construction activity, additional materials used, problems encountered, extraordinary circumstances, abandonment / procedures. *Use additional well data form for more space.*

Well produced 2-3 g.p.m. with Air lift. - Pumped well should actually produce more water

Well Driller Statement

This well was drilled or abandoned under my supervision, according to applicable rules and regulations, and this report is complete and correct to the best of my knowledge and belief.

Name Balsley Well Service (Person, Firm, or Corporation – Print or Type) License No. 610

Signature Tracy Balsley (Licensed Well Driller) Date 3-18-96

WL1

WELL DRILLER'S REPORT
State of Utah
Division of Water Rights

RECEIVED
APR 18 1996
WATER RIGHTS
SALT LAKE

For additional space, use "Additional Well Data Form" and attach

Well Identification PROVISIONAL WELL: 96-05-002-P-02

Owner *Note any changes*

John Hauer
550 North Main Suite C
Moab, UT 84532

Contact Person/Engineer:

Well Location *Note any changes*

SOUTH 2500 feet WEST 2600 feet from the NE Corner of SECTION 36, TOWNSHIP 27S, RANGE 22E, SLB&M.

Location Description: (address, proximity to buildings, landmarks, ground elevation, local well #)

Drillers Activity Start Date: 4-5-96 Completion Date: 4-13-96

Check all that apply:
☒ New ☐ Repair ☐ Deepen ☐ Abandon ☐ Replace ☐ Public Nature of Use:

DEPTH (feet) FROM	TO	BOREHOLE DIAMETER (in)	DRILLING METHOD	DRILLING FLUID
0	18	9 7/8"	Air Rotary	
18	820	6"	Air Rotary	Foam + Water

Well Log

DEPTH (feet) FROM	TO	WATER	PERMEABLE high	PERMEABLE low	UNCONSOLIDATED CLAY	SILT	SAND	GRAVEL	COBBLES	BOULDER	OTHER	CONSOLIDATED ROCK TYPE	COLOR	DESCRIPTIONS AND REMARKS (include comments on *water quality* if known.)
0	303			☒								Sandstone	White sandstone / Rd + Brn. Shales - Morrison	
303	435		☒									Entrada	White Sandstone	
435	555		☒									Entrada	Rd/Brn.	Sandstone / Siltstone
555	820	☒	☒									Navajo	Lt/Brn.	Sandstone 601' Fracture - water 612' - 618' - 646' - Fractures water

265'

Static Water Level

Date 4-12-96 Water Level 497 feet Flowing? ☐ Yes ☒ No

Method of Water Level Measurement Tape If Flowing, Capped Pressure PSI

Point to Which Water Level Measurement was Referenced 0 - Surface

Height of Water Level reference point above ground surface 0 feet Temperature 50 ☐ °C ☒ °F

[redacted] *Well Log* [redacted]

Construction Information

DEPTH (feet) FROM	DEPTH (feet) TO	CASING: CASING TYPE AND MATERIAL/GRADE	CASING: WALL THICK (in)	CASING: NOMINAL DIAM. (in)	DEPTH (feet) FROM	DEPTH (feet) TO	SCREEN ☐ PERFORATIONS ☒: SLOT SIZE OR PERF SIZE (in)	SCREEN DIAM. OR PERF LENGTH (in)	SCREEN TYPE OR NUMBER PERF (per round/interval)
+2	18	steel	.250	6"					
4	820	Plastic sch 40		4½					
					600	820	⅛	6"	4 per Rd.

Well Head Configuration: Welded Steel Cap Access Port Provided? ☐ Yes ☒ No

Casing Joint Type: 6-Lug Perforator Used: Saw

DEPTH (feet) FROM	DEPTH (feet) TO	FILTER PACK / GROUT / PACKER / ABANDONMENT MATERIAL: ANNULAR MATERIAL, ABANDONMENT MATERIAL and/or PACKER DESCRIPTION	Quantity of Material Used (if applicable)	GROUT DENSITY (lbs./gal.,# bag mix, gal./sack etc.)
0	18	Cement		

Well Development / Pump or Bail Tests

Date	Method	Yield	Units Check One GPM	Units Check One CFS	DRAWDOWN (ft)	TIME PUMPED (hrs & min)
4-12-96	Air Lift	1-2	☒			

Pump (Permanent)

Pump Description: _____ Horsepower: _____ Pump Intake Depth: _____ feet

Approximate maximum pumping rate: _____ Well disinfected upon completion? ☒ Yes ☐ No

Comments Description of construction activity, additional materials used, problems encountered, extraordinary circumstances, abandonment / procedures. *Use additional well data form for more space.*

Fractures from 601' to T.D.

Well Driller Statement This well was drilled or abandoned under my supervision, according to applicable rules and regulations, and this report is complete and correct to the best of my knowledge and belief.

Name Balsley Well Service (Person, Firm, or ~~Corporation~~ Print or Type) License No. 610

Signature Tracy Balsley (~~Licensed Well Driller~~) Date 4-14-96

APPENDIX B:

Keating/Brown Well Driller's Log
Conveyance of Keating Water Right
Theis Estimation of Drawdown for the Keating/Brown Well

WELL DRILLER'S REPORT
State of Utah
Division of Water Rights

For additional space, use "Additional Well Data Form" and attach

RECEIVED
JUL 01 1996
DIVISION OF WATER RIGHTS
SALT LAKE

Well Identification WATER RIGHT APPLICATION: 05-2595(A70047)

Owner *Note any changes*
Brown, Jeffrey R.
1701 West Behind The Rocks Road
Moab, UT 84532

Keating / Perry Log

Contact Person/Engineer: _____

Well Location *Note any changes*
COUNTY: San Juan
SOUTH 40 feet EAST 632 feet from the NW Corner of
SECTION 36, TOWNSHIP 27S, RANGE 22E, SLB&M.

Location Description: (address, proximity to buildings, landmarks, ground elevation, local well #) 12 miles South of Moab

Drillers Activity
Start Date: June 17, 1996 Completion Date: June 22, 1996
Check all that apply:
[X] New [ ] Repair [ ] Deepen [ ] Abandon [ ] Replace [ ] Public Nature of Use: IRR, STK, DOM

DEPTH (feet) FROM	TO	BOREHOLE DIAMETER (in)	DRILLING METHOD	DRILLING FLUID
0	340	6¼	Rotary	air

Well Log

DEPTH (feet) FROM	TO	WATER	PERMEABLE high	PERMEABLE low	UNCONSOLIDATED CLAY	SILT	SAND	GRAVEL	COBBLES	BOULDER	OTHER	CONSOLIDATED ROCK TYPE	COLOR	DESCRIPTIONS AND REMARKS (include comments on *water quality* if known.)
0	10						X					Sand		
10	20										X	Sand		
												stone	purple	
20	60										X	Sand		
												stone	Orange	
60	80										X	Sand		
												stone	Purple	
80	110										X	Sand		
												stone	White	
110	200										X	Sand		
												stone	Orange	
200	230										X	Sand		
												stone	Orange	
230	280										X	Shale		
													Purple	
280	340										X	Sand		
												stone	Orange	

