

2015 ANNUAL ICR AND TRR WELL FIELD REPORT

Prepared for

ICR WATER USERS ASSOCIATION

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By

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### ICR WATER USERS ASSOCIATION

The ICR Water Users Association (ICRWUA) is a private member owned non-profit water company formed in 1995 that provides water to the Inscription Canyon Ranch, Whispering Canyons, Preserve at the Ranch and Talking Rock subdivisions. The company also provides water to the Talking Rock golf course. Water for the first three subdivisions comes from the ICR well field consisting of two wells while water for the Talking Rock subdivision and golf course comes from the TRR well field consisting of three wells. The ICR well field and the three subdivisions it serves constitute the ICR groundwater system whereas the TRR well field and the customers it serves constitute the TRR ground system. The two systems are not connected. The company is regulated by the Arizona Corporation Commission.

As of December 2015 ICRWUA provided water to 528 residential customers, an increase of 17 from 2014 and 109 above that served in January 2008, table 1. Of this amount, some 312 residential customers were served in the Inscription Canyon Ranch, Whispering Canyons, and Preserve at the Ranch subdivisions, an increase of 9 customers above 2014 and 41 above 2008. The number of residential customers served at the Talking Rock subdivision in 2015 was 216, an increase of 8 from 2014 and 68 above 2008.

Table 1, Residential Customers Served December 2008 – December 2015

Year	2008	2009	2010	2011	2012	2013	2014	2015
ICR	271	275	282	273	283	291	303	312
TRR	148	148	160	161	170	190	208	216
<b>Total</b>	<b>419</b>	<b>423</b>	<b>442</b>	<b>434</b>	<b>453</b>	<b>481</b>	<b>511</b>	<b>528</b>

At full build-out of the four subdivisions as presently planned, the company will serve about 2,420 residential customers or homes.

In addition to providing water to residential customers in the four subdivisions and the TRR Golf Course, ICRWUA also serves several commercial entities located within the Talking Rock and Inscription Canyon Ranch subdivisions while an additional amount of water is also provided to irrigate common areas in all of the subdivisions.

The ICR well field is capable of meeting the water demand for all of the above purposes of the three subdivisions it serves at full build-out of the subdivisions with either well so that the second well serves as a back-up well. The TRR well field is capable of meeting the water demand of the Talking Rock subdivision for all of the above purposes and the golf course at full build-out of the subdivision with any two of the three wells in the field so that the third well is available for back-up.

## 2015 WATER DEMAND

The monthly and annual 2015 water demand for all major users within ICRWUA’s service area is shown for the ICR and TRR groundwater systems in tables 2 and 3 respectively. Values shown are based on monthly billing records that date from December 16, 2014 through December 16, 2015 rather than on a calendar basis. Column 2 shows the monthly residential water demand in gallons; column 3 shows the number of residential units or homes served, column 4 shows the average daily use per residence in gallons per day (gpd/r), columns 5 and 6 show the monthly use for common area landscape and commercial purposes in gallons respectively. Column 7 shows the number of residential units served that consumed no water for the month and column 8 for the TRR groundwater system shows the monthly water demand of the TRR golf course in gallons.

As shown by the tables, monthly demand varies significantly with demand increasing during the drier pre-monsoon part of the year in response to increased residential use of drip irrigation for plants, particularly in the Inscription Canyon Ranch subdivision, and increased golf course demand.

For each month and for the year as a whole, the average daily residential water use per residential unit for the ICR groundwater system exceeds that of the residential units in the TRR groundwater system. The increased use in the ICR groundwater system reflects a greater use of water for drip irrigation for residential landscape compared to the Talking Rock subdivision. On the other hand, water used for irrigation of common areas and for commercial purposes in the TRR groundwater system (3,459,303 gallons) significantly exceeds that of the ICR system (398,970 gallons) by about 3.1 million gallons.

Table 2, 2015 ICR Groundwater System Residential, Landscape, and Commercial Water Demand

Month	residential	customers	gpd/r	landscape	commercial	Zero
Jan	1,104,210	299	123	2,240	370	22
Feb	1,161,850	296	123	8,710	1,730	12
March	1,186,570	295	118	3,940	610	13
April	1,987,610	299	266	42,010	2,770	9
May	2,305,070	302	239	60,080	1,030	19
June	2,319,350	303	247	46,200	1,350	13
July	2,976,690	306	295	46,800	2,240	14
Aug	2,525,610	302	253	37,330	2,720	10
Sept	2,702,490	305	316	47,460	1,100	10
Oct	2,255,510	304	239	45,420	1,560	7
Nov	1,693,310	307	178	32,870	500	15
Dec	1,290,490	312	143	1,150	8,780	15
<b>Total</b>	<b>23,508,760</b>	<b>303</b>	<b>213</b>	<b>374,210</b>	<b>24,760</b>	<b>13</b>

Table 3, 2015 TRR Groundwater System Residential, Landscape, Commercial, and Golf Course Water Demand

Month	residential	customers	gpd/r	landscape	commercial	zero	golf course
Jan	423,550	204	69	50	60,957	39	3,723,000
Feb	447,680	205	68	0	100,898	32	1,898,000
March	490,870	200	72	10	74,797	35	1,105,000
April	709,280	201	141	1,020,106	58,532	33	9,365,000
May	952,260	204	146	126,154	89,261	21	10,529,000
June	998,060	205	157	136,101	105,817	21	10,455,000
July	1,928,780	211	277	153,418	714,229	12	10,151,000
Aug	1,118,310	203	167	134,539	97,327	12	8,758,000
Sept	1,055,320	216	174	184,647	68,359	24	8,191,000
Oct	1,045,830	212	159	84,418	91,043	8	8,338,000
Nov	810,570	209	125	17,969	81,537	15	7,090,000
Dec	528,910	216	84	20	59,114	15	2,338,000
<b>Total</b>	<b>10,509,420</b>	<b>207</b>	<b>139</b>	<b>1,857,432</b>	<b>1,601,871</b>	<b>22</b>	<b>81,941,000</b>

WATER DEMAND: 2008 - 2015

The individual and combined annual ICR and TRR well field water demand for 2008 through 2015 based on a calendar basis is shown in table 4. Annual demand for the TRR golf course based on monthly billing is also shown.

Table 4, Individual and Combined Annual ICR and TRR Well Field Demand, 2008 – 2015, in gallons

Year	ICR	TRR	Combined	Golf Course
2008	25,934,023	115,051,300	140,985,323	102,184,000
2009	29,988,500	108,222,500	138,211,000	93,892,000
2010	24,476,500	116,091,800	140,568,300	107,248,810
2011	25,125,980	106,658,000	131,783,980	102,180,500
2012	27,012,000	104,613,000	131,625,000	94,675,000
2013	26,375,000	107,520,000	133,895,000	96,138,000
2014	27,500,000	107,033,000	134,533,000	90,289,000
2015	25,669,000	94,270,000	119,939,000	81,941,000

The 2015 annual demand at the ICR and TRR well fields respectively was 25,669,000 gallons and 94,270,000 gallons. The combined demand for all uses for 2015 was 119,939,000 gallons, the lowest demand for the period of record. The 2015 golf course use of 81,941,000 gallons represents about 87 percent of the total annual pumpage from the TRR well field and 68 percent of the combined pumpage from both well fields.

