

Well W247 Replacement (W247R)

Laws Wellfield, Owens Valley

Pre-Construction Evaluation Report

Eastern Sierra Environmental Group

Water Operations Division

Los Angeles Department of Water and Power

May 2024

1. PURPOSE

The City of Los Angeles Department of Water and Power (LADWP) plans to drill and construct a well to replace the existing well W247 located in Laws Wellfield, primarily to supply water to irrigate a pasture area west of Highway 6. This report's purpose is to satisfy Section IV.B of the Greenbook (the Technical Appendix to the Water Agreement), Guidelines for Drilling and Activating New Production Wells.

2. BACKGROUND

2.1 Introduction

LADWP plans to replace production well W247 in Laws Wellfield using the current industry standards for well construction and improve LADWP's operational flexibility in managing water resources in Owens Valley. According to Section VI(g) of the Water Agreement, "LADWP may replace existing wells and construct new wells in areas where hydrogeologic conditions are favorable".

Well W247 was constructed in 1928 to a depth of 495 feet below ground surface (bgs) to supply water for in-valley uses and the Los Angeles Aqueduct. The well casing is perforated from 28 to 470 feet-bgs.

According to Section VI of the Inyo/LA Long-Term Water Agreement (Water Agreement),

The Department's current groundwater pumping capacity may be increased to provide increased operational flexibility and to facilitate rotational pumping. The Department may replace existing wells and construct new wells in areas where hydrogeologic conditions are favorable, and where the operation of that well will not cause a change in vegetation that would be inconsistent with these goals and principles.

According to the 1991 EIR, the capacity of W247 is 5.3 cfs, which has been unchanged as of recent operation in the summer of 2020. In recent years, W247 has been used primarily to supply water to the McNally Pasture Enhancement/Mitigation Project in the summer months if the vegetation monitoring Site L1 is in ON status. When monitoring

site L1 is in OFF status and Lower McNally Canal is not operating, there is no water source for the McNally Pasture Project.

2.2 Geographic Setting

Laws Wellfield is located in the northern Owens Valley and is north and east of the city of Bishop. The main hydrologic features in the Laws area are Fish Slough and the McNally Canals. The latter of these can convey pumped groundwater to the Owens River and supply water from Owens River to irrigated lands owned by LADWP and leased to ranchers as well as spreading areas. **Figure 1** shows the location of the existing W247 and the proposed location of the replacement well W247R. Similar to the existing W247, the replacement well will discharge water to the Lower McNally Canal.