Static Water Level
Date _____ Water Level 220 feet Flowing? [ ] Yes [X] No
Method of Water Level Measurement _____ If Flowing, Capped Pressure _____ PSI
Point to Which Water Level Measurement was Referenced top of Casing 220 ft down
Height of Water Level reference point above ground surface / feet Temperature _____ [ ] °C [ ] °F

[redacted] Well Log [redacted]

Construction Information

DEPTH (feet) FROM	TO	CASING: CASING TYPE AND MATERIAL/GRADE	WALL THICK (in)	NOMINAL DIAM. (in)	DEPTH (feet) FROM	TO	SCREEN ☐ PERFORATIONS ☒ SLOT SIZE OR PERF SIZE (in)	SCREEN DIAM. OR PERF LENGTH (in)	SCREEN TYPE OR NUMBER PERF. (per round/interval)
0	20	Steel Casing	¼	7	320	320	⅛ X 5		4 over 1 ft
0	340	plastic Casing	¼	4½					

Well Head Configuration: _____ Access Port Provided? ☐ Yes ☐ No

Casing Joint Type: Glue Perforator Used: cutting Torch

DEPTH (feet) FROM	TO	FILTER PACK / GROUT / PACKER / ABANDONMENT MATERIAL: ANNULAR MATERIAL, ABANDONMENT MATERIAL and/or PACKER DESCRIPTION	Quantity of Material Used (if applicable)	GROUT DENSITY (lbs./gal.,# bag mix, gal./sack etc.)
0	20	7 inch steel casing		
		portland Cement	3 Bags	
		Quick Crete	6 Bags	

Well Development / Pump or Bail Tests

Date	Method	Yield	Units Check One GPM	Units Check One CFS	DRAWDOWN (ft)	TIME PUMPED (hrs & min)
June 22-96	Air Jet		15			

Pump (Permanent)

Pump Description: _____ Horsepower: _____ Pump Intake Depth: _____ feet

Approximate maximum pumping rate: _____ Well disinfected upon completion? ☐ Yes ☐ No

Comments

Description of construction activity, additional materials used, problems encountered, extraordinary circumstances, abandonment / procedures. *Use additional well data form for more space.*

Well Driller Statement

This well was drilled or abandoned under my supervision, according to applicable rules and regulations, and this report is complete and correct to the best of my knowledge and belief.

Name H. E. Dresman Drilling (Person, Firm, or Corporation – Print or Type) License No. 218

Signature H. E. Dresman (Licensed Well Driller) Date June 26, 1996

GARY R. HERBERT
Governor
SPENCER J. COX
Lieutenant Governor

State of Utah

DEPARTMENT OF NATURAL RESOURCES

Division of Water Rights

MICHAEL R. STYLER
Executive Director

KENT L. JONES
State Engineer/Division Director

RETURN No. 17-00453 **Date: February 9, 2017**

WILLIAM AND JUDITH PERRY
PO BOX 122
CARBONDALE, CO 81623

Dear Applicant/Professional:

This letter is regarding Report of Conveyance (ROC) for: 05-3304 (A76874)

Unfortunately, the above item(s) WILL NOT be processed and is being returned for the following reason(s):

1. **Insufficient Documents were Attached.**

Therefore, the Division is returning your Check numbered 1997 for $40.

Please fix the issues detailed herein and resubmit your request.
If you have any question or concerns, please visit the Utah State Division of Water Rights at 1594 West North Temple, Suite 220, Salt Lake City, UT 84114 or call us at (801)538-7240.

Enclosure(s):

Report of Conveyance (ROC) for 05-3304 (A76874)
Check #1997 in the amount of $40

REPORT OF WATER RIGHT CONVEYANCE

$40 Fee Rec'd by _____

Receipt # _____

USE THIS CONVEYANCE REPORT FORM WHEN 100% OF THE WATER RIGHT IS CONVEYED.

WATER RIGHT # 05-3304

SECTION A. CONVEYANCE SUMMARY

By Appurtenance (no water right number mentioned on deed) **Yes (maps attached)** ___ **No** X

1. Assignment__ Warranty Deed X Quitclaim Deed__ Sheriff's Deed__ Trustee's Deed__ Water Deed__ Trust Deed__
   Other : _____
2. Date Signed 09/15/2010 Date Recorded 11/12/2010
   Book 923 Page # 563-564 Entry # 111653
3. Grantor William K. Perry and Judith Fox-Perry
4. Grantee(s) Perry Moab LLC
5. Mailing Address : PO Box 122, Carbondale, CO 81623
6. E-mail Address (to be notified of ownership updates) : foxperry@wildblue.net
7. Special Conditions/Information of Conveyance _____

By Appurtenance (no water right number mentioned on deed) **Yes (maps attached)** ___ **No** X

1. Assignment__ Warranty Deed X Quitclaim Deed__ Sheriff's Deed__ Trustee's Deed__ Water Deed__ Trust Deed__
   Other : _____
2. Date Signed 03/01/07 Date Recorded 03/01/07
   Book 867 Page # 348-349 Entry # 091274
3. Grantor Scott Keating and Nancy Lovendahl
4. Grantee(s) William K. Perry and Judith Fox-Perry
5. Mailing Address : PO Box 122, Carbondale, CO 81623
6. E-mail Address (to be notified of ownership updates) : foxperry@wildblue.net
7. Special Conditions/Information of Conveyance _____

By Appurtenance (no water right number mentioned on deed) **Yes (maps attached)** ___ **No** ___

1. Assignment X Warranty Deed__ Quitclaim Deed__ Sheriff's Deed__ Trustee's Deed__ Water Deed__ Trust Deed__
   Other : _____
2. Date Signed 03/01/07 Date Recorded 03/02/07
   Book 867 Page # 345-347 Entry # 091273
3. Grantor Scott Keating and Nancy Lovendahl
4. Grantee(s) William K. Perry and Judith Fox-Perry
5. Mailing Address : PO Box 122, Carbondale CO 81623
6. E-mail Address (to be notified of ownership updates) : foxperry@wildblue.net
7. Special Conditions/Information of Conveyance _____

RECEIVED
FEB 09 2017
WATER RIGHTS
SALT LAKE
AM

REPORT OF WATER RIGHT CONVEYANCE

WATER RIGHT # 05-3304

SECTION B. CERTIFICATION for Perry MOAB LLC

I, William K. Perry, certify that I am authorized by Administrative Rule R655-3-7 to complete this report, and that the information contained herein or attached hereto is true and accurate to the best of my knowledge.

William K Perry — 2/7/2017 — 970 963 2464

Signature Member - Perry MOAB LLC — Date — Phone #

FOR LICENSED PROFESSIONALS ONLY

I, _____, certify that I am licensed as _____ in the State of Utah, that my license number is _____, that I was retained by an owner of the water right to prepare or supervise the preparation of the Report of Conveyance; that the report is true and accurate to the best of the preparer's knowledge; that an appropriate search of County Records records has been made and that the attached documents evidence the ownership interest of the grantee.