Combined water demand in 2008 exceeds that for the succeeding years through 2015 and exceeds that of 2015 by approximately 21.04 million gallons; a significant decrease despite the fact that, as discussed above, the number of residential units served by ICRWUA increased by 109 homes over the same time period, an increase of about 26 percent above 2008. Most of the decrease, about 20.2 million gallons, is accounted for by the reduced demand at the golf course, but even still there is a remaining decrease of about 0.84 million gallons.

As shown in table 4, demand on the ICR well in 2015 is essentially the same as in 2008 despite the increase of 41 residential units being served over the same time period, an increase of about 15 percent from 2008.

Demand on the TRR well field decreased from 2008 to 2015, by about 20.8 million gallons. If the reduced demand at the golf course is accounted for, water demand from the well field in 2015 is still approximately 0.6 million gallons less than in 2008 even though the number of homes served increased by 68, an increase of about 46 percent above 2008.

#### THE ICR WELL FIELD

There are two wells in the Inscription Canyon Ranch (ICR) well field about 47 feet apart; ICR 1 and ICR 2. The latter well is often referred to as Whispering Canyon 1 (WC 1). ICR 1 is the original well constructed by the developer of the Inscription Canyon Ranch subdivision to serve the subdivision as initially planned. Whispering Canyons L.L.C constructed ICR 2 and paid all other cost associated with bringing this well on line. The well field provides water to the Inscription Canyon Ranch (ICR), Whispering Canyon (WC), and Preserve at the Ranch subdivisions.

The wells are located in Section 17, Township 16 North, Range 3 West. They are situated in the Mint Wash floodplain about one-half mile west of Williamson Valley road where the road crosses the wash. Construction of ICR 1 began on June 24, 1994 and was completed on August 5, 1994. Construction of ICR 2 began March 30, 2002 and was completed April 10, 2002.

The wells are owned by Aqua Meadows and are on land owned by Aqua Meadows. ICRWUA has an agreement dated August 1, 1995 that gives the Association the right to operate and use ICR 1 as a water supply for the ICR and Preserve at the Ranch subdivisions for 100 years subject to renewal every 25 years. The purpose of this agreement is to satisfy the Arizona Department of Water Resources 100 year Water Adequacy Requirement. An amendment to the agreement (Amendment 1) dated July 24, 2001 adds Whispering Canyon. It is the responsibility of ICRWUA to operate and maintain the two wells and pay all cost associated with operation and maintenance. Per contract with Aqua Meadows, the Association is permitted to withdraw 164,518,498 gallons per year for servicing the ICR, WC, and Preserve at the Ranch subdivisions.

The well field is managed so that ICR 1 is the main source of water. Well 2 serves as a backup well and is used in a manner to preserve its operational efficiency. Only one well is used on a given day and it is in service, on average for about 3 hours or less.

The aquifer tapped by the wells consists of a mixture of unconsolidated sediments consisting of a mixture of clay, silt, sand, and gravel. In places the sediment has been cemented to form a conglomerate. The base of the aquifer is formed by granitic and metamorphic rocks occurring at depth of about 223 ft. at ICR 1 and about 220 ft. at well 2. The pump intakes at ICR well 1 is 172 below land surface. Depth to the pump intake at ICR 2 is 160 feet.

The altitude of the water table varies naturally in accordance with the seasonal pattern of precipitation. At the time ICR 1 was completed the regional water table was at a depth of about 18 ft. below land surface. At ICR 2, which is slightly higher in elevation than well 1, the initial depth to water was 19 ft.

#### Monthly Well Field Demand 2008-2015

The variation in monthly demand at the ICR well field for 2008 through 2015 is shown in table 5. Minimum demand occurs in one of the winter months, December, January, or February, with lowest demand generally occurring in February. The months of June and July are predominantly the months of highest demand although this has also occurred once in August. The difference between maximum and minimum demand averages about 2.4 million gallons and has been as much as approximately 2.7 million gallons.

As presented above, annual demand at the well field over this time period has ranged from a high of 29,988,500 gallons in 2009 to a low of 24,476,500 gallons in 2010. These rates correspond to an average daily pumping rate ranging from 57 gallons per minute (gpm) to 47 gpm compared to the capacity of each of the wells in the well field of approximately 375 gpm.

Table 5, Monthly and Annual ICR Well Field Water Demand, 2008 – 2015, in gallons

Month	2008	2,009	2,010	2,011	2,012	2,013	2014	2015
Jan	1,149,845	1,216,000	1,250,000	1,237,000	1,161,000	1,418,000	1,485,000	1,433,000
Feb	903,632	1,098,700	747,300	1,172,980	1,172,000	1,006,000	1,408,000	1,238,000
March	1,152,293	1,825,300	1,438,200	1,441,000	1,423,000	1,710,000	1,771,000	1,601,000
April	2,218,695	2,628,000	1,862,000	2,088,000	2,036,000	2,480,000	2,440,000	2,299,000
May	2,401,193	3,577,500	2,577,000	2,572,000	2,973,000	3,046,000	3,019,000	2,488,000
June	2,969,079	3,195,000	3,170,000	2,981,000	<b>3,464,000</b>	<b>3,700,000</b>	<b>3,753,000</b>	<b>3,183,000</b>
July	<b>3,598,241</b>	<b>3,632,000</b>	<b>3,295,000</b>	2,889,000	3,274,000	2,985,000	3,270,000	3,013,000
August	2,926,481	3,613,000	2,552,000	<b>3,327,000</b>	2,995,000	2,817,000	2,603,000	2,820,000
Sept	2,988,095	3,070,000	3,050,000	2,674,000	2,727,000	2,172,000	2,305,000	2,636,000
Oct	2,197,015	3,044,000	1,838,000	2,234,000	2,621,000	2,304,000	2,642,000	2,161,000
Nov	2,118,432	1,892,000	1,493,000	1,389,000	1,764,000	1,495,000	1,469,000	1,375,000
Dec	1,311,022	1,197,000	1,204,000	1,121,000	1,402,000	1,242,000	1,335,000	1,422,000
<b>Total</b>	<b>25,934,023</b>	<b>29,988,500</b>	<b>24,476,500</b>	<b>25,125,980</b>	<b>27,012,000</b>	<b>26,375,000</b>	<b>27,500,000</b>	<b>25,669,000</b>

## Yield

ICR 1 was used for 938 hours during the year for an average daily use of 2.6 hours. ICR 2 was used for 192 hours for an average daily use of 0.5 hours. Average yield from ICR 1 ranged from about 375 gpm in the drier warmer months with associated higher pumpage and lower water levels to about 395 gpm in January with relatively low pumpage and higher water levels. Average yield from ICR 2 was 375 gpm.