Signature _____ Date _____ Phone # _____

Address: _____

This report is not a title opinion based on the title search made. It does not warrant or guarantee title to water rights. This report was prepared for the purpose of updating records of the Division of Water Rights.

SECTION C. DIVISION OF WATER RIGHTS - FOR OFFICIAL USE ONLY

Received: ____/____/____ Filed: ____/____/____ Reviewed By: _____

Database Changed: ____/____/____ By: _____

File Changed: ____/____/____ By: _____

New File Number based on Segregation _____

Remarks: _____

AMOUNT OF WATER RIGHT RETAINED _____

RECEIVED
FEB 09 2017
WATER RIGHTS
SALT LAKE

No agency of the State of Utah warrants or guarantees title to certain water rights. The water right ownership information of record in the Division of Water Rights concerning this water is based on the information which has been submitted by this Report of Water Right Conveyance.

Perry Moab LLC – William Perry & Judith Fox-Perry

PO Box 122, Carbondale, CO 81623

Feb 7, 2017

To Division of Water Rights

1594 West North Temple, Suite 220, Salt Lake City, Utah 84116

Please find the enclosed forms with fees. I tried to do this in 2012 but the forms were returned.

100% Water Right Conveyance Form with $ 40.00 fee.

Water Right Owner change of address request

Request for Extension of Time to file Proof of Beneficial Use with $ 50.00 fee

Copy of Extension of Time form filed in 2012

Please make sure all correspondence goes to

William Perry – Perry Moab LLC

PO Box 122, Carbondale, CO 81623

970 963 2464 – email foxperry@wildblue.net.

Thank you

William Perry

RECEIVED
FEB 09 2017
WATER RIGHTS AM
SALT LAKE

utah.gov Online Services Agency List Business Search
Utah Division of Water Rights

CALCULATED THEIS:

Given input:

Constant pumping rate (Q): 0.334201 cfs
Aquifer transmissivity (T): 4290 ft²/day or 0.049653 ft²/second
Time since pumping began (t): 1825 days
Radial distance from well (r): 1,600.00 feet
Aquifer storativity (S): .001

$$h_o - h = \frac{Q}{4\pi T} W(u) \qquad u = \frac{r^2 S}{4Tt}$$

$$h_o - h = \frac{Q}{4\pi T}\left[-0.5772 - \ln u + u - \frac{u^2}{2 \cdot 2!} + \frac{u^3}{3 \cdot 3!} - \frac{u^4}{4 \cdot 4!} + \cdots\right]$$

Q is the constant pumping rate (L3/T; ft3/day or m3/day)
h is hydraulic head (L; ft or m)
ho is hydraulic head before pumping started (L; ft or m)
ho-h is the drawdown (L; ft or m)
T is aquifer transmissivity (L2/T; ft2/day or m2/day)
t is time since pumping began (T; days)
r is radial distance from the pumping well (L; ft or m)
S is aquifer storavity (dimensionless)
b is aquifer thickness (L; ft or m)

u: 0.000082
W(u) series: 8.8347908446537

Drawdown (ho-h) at day 1825: 4.73 ft using series calculation of W(u) to u^6

Drawdown over the course of a year from initial well drilling:
Day 1: 0.79 ft
Day 4: 1.47 ft
Day 7: 1.76 ft
Day 10: 1.95 ft
Day 13: 2.09 ft
Day 16: 2.20 ft
Day 19: 2.29 ft
Day 22: 2.37 ft
Day 25: 2.44 ft
Day 28: 2.50 ft
Month 1: 2.54 ft
Month 2: 2.91 ft
Month 3: 3.13 ft
Month 4: 3.28 ft
Month 5: 3.40 ft
Month 6: 3.50 ft
Month 7: 3.58 ft
Month 8: 3.65 ft
Month 9: 3.72 ft
Month 10: 3.77 ft
Month 11: 3.82 ft
Month 12: 3.87 ft

Drawdown over multiple years from initial well drilling:
Year 1: 3.87 ft
Year 2: 4.24 ft
Year 3: 4.46 ft
Year 4: 4.61 ft
Year 5: 4.73 ft
Year 6: 4.83 ft
Year 7: 4.91 ft
Year 8: 4.98 ft
Year 9: 5.05 ft
Year 10: 5.10 ft
Year 11: 5.15 ft
Year 12: 5.20 ft
Year 13: 5.24 ft
Year 14: 5.28 ft

APPENDIX B:

March 2018 & March 2019 Water Elevation Data

Site Key	2019 Water Elevation	2018 Water Elevation	1986 Water Elevation	2019 - 2018 Water Change	2019 - 1986 Water Change
1	3962.16	3961.63	3964.57	0.53	-2.41
2	3966.81	3967.22		-0.41	
3	3959.46	3959.87		-0.41	
4	3961.69	3962.80		-1.11	
5	3956.36	3956.40		-0.04	
6	4023.02	4023.10		-0.08	
7			4011.20		
8	4053.20	4052.96		0.24	
9	4132.33	4133.39		-1.06	
10			4355.00		
11			4278.20		
12			4375.00		
13	4279.18	4278.70		0.48	
14			4535.00		
15			4522.20		
16			4468.40		
17	4324.60	4324.10		0.50	
18			4545.30		
19			4550.16		
20			4464.50		
21			4567.17		
22			4529.50		
23			4589.20		
24			4550.45		
25			4551.34		
26	4618.14	4620.35	4624.76	-2.21	-6.62
27	4466.61	4466.93		-0.32	
28			4566.35		
29			4508.10		
30	4478.49	4478.89		-0.40	
31	4570.45	4572.60	4579.60	-2.15	-9.15
32	4525.03	4527.36	4532.10	-2.33	-7.07
33			4545.00		
34		4558.18	4566.88		
35	4579.88				
36	4621.69	4625.62		-3.93	
37			4603.00		
38			4608.29		
39	4668.37	4673.22		-4.85	
40	4596.10	4601.14		-5.04	
41	4672.77	4681.64		-8.88	
42	4688.75	4699.97		-11.22	
43	4672.50	4678.07		-5.56	
44		4625.45			
45	4742.29	4756.79		-14.49	
46	6047.46				
47	5135.54	5135.57		-0.03	

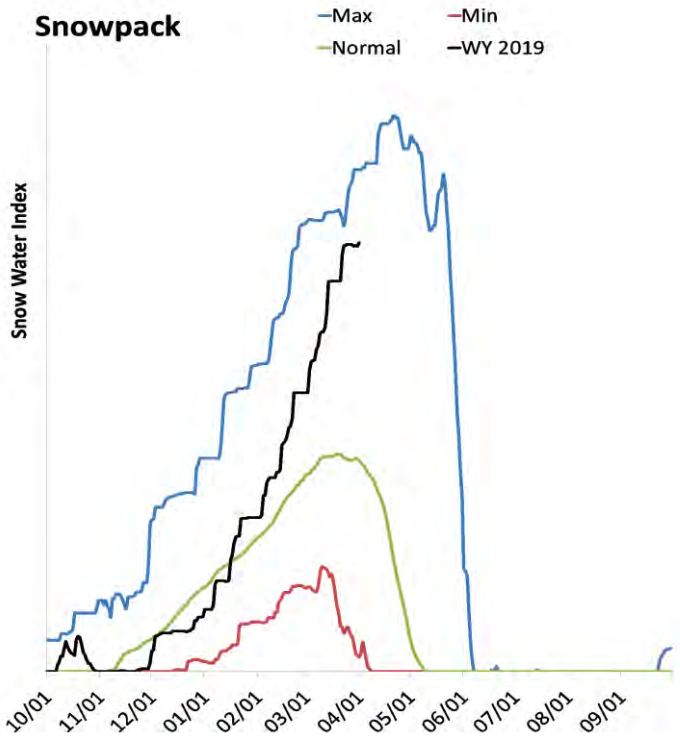
APPENDIX C:

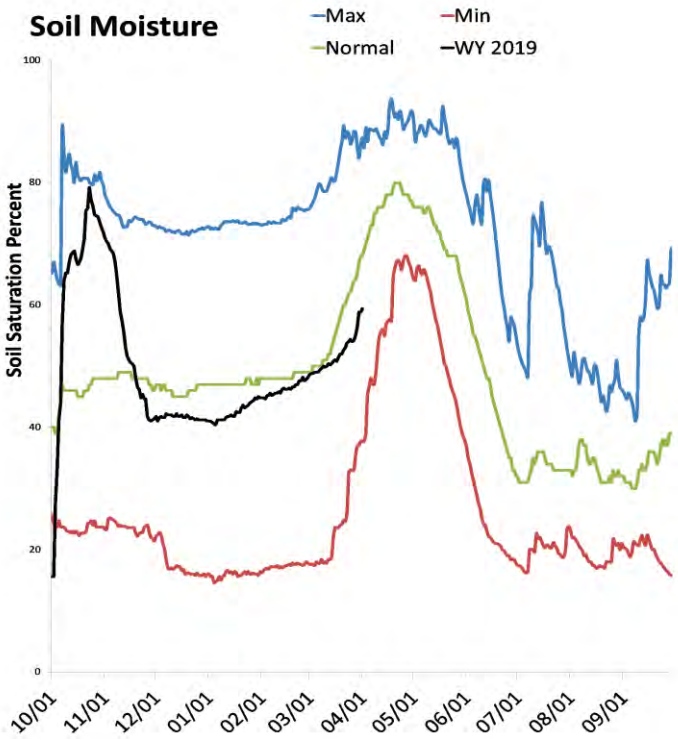
May 1st, 2018 NRCS Utah Water Supply Outlook Report for Southeastern Utah

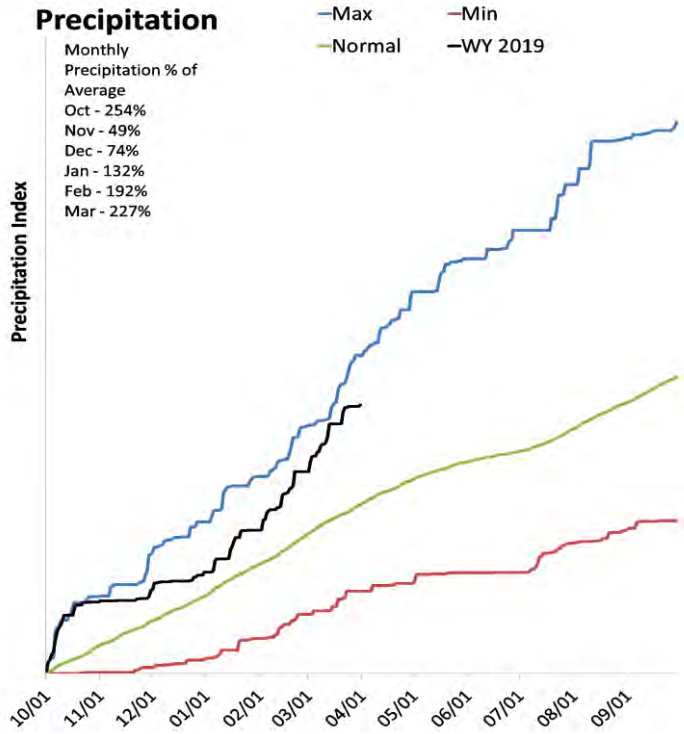
Southeastern Utah

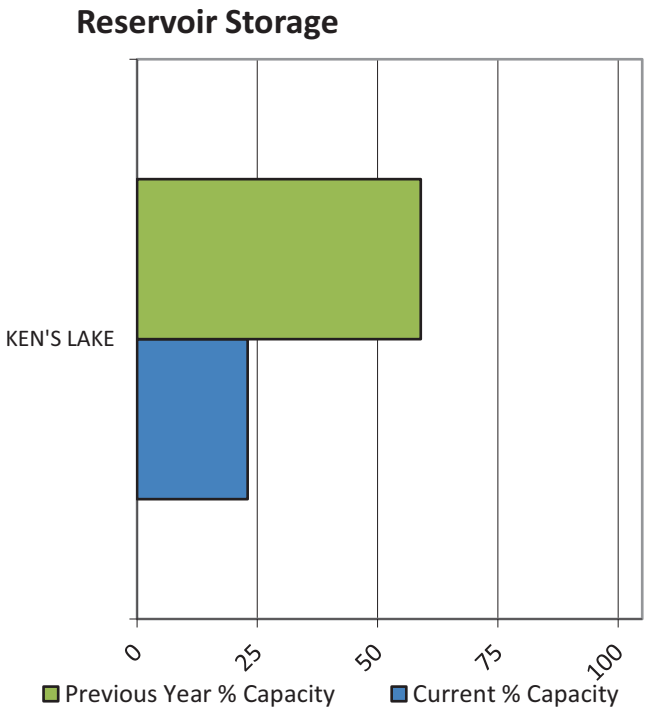
April 1, 2019

Snowpack in the Southeastern Utah is much above normal at 203% of normal, compared to 45% last year. Precipitation in March was much above average at 228%, which brings the seasonal accumulation (Oct-Mar) to 159% of average. Soil moisture is at 59% compared to 45% last year. Reservoir storage is at 23% of capacity, compared to 59% last year. Forecast streamflow volumes range from 145% to 293% of average. The surface water supply index is 94% for Moab.