## Water Levels

There is a long-term decline in the water level of a pumped well until water in an amount equal to the rate the well is being pumped is diverted to the well from the aquifer's discharge area. Once this occurs, the long-term decline ceases. For the two ICR wells, this diversion would be expected to take decades if not longer to occur. If water levels fall too far before stabilizing, the wells will cease to be viable. It is important therefore to measure water levels through time in order to monitor the well field's status. There is also a short term, but significant, decline in the water level at a well that is being pumped intermittently, such as those at the ICR well field. Water levels fall while the well is being pumped and subsequently rise when pumping ceases to an altitude equal to or near that existent before pumping.

For practical reasons it is best to maintain the pumping water level in the wells at about two-thirds of the original thickness of the aquifer at each well. This consideration maximizes production relative the decline in the pumping water level in the well and to pumping cost. For both wells, this suggests that the maximum depth to water should be about 152 ft.

Another consideration however is the requirement to maintain the pumping water level in a well above the pump intakes which as stated above, is 172 ft. at ICR 1 and 160 ft at ICR 2. Long-term viability of the well therefore requires a pumping level above these depths.

## ICR Well 1

Non-pumping depths to water below land surface at ICR 1 in 2015 ranged from about 48 ft. to 60 ft. and were generally 5 feet or more above 2014, figure 1. Minimum non-pumping depths of 48 ft. were recorded in March and April following flow at Mint Creek that occurred in late February-early March. Water levels of 60 ft. or less represent non-pumping conditions at the well field. Water levels lower than this, but above 70 ft. represent non-pumping conditions at ICR 1 and pumping at ICR 2, figure 2. Lower water levels represent pumping conditions at ICR 1 alone. Depth to water during pumping varied from about 100 ft. to 109 feet; well above the pump intakes.

As discussed above, the water level at ICR 1 was about 18 ft. below land surface when it was completed on August 5, 1994. The minimum non-pumping water level at the well of 48 ft. below land surface is 30 ft. lower than that originally measured at completion of the well. This decline is within that which would be considered acceptable for long-term viability of the well.

Figure 1, 2014-2015 ICR Well 1 Non-Pumping Depth to Water

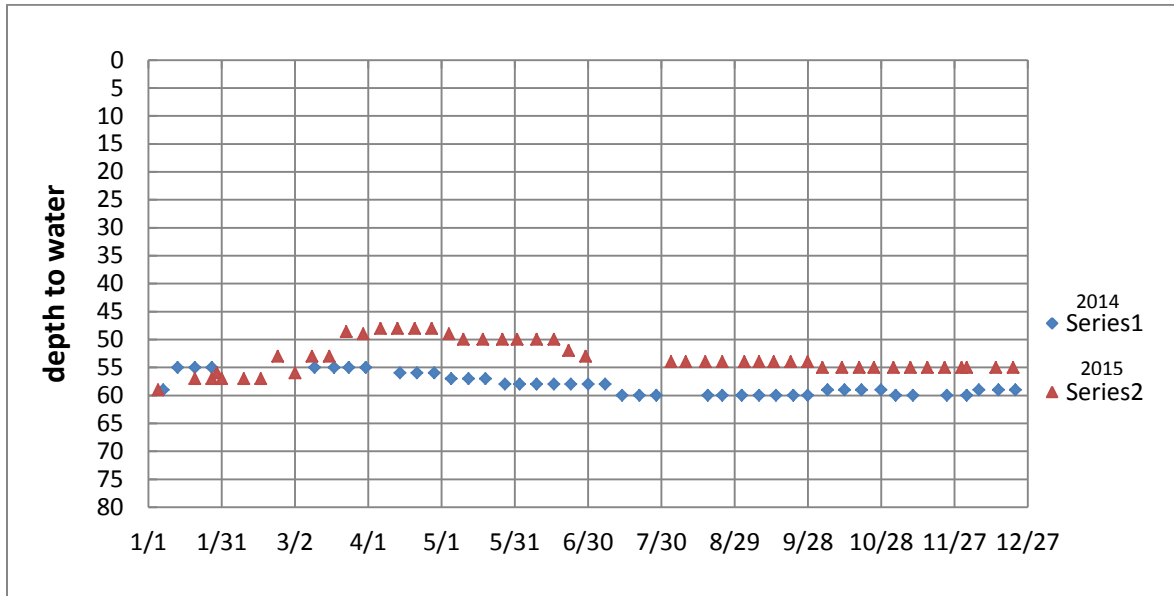
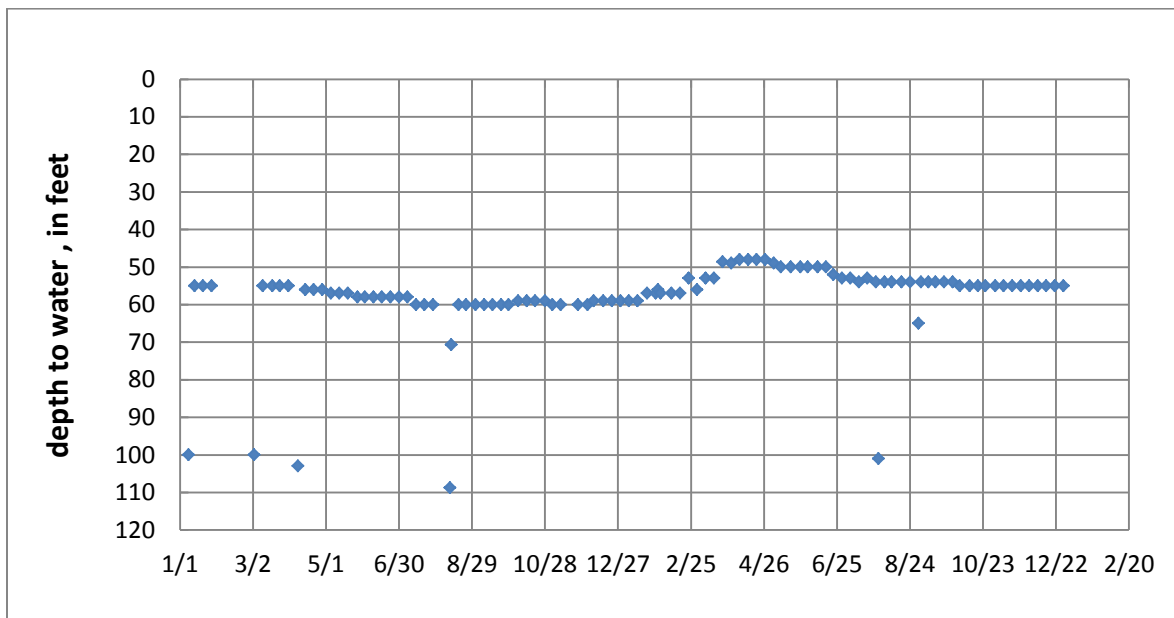