SNOTEL Data

Data Current as of: 4/3/2019 3:30:37 PM

Southeastern Utah
Streamflow Forecasts - April 1, 2019

Forecast Exceedance Probabilities for Risk Assessment
Chance that actual volume will exceed forecast

Southeastern Utah	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
Mill Ck at Sheley Tunnel nr Moab								
	APR-JUL	8.1	9.2	10	233%	10.8	11.9	4.3
South Ck ab Resv nr Monticello								
	MAR-JUL	1.68	2.4	3	275%	3.7	4.8	1.09
	APR-JUL	1.62	2.3	2.9	293%	3.6	4.7	0.99
Colorado R nr Cisco [2]								
	APR-JUL	4990	5760	6320	148%	6900	7800	4280
San Juan R near Bluff [2]								
	APR-JUL	1160	1410	1600	145%	1800	2120	1100

1) 90% and 10% exceedance probabilities are actually 95% and 5%
2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions
3) Median value used in place of average

Reservoir Storage End of March, 2019	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Ken's Lake	0.5	1.4	1.3	2.3
Basin-wide Total	0.5	1.4	1.3	2.3
# of reservoirs	1	1	1	1

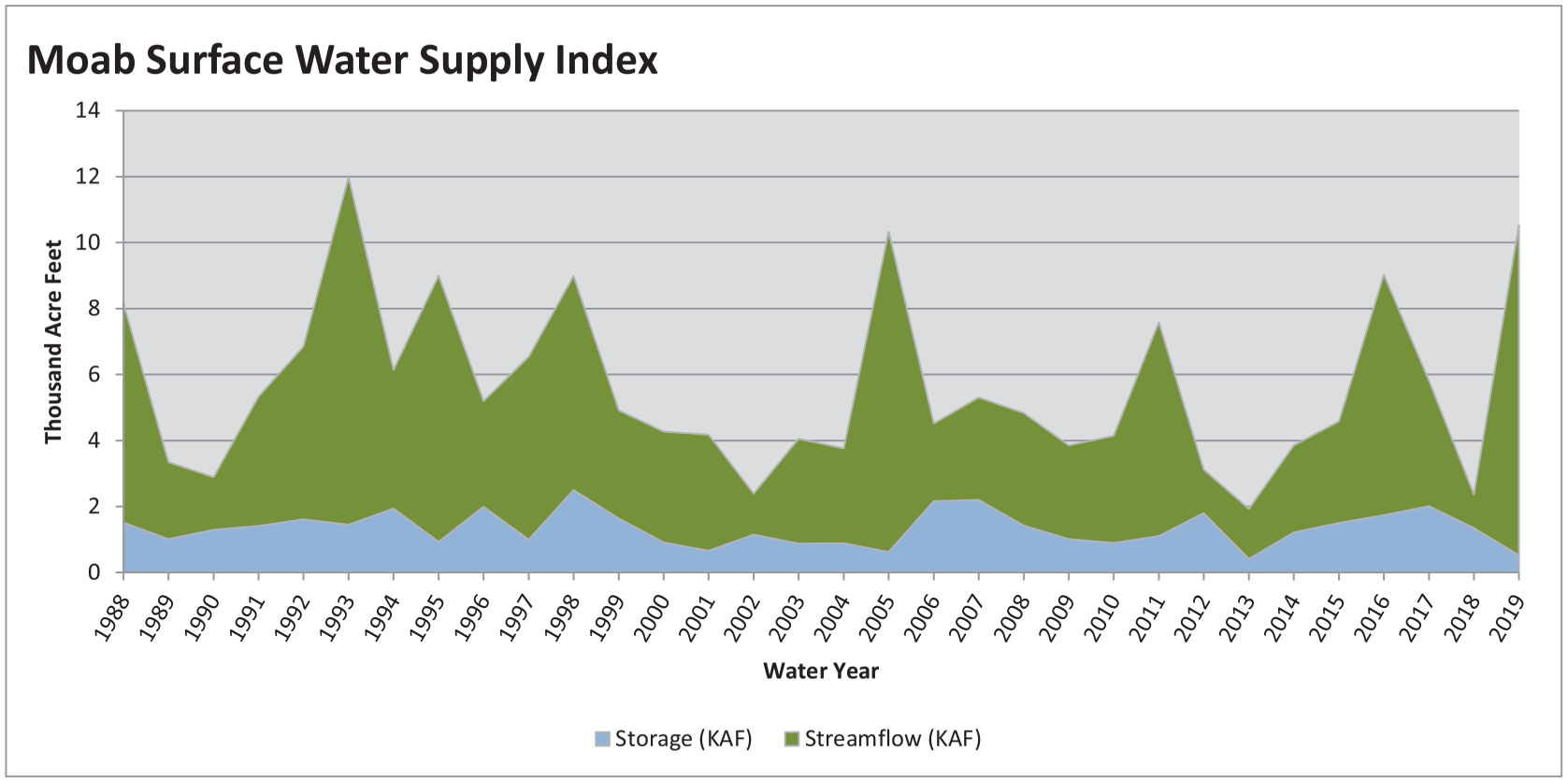
Watershed Snowpack Analysis April 1, 2019	# of Sites	% Median	Last Year % Median
Lasal Mountains	2	187%	68%
Lower San Juan	2	209%	28%
Lower Green	2	166%	49%
Henry Mountains	0		

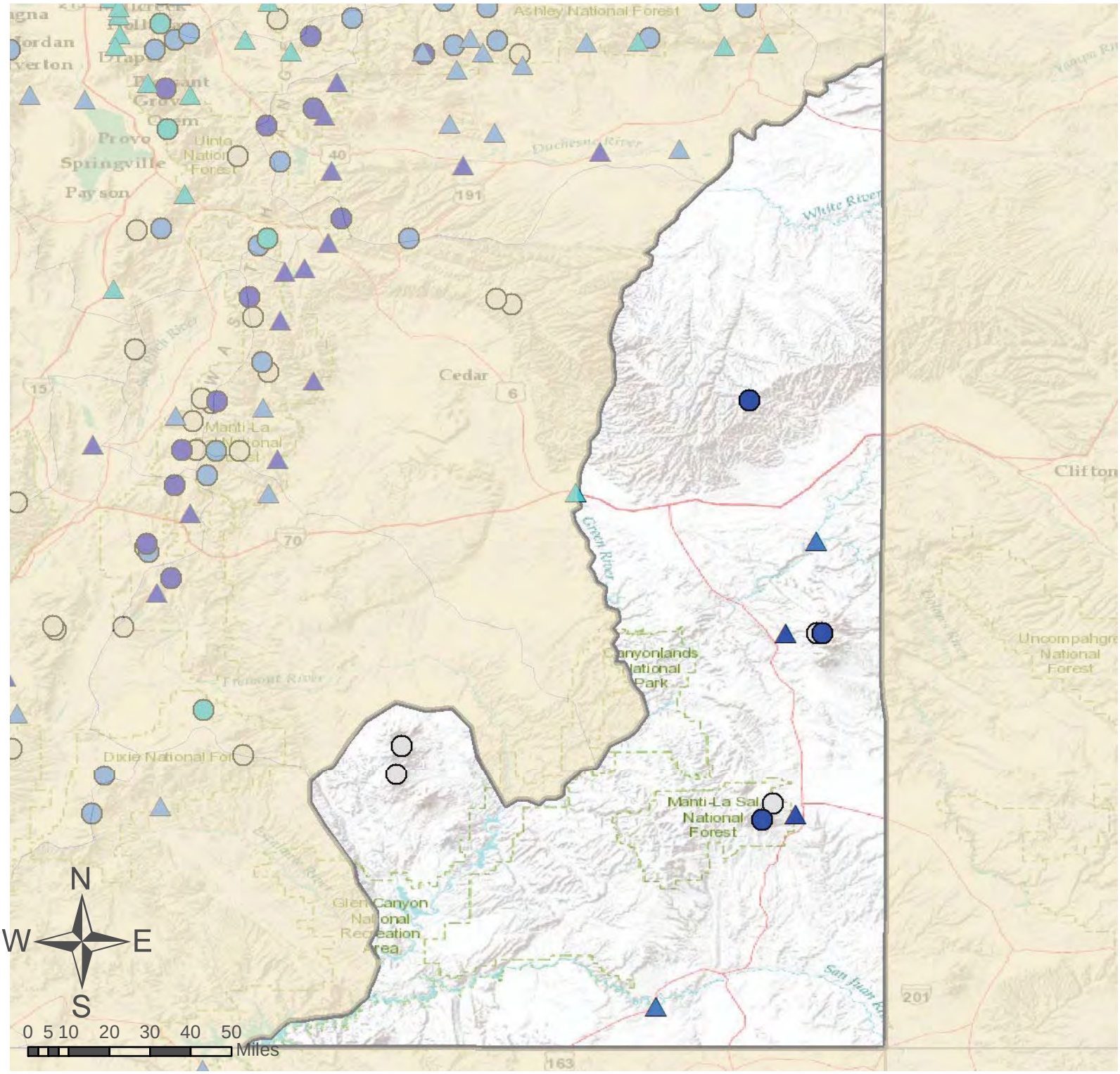
April 1, 2019

Surface Water Supply Index

Basin or Region	Mar EOM* Storage	APR-JUL Forecast	Storage + Forecast	Percentile	SWSI#	Years with similiar SWSI
	KAF^	KAF^	KAF^	%		
Moab	**0.52**	**10.00**	**10.52**	**94**	**3.66**	**93, 05, 16, 95**

*EOM, end of month; #SWSI, Surface Water Supply Index; ^KAF, thousand acre-feet.





Southeastern Utah

SNOTEL Site

Forecast Point

<u>As of April 1, 2019:</u>

203% of Normal SWE

159% of Normal Precipitation

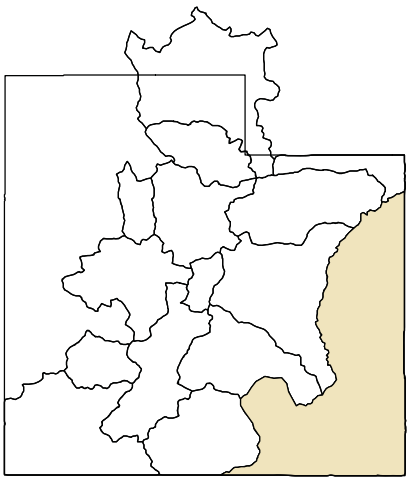
228% of Normal Precipitation Last Month

59% Saturation Soil Moisture

Southeastern Utah

% of Normal

- < 50%
- 50 - 69%
- 70 - 89%
- 90 - 109%
- 110 - 129%
- 130 - 149%
- > 150%
- No Normal



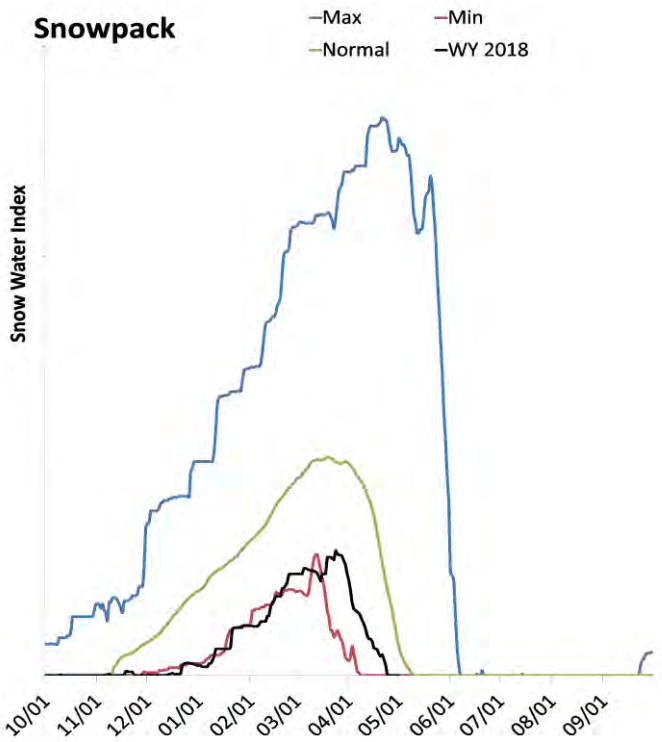
APPENDIX D:

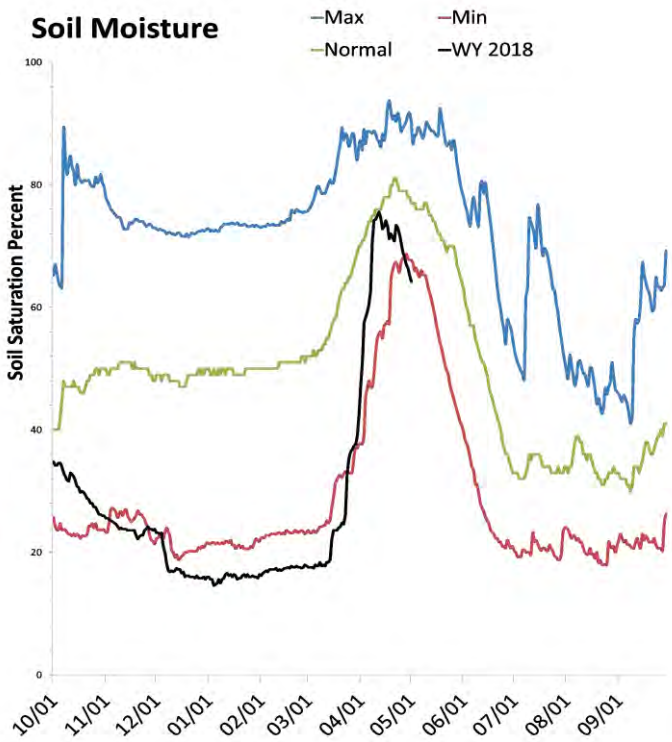
April 1st, 2019 NRCS Utah Water Supply Outlook Report for Southeastern Utah