Figure 2, 2014-2015 ICR Well 1 Depth to Water





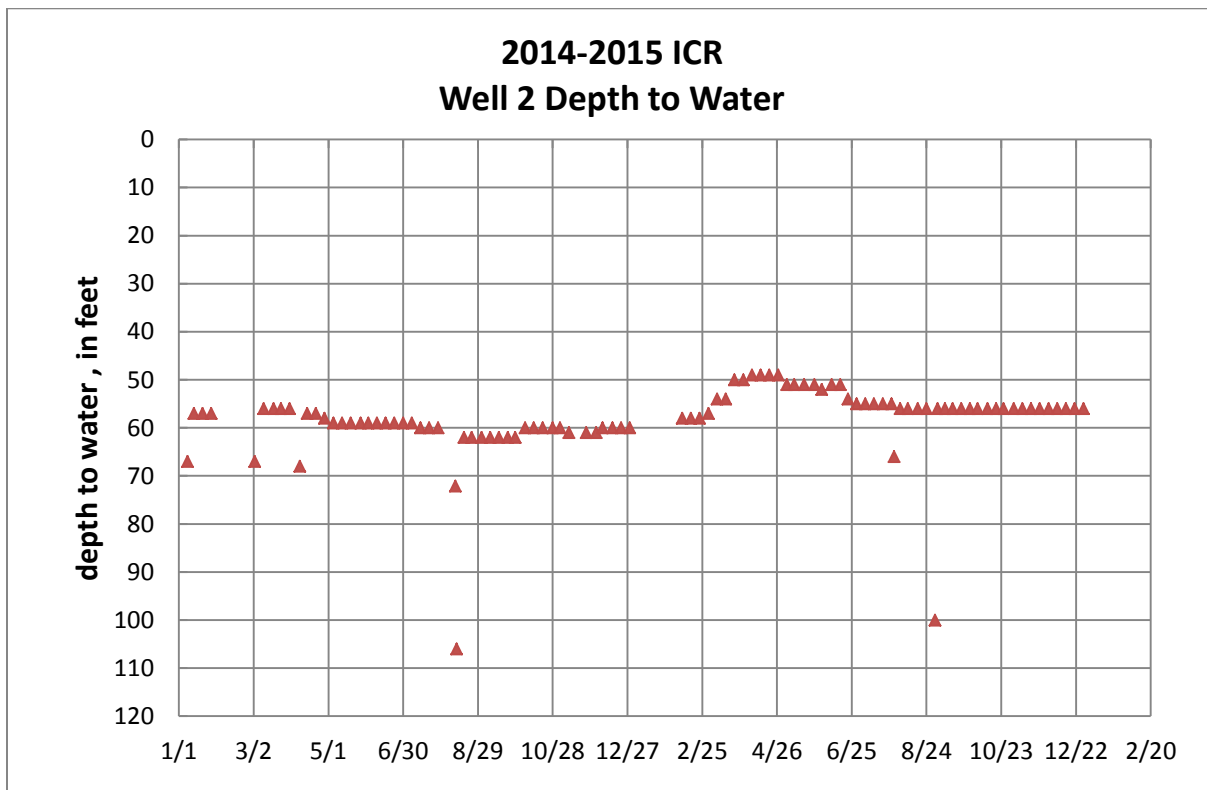
## ICR Well 2

Non-pumping depth to water below land surface at ICR 2 in 2015 ranged from about 49 ft. to 58 ft. figure 3. Water levels lower than this but above a depth of 75 feet represent non-pumping at ICR well 2 and pumping at ICR 1. Water levels of about 100 ft. or more represent pumping at the well. 2014 water levels are also shown for comparison.

As discussed above, the water level at ICR 2 was about 19 ft. below land surface when it was completed on April 10, 2002. The minimum water level at the well of 49 ft. below land surface is 30 ft. lower than that originally measured at completion of the well, the same as at ICR well 1 which would be expected. . This decline is within that which would be considered acceptable for long-term viability of the well.

As at ICR well 1, a pumping water level of 108 ft. is acceptably above the pump intakes.

Figure 3, 2014-2015 ICR Well 2 Depth to Water



## THE TALKING ROCK WELL FIELD

The Talking Rock Ranch (TRR) well field consists of three wells referred to as TRR wells TRR 1, 2, and 3. Construction of TRR 1 began on January 3, 2001 and was completed on February 5, 2001; construction of TRR 2 began on March 27, 2002 and was completed April 20, 2002; construction of TRR 3 began May 13, 2002 and was completed May 15, 2002. The wells are situated along the eastern edge of the Mint Wash floodplain immediately east of Williamson Valley road where the road crosses the wash. The well field services the Talking Rock subdivision and the TRR golf course. The well field and the land it is on are owned by the ICR Water Users Association.

The aquifer tapped by the TRR well field consist of medium to coarse sand with small amounts of intermixed gravel and layers of gravel and sand mixed with minor amounts of silt and clay. Interbedded within this material is a layer of basalt that is encountered at depths ranging from 70 ft., 108 ft., and 118 ft. below land surface at wells 1, 2, and 3 respectively. Thickness of the basalt ranges from 41 ft. to 50 ft. Geologic logs of nearby wells indicate that the areal extent of the basalt is limited and does not extend to the ICR Well Field. The base of the aquifer is formed by granitic and metamorphic rocks occurring at depths ranging from about 300 ft. below land surface at well 1, 262 ft. at well 2, and 240 ft. below land surface at well 3.

The regional water table lies in the unconsolidated sands and gravel above the basalt. In the absence of pumping, the altitude of the water table varies naturally in accordance with the seasonal pattern of precipitation. Measured depth to water at completion of drilling for each well was 20 ft., 57 ft., and 23 ft. below land surface at wells 1, 2, and 3 respectively. Wells 1 and 3 are at about the same elevation above sea level whereas well 2 is about 10 ft. higher. Subsequent non-pumping measurements at the well field have shown that depth to water at well 2 is about 8-10 ft. greater than that at wells 1 and 3. This difference is consistent with the difference in elevation of well 2 compared to wells 1 and 3. This suggests that the initial water level measurement at well 2 was not representative of non-pumping conditions at the well field.

The pumping capacity at all three wells has been downsized from that originally installed at all three wells due to initial overly optimistic estimates of the long-term yield of each well that resulted in unacceptable decline in water levels and air entrainment at all three wells. The pump at well 3 was downsized from 430 gpm to about 260 gpm in 2003 after which the well has been highly reliable. The pump at well 2 was downsized from about 530 gpm to a pump capacity of about 285 gpm in 2009. Due to an electrical problem the pump at well 2 failed in June 2013 and was replaced in July of that year. The capacity of the new pump ranges from about 275 to 290 gpm. The pump at well 1 was downsized in February 2012 and reliably yields about 330 gpm.

The well field is managed so that the wells are called up sequentially as demand increases. As a result on a given day, only one well is initially in service until demand requires an additional well. In general any two wells can meet daily demand except during the hottest and driest part of the year when the water demand for the TRR golf course is at its greatest. The general practice is to use either well 1 or 2 as the initial well on call followed by well 3.

## Demand

The variation in monthly demand at the TRR well field for 2008 through 2015 is shown in table 6. Minimum demand occurs in one of the winter months, December, January, or February. The month of June is predominantly the month of highest demand although this has also occurred in May, July and August. The difference between maximum and minimum demand averages about 14.6 million gallons and has been as much as 21.7 million gallons. The high difference between the maximum and minimum demand compared to the ICR well field reflects the summer demand of the TRR golf course. As can be seen in table 6, the maximum demand for 2011 through 2015 falls below that of 2010 and follows the construction of the golf course lake in the latter year that, in turn, has allowed storage of water during the colder months thereby reducing the maximum demand on the well field during the warmer pre-monsoon months.

As discussed above, annual demand at the well field over this time period has ranged from a high of 116,091,180 gallons in 2009 to a low of 94,270,000 gallons in 2015. These rates correspond to an average daily pumping rate ranging from about 220 gpm to 180 gpm compared to the capacity of TRR well 1, 2, and 3 equal to 332 gpm, 262 gpm, and 224 gpm respectively.

Table 6, Monthly and Annual TRR Well Field Demand 2008-2015, in gallons

Month	2008	2009	2010	2011	2,012	2013	2014	2,015
Jan	742,000	757,000	2,691,500	4,263,000	3,499,000	6,554,000	6,041,000	2,176,000
Feb	632,000	646,100	5,747,700	805,000	3,750,000	1,130,000	4,805,000	3,078,000
March	9,014,000	8,612,900	7,192,600	4,708,000	5,363,000	6,648,000	8,162,000	4,349,000
April	13,882,000	9,276,000	13,290,000	10,180,000	9,641,000	12,076,000	12,214,000	12,537,000
May	14,003,400	13,927,000	<b>14,925,000</b>	11,283,000	12,560,000	14,674,000	14,255,000	11,789,000
June	<b>22,215,500</b>	16,132,000	11,287,000	<b>16,018,000</b>	14,342,000	<b>15,433,000</b>	<b>15,584,000</b>	<b>13,142,000</b>
July	11,399,300	13,348,500	14,144,000	14,087,000	<b>17,613,000</b>	10,726,000	13,072,000	11,093,000
August	14,365,700	<b>17,862,200</b>	9,511,000	15,325,000	11,203,000	12,199,000	6,243,000	10,572,000
Sept	12,779,500	12,409,300	13,306,000	12,985,000	7,540,000	7,447,000	7,133,000	8,922,000
Oct	10,735,000	9,106,000	10,756,000	7,266,000	6,860,000	10,927,000	7,138,000	10,264,000
Nov	4,770,900	5,646,500	7,612,000	6,734,000	7,525,000	6,679,000	6,809,000	4,513,000
Dec	512,000	499,000	5,629,000	3,004,000	4,717,000	3,027,000	5,577,000	1,835,000
<b>Total</b>	<b>115,051,300</b>	<b>108,222,500</b>	<b>116,091,800</b>	<b>106,658,000</b>	<b>104,613,000</b>	<b>107,520,000</b>	<b>107,033,000</b>	<b>94,270,000</b>

Total pumpage at wells 1, 2, and 3 for 2015 were 23,576,000 gallons, 42,183,000 gallons, and 28,511,000 gallons respectively, table 7. Columns 2, 3, and 4, table 7, show monthly pumpage in gallons from TRR wells 1, 2, and 3 respectively; Column 5 shows total monthly pumpage from all three wells in gallons. Column 6 shows average daily pumpage in gallons per day, and column 7 shows average demand at the well field during the month in gallons per minute. The latter demand ranged from 41 gpm in December to 304 gpm in June.

Monthly demand on the well field in 2015 increased from about 2,176,000 gallons in January to about 4,349,000 gallons in March, 12,537,000 gallons in April, and 13,142,000 gallons in June when pumpage

peaked. Demand slowly decreased from this level falling to about 1,835,000 gallons in December, table 6 and 7.

Table 7, 2015 Monthly, Annual, and average Daily TRR Well Field Pumpage, in gallons

1	2	3	4	5	6	7
Month	TRR 1	TRR 2	TRR 3	Total	Daily	GPM
Jan	1,926,000	0	250,000	2,176,000	70,194	49
Feb	2,615,000	0	463,000	3,078,000	109,929	76
March	3,627,000	0	722,000	4,349,000	140,290	97
April	9,750,000	328,000	2,459,000	12,537,000	417,900	290
May	37,000	7,852,000	3,900,000	11,789,000	380,290	264
June	288,000	8,280,000	4,574,000	13,142,000	438,067	304
July	161,000	6,928,000	4,004,000	11,093,000	357,839	248
Aug	100,000	6,781,000	3,691,000	10,572,000	341,032	237
Sept	0	5,758,000	3,164,000	8,922,000	297,400	207
Oct	358,000	6,166,000	3,740,000	10,264,000	331,097	230
Nov	3,249,000	83,000	1,181,000	4,513,000	150,433	104
Dec	1,465,000	7,000	363,000	1,835,000	59,194	41
<b>Total</b>	<b>23,576,000</b>	<b>42,183,000</b>	<b>28,511,000</b>	<b>94,270,000</b>	<b>258,274</b>	<b>179</b>

#### Golf Course Demand

Monthly and annual golf course demand for the years 2008 through 2015 based on monthly billing records that, as discussed above are not calendar based, is shown in table 8. Three things are evident in the record. First, overall demand has decreased since 2010; second, the month of highest demand occurs during May through September; and third, the monthly variability in demand for a given year has been reduced since construction of the golf course lake in 2010.