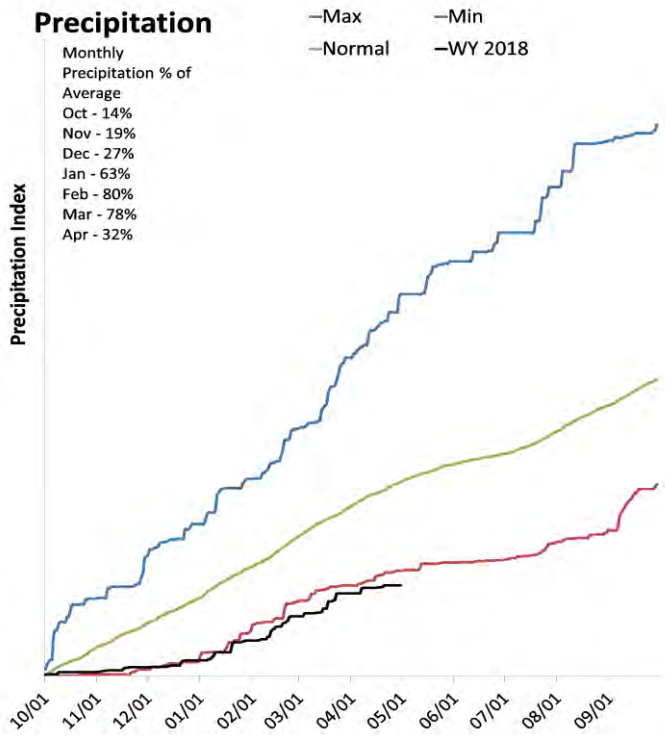
Southeastern Utah

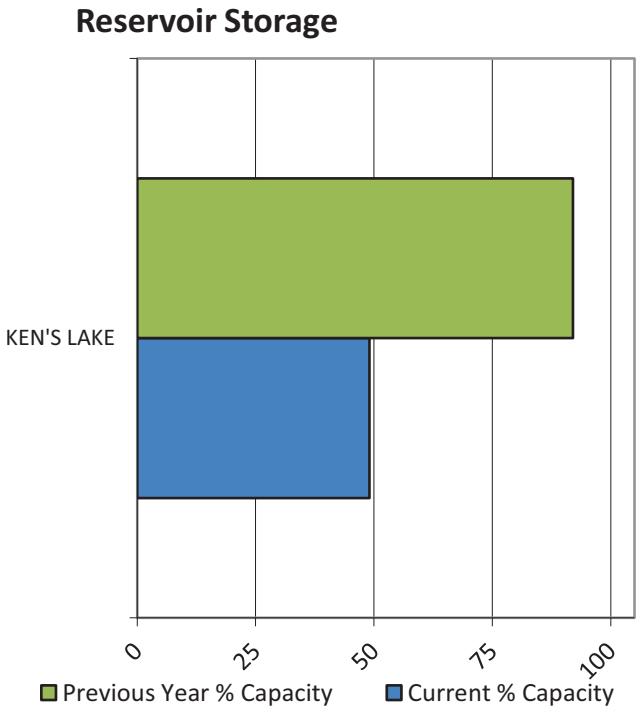
May 1, 2018

Snowpack in the Southeastern Utah is much below normal at 0% of normal, compared to 0% last year. Precipitation in April was much below average at 31%, which brings the seasonal accumulation (Oct-Apr) to 46% of average. Soil moisture is at 64% compared to 74% last year. Reservoir storage is at 49% of capacity, compared to 92% last year. Forecast streamflow volumes range from 4% to 42% of average. The surface water supply index is 9% for Moab.









SNOTEL Data

Data Current as of: 5/4/2018 6:37:40 AM

Southeastern Utah
Streamflow Forecasts - May 1, 2018

Southeastern Utah	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
		Forecast Exceedance Probabilities for Risk Assessment Chance that actual volume will exceed forecast						
Mill Ck at Sheley Tunnel nr Moab								
	APR-JUL	0.85	1.21	1.5	35%	1.84	2.4	4.3
	MAY-JUL	0.47	0.83	1.12	30%	1.46	2	3.7
South Ck ab Resv nr Monticello								
	MAR-JUL	0	0.02	0.04	4%	0.08	0.16	1.09
	MAY-JUL	0	0.02	0.04	6%	0.08	0.16	0.69
Colorado R nr Cisco [2]								
	APR-JUL	1350	1610	1810	42%	2020	2350	4280
	MAY-JUL	1100	1360	1560	42%	1770	2100	3720
San Juan R near Bluff [2]								
	APR-JUL	105	138	166	15%	198	255	1100
	MAY-JUL	39	72	100	12%	132	189	855

1) 90% and 10% exceedance probabilities are actually 95% and 5%
2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions
3) Median value used in place of average

Reservoir Storage End of April, 2018	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Ken's Lake	1.1	2.1	1.5	2.3
Basin-wide Total	1.1	2.1	1.5	2.3
# of reservoirs	1	1	1	1

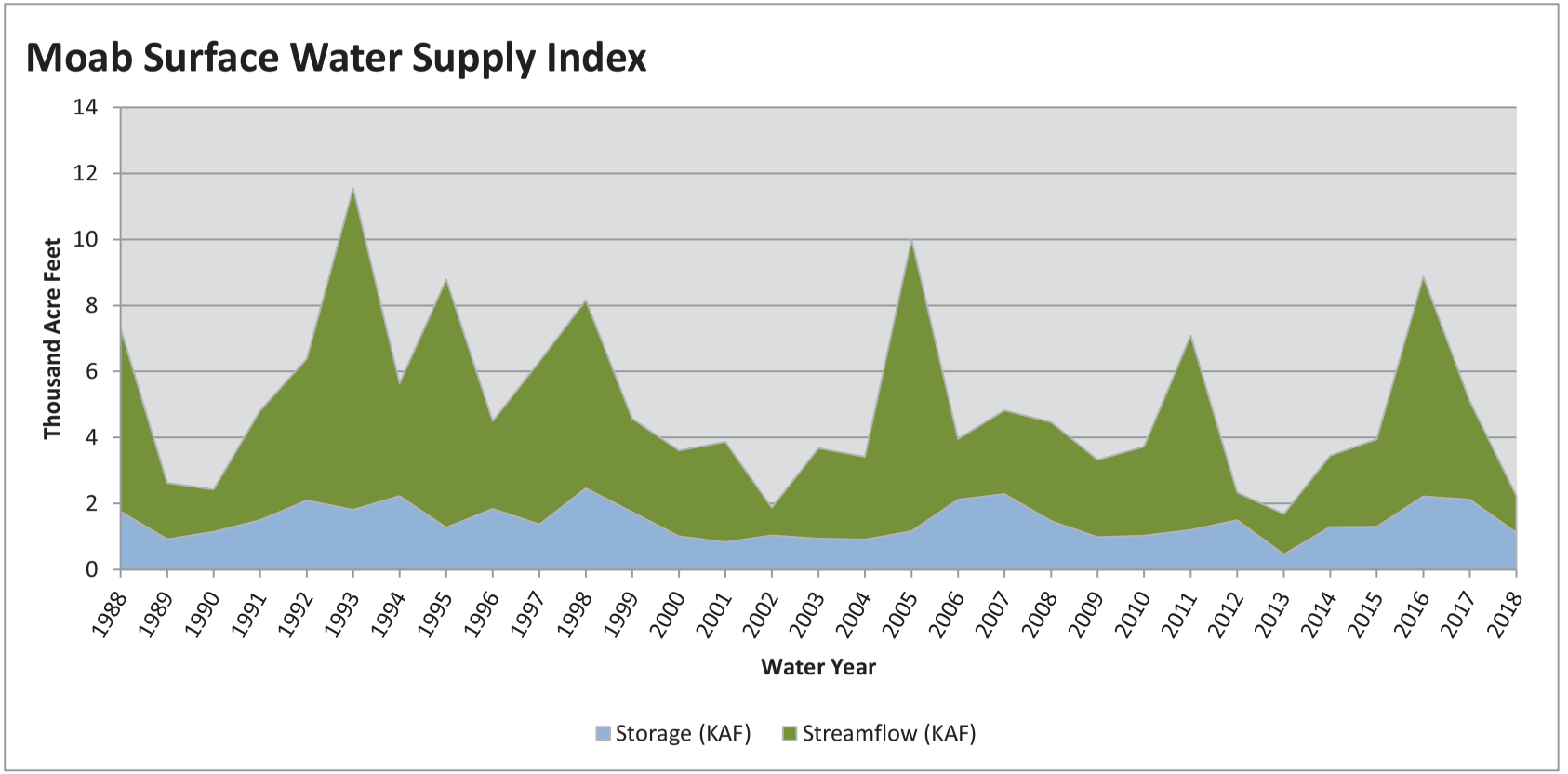
Watershed Snowpack Analysis May 1, 2018	# of Sites	% Median	Last Year % Median
Lasal Mountains	2	0%	0%
Lower San Juan	2	0%	0%
Lower Green	2	0%	195%
Henry Mountains	0		