Table 8, Golf Course Demand 2008 - 2015

Month	2008	2009	2010	2011	2012	2013	2014	2015
Jan	0	0	0	4,312,700	-	4,929,000	2,688,000	3,723,000
Feb	0	0	5,616,200	482,200	-	3,556,000	4,699,000	1,898,000
March	3,879,000	3,528,000	4,837,400	1,486,700	8,189,200	2,003,000	5,357,000	1,105,000
April	13,233,000	9,577,000	10,869,400	7,055,200	8,257,100	9,493,000	9,807,000	9,365,000
May	12,702,000	15,675,000	<b>15,396,500</b>	10,554,300	9,960,800	12,514,000	11,308,000	<b>10,529,000</b>
June	<b>16,814,000</b>	9,792,000	10,334,000	12,351,600	12,326,900	11,811,000	<b>14,345,000</b>	10,455,000
July	12,746,000	12,864,000	10,606,200	13,912,700	<b>15,509,500</b>	<b>15,103,000</b>	12,191,000	10,151,000
Aug	13,189,000	<b>13,084,000</b>	12,770,700	13,736,300	14,468,400	8,278,000	8,589,000	8,758,000
Sept	13,219,000	10,981,000	9,405,600	<b>14,799,800</b>	7,081,600	7,893,000	4,436,000	8,191,000
Oct	9,355,000	12,040,000	12,503,400	8,676,700	5,770,200	7,585,000	5,084,000	8,338,000
Nov	6,432,000	4,836,000	9,478,800	6,623,100	7,105,500	8,211,000	6,816,000	7,090,000
Dec	615,000	1,515,000	5,428,600	8,189,200	6,005,800	4,762,000	4,969,000	2,338,000
<b>Total</b>	<b>102,184,000</b>	<b>93,892,000</b>	<b>107,248,810</b>	<b>102,180,500</b>	<b>94,675,000</b>	<b>96,138,000</b>	<b>90,289,000</b>	<b>81,941,000</b>

## Yield

In general the TRR well field is operated with only two wells pumping during a given day. As discussed above, either well 1 or well 2 serves as the primary well on call while well 3 is used to provide additional water if required. The third well comes on line during periods when the primary well and well 3 cannot meet the immediate demand while maintaining the desired water level in the storage tanks.

Well 1 was primary in January through April and in November and December. Well 2 was primary from May through October. Well 3 was the primary back-up well through the year.

Yield from the well field varies with the water level at the well field, with yield falling during the summer as water levels decline. The decline in water level is relatively small and therefore the range in yield is also relatively small. Yield of well 1 averaged about 332 gpm with little variation during the year. Yields of wells 2 and 3 averaged about 262 gpm and 224 gpm respectively, also with little variation.

## Water Levels

As discussed, the pumping water level in the wells should be limited to about two-thirds of the original thickness of the aquifer to maximize production relative the pumping water level in the well and to pumping cost. Under this consideration, the maximum depth to water at well 1 should be about 185 ft. For well 2 the maximum depth should be about 155 ft. and about 145 ft. at well 3. An additional consideration however, is that in order to limit problems with air entrainment at wells 1 and 2, the pumping level in well 1 should not be more than about 165 ft. below land surface and the pumping water level in well 2 should be no more than about 155 ft. below land surface.

The pump intakes at TRR wells 1 and 2 are set at approximately 262 ft. below land surface. Maintaining a pumping level of 165 ft. or less at well 1, although not maximizing production relative to pumping cost, assures at least 97 ft. of water above the pump intakes. Maintaining a pumping level of 155 ft. or less at well 2 assures at least 107 ft. of water above the intakes and also meets the two-thirds rule. The pump intake at well 3 is set at approximately 230 ft. below land surface. Maintaining a pumping level of 145 ft. assures at least 85 ft. of water above the intakes.

## TRR Well 1

Depth to water below land surface at TRR 1 in 2015 ranged from about 41 ft. to 110 ft., 6 to 8 feet above 2014 respectively, figure 4. Water levels in figure 4 that are less than 80 ft. below land surface represent non-pumping conditions at the well, but not necessarily at one or both of the other wells. Water levels deeper than about 80 ft. represent pumping conditions at well 1.

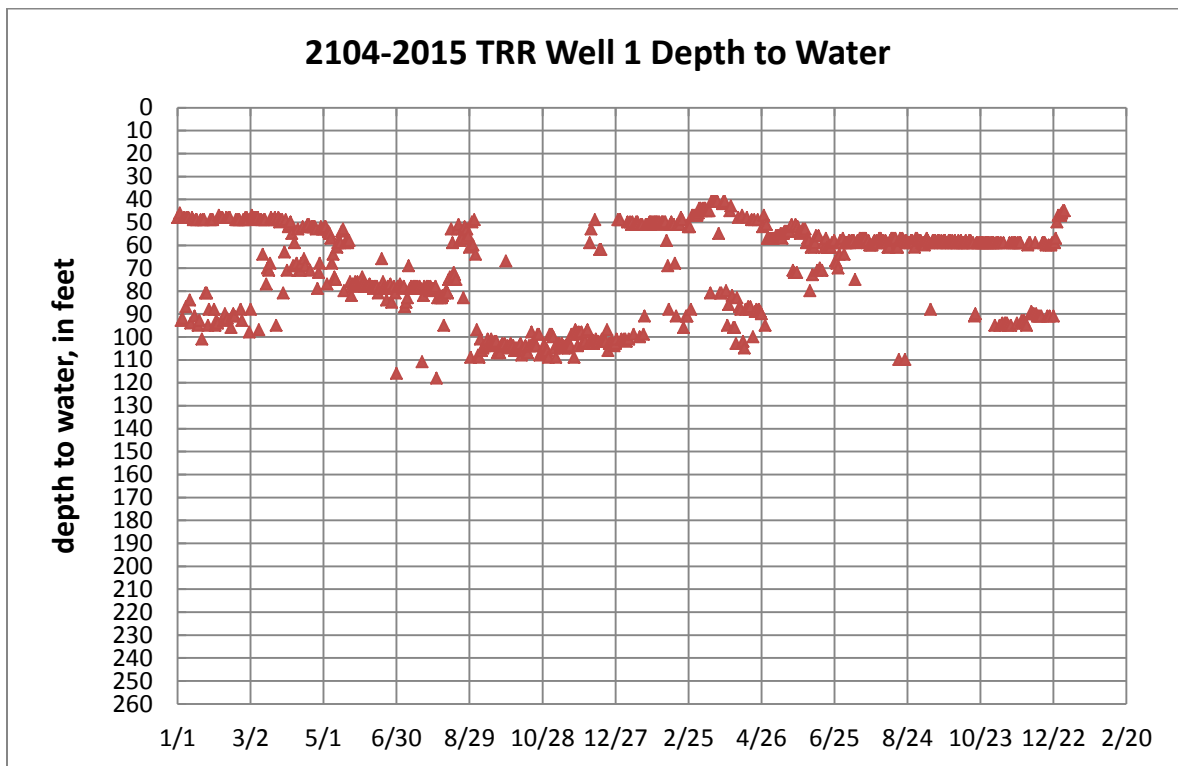
Non-pumping water levels at the well varied throughout the year, being deeper in the summer months when well field use was greatest. Non-pumping water levels varied from about 41 feet below land

surface in March to about 80 feet in June. Non-pumping water levels rose to about 45 feet below land surface by the end of the year (4 ft. above 2014) when pumping at the well field was relatively low. 2014 and 2015 water levels at the well are shown in figure 4.

Pumping water levels in 2015 ranged from about 80 feet to 110 feet below land surface. This range is about 5 to 8 feet higher than that of 2014. These depths are considerably above 165 feet below land surface required to preclude air entrapment. The intakes for the pump at TRR well 1 are at a depth of 255 feet, so that at its deepest point during the year, pumping water levels were about 145 feet above the intakes.

As discussed above, the water level at TRR well 1 was about 20 ft. below land surface when it was completed on February 5, 2001. The minimum non-pumping water level of 41 ft. below land surface in 2015 represents a decline of about 21 ft. since 2001 which is not considered to be excessive. Given this, and the fact that maximum pumping water levels remained 145 feet above the pump intakes, there is no concern regarding the long-term viability of the well.

Figure 4

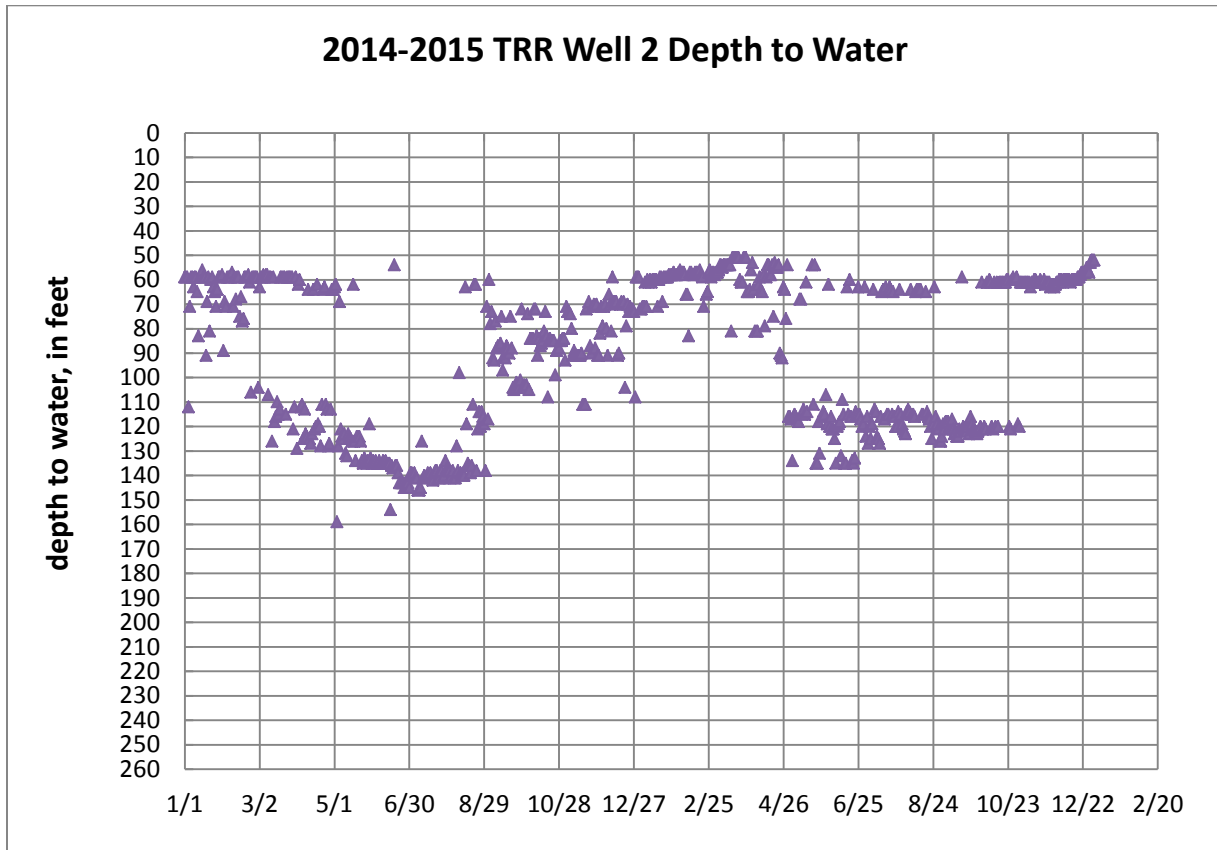


## TRR Well 2

Depth to water below land surface at TRR 2 in 2015 ranged from about 51 feet to about 135 feet at its deepest level, some 3 to 14 feet above 2014 respectively, figure 5. Water levels in figure 5 that are less than 90 feet below land surface represent non-pumping conditions at the well, but not necessarily at one or both of the other wells. Water levels deeper than 90 feet represent pumping conditions at the well. The maximum pumping depth to water of 135 feet is 20 feet above that required for practical reasons and for problems associated with air entrainment and places the pumping water 120 feet above the pump intakes. Non-pumping water levels recovered to about 52 feet below land surface at the end of the year. 2014 and 2015 water levels at the well are shown in figure 5.

As discussed above, the water level at TRR well 2 was about 57 ft. below land surface when it was completed on April 20, 2002. The minimum water level of 51 ft. below land surface in 2013 is about 6 ft. higher than that originally measured at completion of the well.

Figure 5



### TRR Well 3

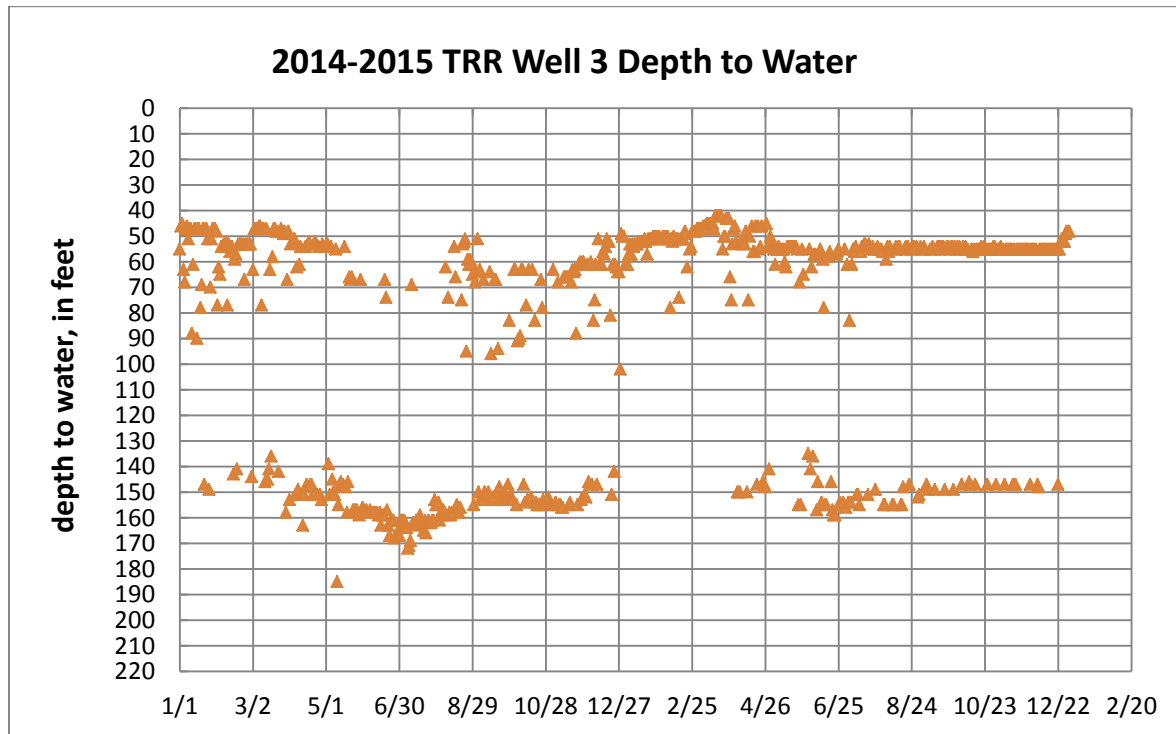
Depth to water below land surface at TRR 3 in 2015 ranged from about 42 feet to 157 feet, some 4 to 28 feet above 2014 respectively, figure 6. The pumping water level varied from about 135 feet below land to 157 feet and averaged about 145 feet below land surface. 2014 and 2015 water levels are shown in figure 6.