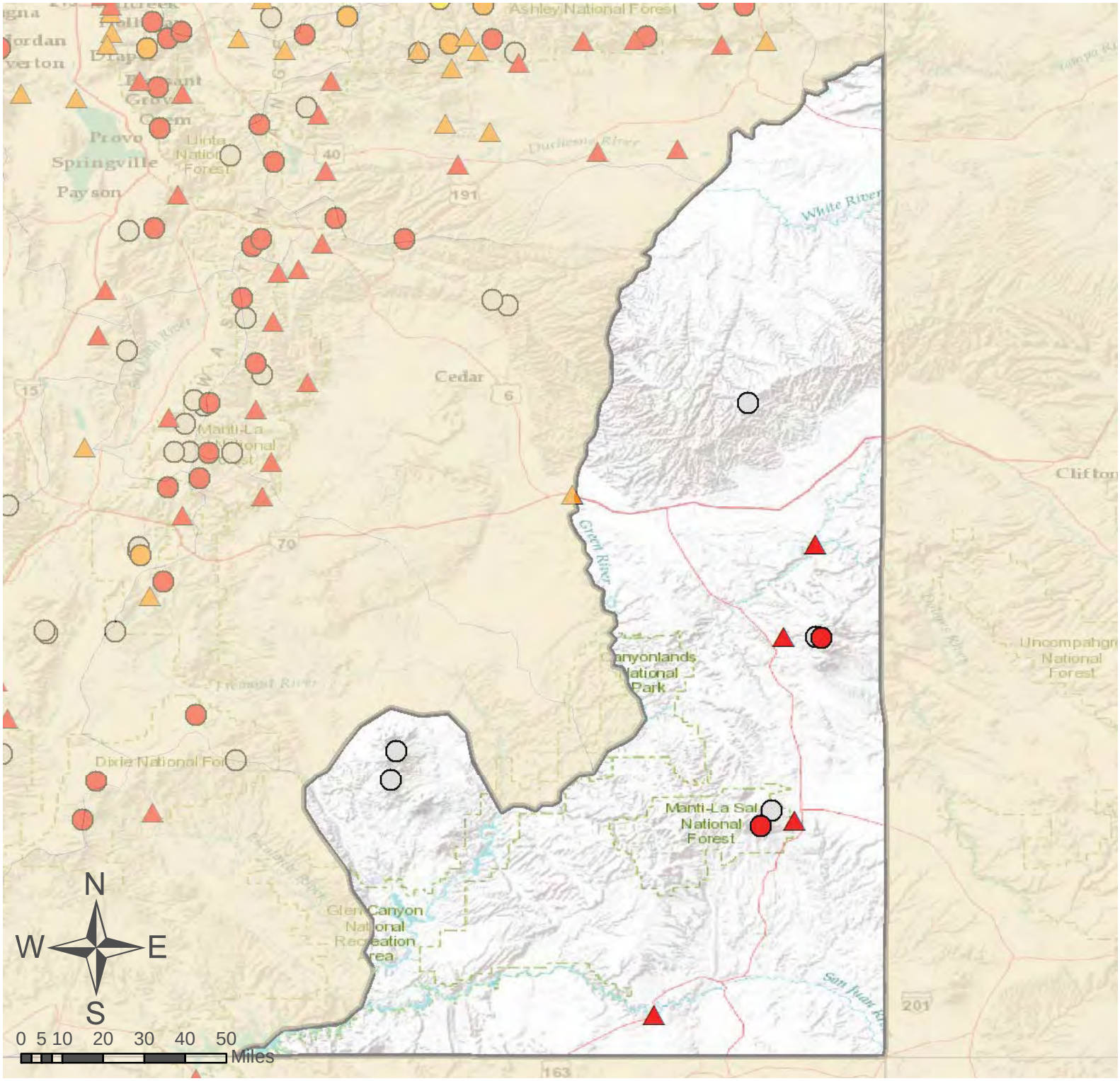
May 1, 2018

Surface Water Supply Index

Basin or Region	Apr EOM* Storage	MAY-JUL Forecast	Storage + Forecast	Percentile	SWSI#	Years with similiar SWSI
	KAF^	KAF^	KAF^	%		
Moab	**1.12**	**1.12**	**2.24**	**9**	**-3.39**	**13, 02, 12, 90**

*EOM, end of month; #SWSI, Surface Water Supply Index; ^KAF, thousand acre-feet.





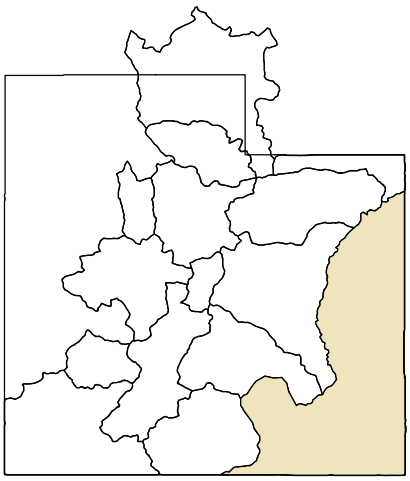
Southeastern Utah

SNOTEL Site

Forecast Point

% of Normal

- < 50%
- 50 - 69%
- 70 - 89%
- 90 - 109%
- 110 - 129%
- 130 - 149%
- > 150%
- No Normal



As of May 1, 2018:

0% of Normal SWE

46% of Normal Precipitation

31% of Normal Precipitation Last Month

64% Saturation Soil Moisture

49% Reservoir Capacity