Non-pumping water levels ranged from about 42 feet below land surface in March to about 83 feet in July. The average non-pumping water level was about 55 feet below land surface, approximately 5 feet higher than 2014. Water levels in figure 6 greater than about 70 feet but less than 110 feet represent non-pumping conditions at well 3 but pumping conditions at well 1 or 2.

The maximum depth to water of about 157 feet is about 12 feet lower than that required for efficiency reasons although it provides 73 feet of water above the pump intakes. The average pumping depth to water of about 145 feet is equal to that required for practical reasons and provides about 85 feet of water above the pump intakes; both of which are acceptable.

The minimum non-pumping water level of 42 ft. below land surface in 2014 represents a decline of about 19 ft. since the well's completion. As in the case of well 1, this decline is not considered to be excessive. Given this, and the fact that pumping water level remained about 85 feet above the pump intakes, there is no concern regarding the long-term viability of the well.

Figure 6





## SUMMARY

The ICR Water Users Association (ICRWUA) is a private non-profit water company that provides water to the Inscription Canyon Ranch, Whispering Canyons, Preserve at the Ranch and Talking Rock subdivisions. The company also provides water to the Talking Rock golf course. Water for the first three subdivisions comes from the ICR well field while water for the Talking Rock subdivision and golf course comes from the TRR well field. The combined demand for all uses from both well fields for 2015 was 119,939,000 gallons. Of this amount 25,669,000 gallons came from the ICR well field and another 94,270,000 gallons came from the TRR well field. The golf course use was approximately 81,941,000 gallons, or about 87 percent of the total pumpage from the TRR well field and 68 percent of the combined pumpage from both well fields.

There is a long-term decline in the water level of a pumped well until water in an amount equal to the rate the well is being pumped is diverted to the well from the aquifer's discharge area. Once this occurs, the long-term decline ceases. For the wells in the ICR and TRR well fields this diversion would be expected to take decades if not longer to occur. If water levels fall too far before stabilizing, the wells will cease to be viable. It is important therefore to measure water levels through time in order to monitor the well field's status. There is also a short term, but significant, decline in the water level at a well that is being pumped intermittently, such as at the two well fields. Water levels fall while the well is being pumped and subsequently rise to an altitude equal to or near that existent before pumping. The long-term decline at both well fields that began with the initiation of pumpage is about 30 feet at the ICR well field and 20 feet at the TRR well field. Respectively, these depths are 7 to 3 feet higher than those in 2014. Both declines are within acceptable limits for long-term viability of the wells. Pumping water levels are also within the range of values necessary for long-term viability

There are two wells in the Inscription Canyon Ranch (ICR) well field about 47 feet apart; ICR 1 and ICR 2. The ICR well field is operated with only one well pumping during a given day. ICR 1 was used for 938 hours during the year for an average daily use of about 2.6 hours. ICR 2 was used for 192 hours for an average daily use of 0.5 hours. Average yield from ICR 1 ranged from about 375 gpm in the drier warmer months with associated higher pumpage and lower water levels to about 395 gpm in January with relatively low pumpage and higher water levels. Average yield from ICR 2 was 375 gpm.

Overall non-pumping water levels decline at the ICR well field Water since construction of the wells has been 30 feet which is not considered to be excessive and there is no concern regarding the long-term viability of the well field.

Non-pumping depths to water below land surface at ICR 1 in 2015 ranged from about 48 ft. to 60 ft. and were generally 5 feet or more above 2014. Minimum non-pumping depths of 48 ft. were recorded in March and April following flow at Mint Creek that occurred in late February-early March. Depth to water during pumping varied from about 100 ft. to 109 feet placing the water level from 72 to 63 feet above the pump intakes which is acceptable.

Non-pumping depth to water below land surface at ICR 2 in 2015 ranged from about 49 ft. to 58 ft. The pumping water level at the well of 108 ft. is 52 feet above the pump intakes which is an acceptable condition.

The Talking Rock Ranch (TRR) well field consists of three wells referred to as TRR wells TRR 1, 2, and 3. The well field is managed so that the wells are called up sequentially as demand increases. As a result on a given day, only one well is initially in service until demand requires an additional well. In general any two wells can meet daily demand except during the hottest and driest part of the year when the water demand for the TRR golf course is at its greatest. The general practice is to use either well 1 or 2 as the initial well on call followed by well 3.

Overall non-pumping water levels decline at the TRR Water level declines since construction of the wells in 2001 and 2002 has been 19-21 feet is not considered to be excessive and there is no concern regarding the long-term viability of the well field.

Depth to water below land surface at TRR 1 in 2015 ranged from about 41 ft. to 110 ft., 6 to 8 feet above 2014 respectively. Pumping water levels in 2015 ranged from about 80 feet to 110 feet below land surface. This range is about 5 to 8 feet less than that of 2014. These depths are considerably above 165 feet below land surface that is required to preclude air entrapment. The intakes for the pump at TRR well 1 are at a depth of 255 feet, so that at its deepest point during the year, pumping water levels were about 145 feet above the intakes.

Depth to water below land surface at TRR 2 in 2015 ranged from about 51 feet to about 135 feet at its deepest level, some 3 to 14 feet above 2014 respectively, figure 5. The maximum pumping depth to water of 135 feet is 20 feet above that required for practical reasons and for problems associated with air entrainment and places the pumping water 120 feet above the pump intakes.

Depth to water below land surface at TRR 3 in 2015 ranged from about 42 feet to 157 feet, some 4 to 28 feet above 2014 respectively. Non-pumping water levels ranged from about 42 feet below land surface in March to about 83 feet in July. The average non-pumping water level was about 55 feet below land surface, approximately 5 feet higher than 2014. The average pumping depth to water of about 145 feet is equal to that required for practical reasons and provides about 85 feet of water above the pump intakes.