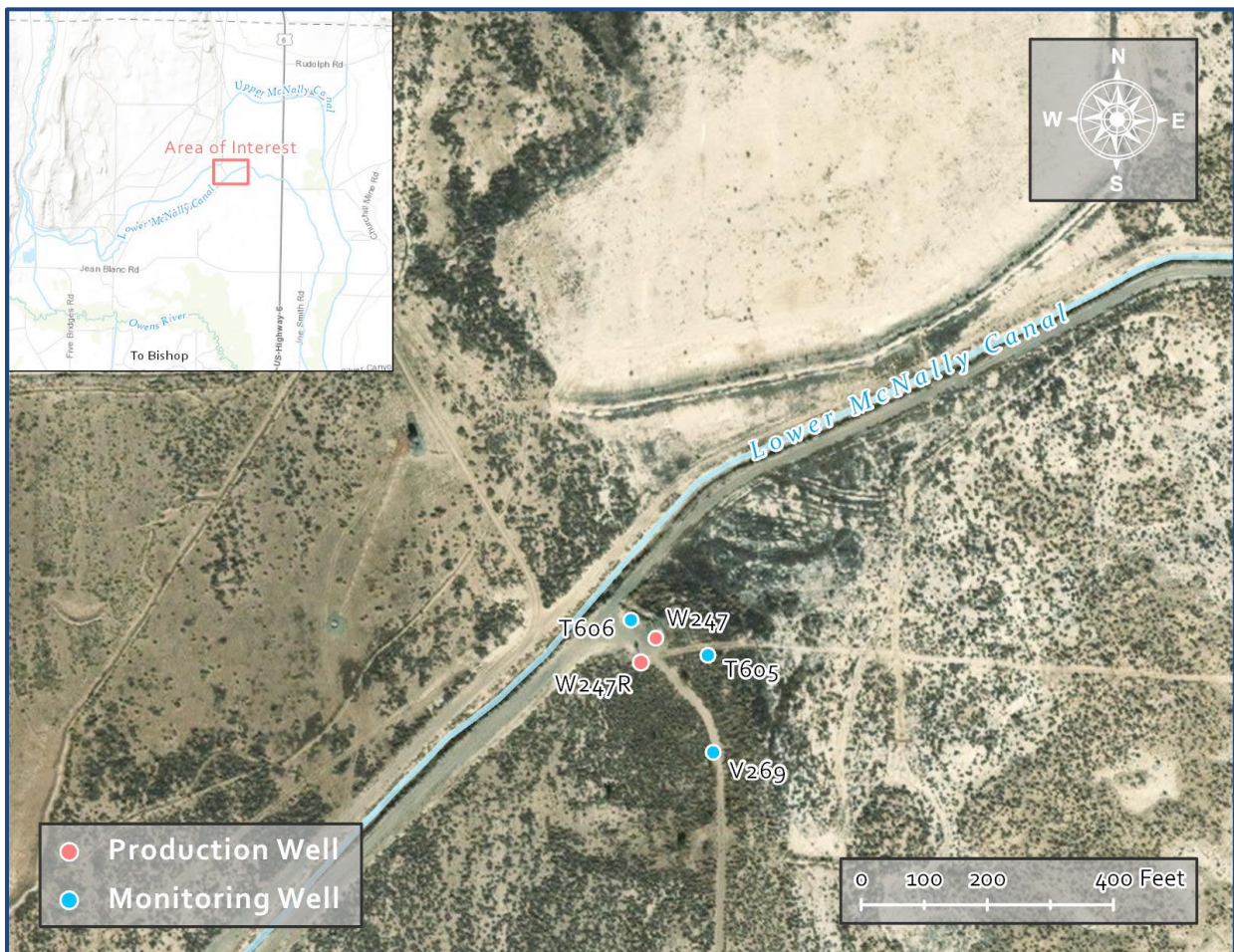


Figure 1– Locations of existing well W247 and replacement W247R in Laws Wellfield

3. HYDROGEOLOGIC CONDITIONS

3.1 Geology

The conceptual geological framework of the Owens Valley is presented in a 1991 U.S. Geological Survey (USGS) report "Geology and Water Resources of Owens Valley, California" (Hollett, et. al., 1991). Owens Valley is a structural graben filled by debris eroded from the White and Inyo Mountains to the east and the Sierra Nevada mountain range to the west. Laws Wellfield is located at the base of the Eastern Sierra Nevada mountains, within the Volcanic Tablelands, and north and east of Bishop Wellfield. The lithology of the sediments underlying Laws Wellfield is a combination of alluvial deposits originating from the Eastern Sierra Nevada, volcanic eruptions that resulted in the Bishop Tuff formation, and fluvial/lacustrine deposits stemming from the ancestral Owens River and associated lake environment in the Bishop Basin.

3.2 Hydrology

3.2.1 Groundwater

Groundwater in Laws Wellfield resides mainly in the alluvial and valley fill that consists of debris flows and fluvial material originating from mountain canyons. Groundwater in Laws Wellfield generally flows to the south from the recharge areas north, east, and west of the wellfield. The McNally Canals are a primary source of recharge for Laws Wellfield. This wellfield receives low recharge (median of 11,000 AF over the last two decades) compared with other wellfields because of its distance from the Sierra mountain front, except when the McNally Canals are operated in wet and very wet years.

A review of the driller's logs for existing wells in Laws Wellfield and previous studies indicates the existence of shallow and deep aquifer zones separated by lower permeability materials. MWH (2005) summarized several stratigraphic trends as listed below:

- Volcanic tuff tends to thin toward the south and east.

- Relatively thick clay units appear to underlie the central portion of Laws Wellfield between approximately 3,200 and 3,600 feet above mean sea level (amsl).
- Above 3,600 feet amsl, sand and gravel deposits are predominant with interbeds of lenticular clay layers.
- Clay deposits tend to be thickest in the lowest-lying areas. These low-lying areas may be related to the presence of alkaline lakes as hypothesized by Hollett et. al. (1991).
- The Volcanic Tablelands to the north of Laws Wellfield consist mainly of the welded tuff member of Bishop Tuff. Gilbert (1938) describes Bishop Tuff as pumice and welded ash that originated from the Long Valley Caldera eruption.

Hydrogeologic characteristics of the area's aquifers were estimated in previous studies using data from pumping tests conducted on existing wells. The calculated transmissivities ranged from 1,200 to 120,000 ft²/day. Lower transmissivities are found in lacustrine deposits near the valley center (MWH, 2005). Hollett et. al, (1991) estimated that the vertical hydraulic conductivity of the confining clays in the valley ranges from 0.002 to 0.00083 ft/day.

Currently, LADWP has 15 active production wells in Laws Wellfield. Table 1 lists the total annual pumping volume from five wells within a 1-mile radius of W247 since the 1971 runoff year (ROY). Annual pumping volumes from all 15 production wells and wells that have been replaced since the 1971 ROY are presented in Table A of the Appendix. As shown in **Table 1**, total groundwater pumping in Laws Wellfield has ranged generally between 1 and 10 thousand acre-feet per year since 1991, when the Water Agreement was implemented. In addition to LADWP wells shown in **Figure 2**, there are several relatively shallow private and community domestic supply wells in Laws Wellfield, but none in the vicinity of W247. In recent years, LADWP has replaced well W365 with well W424 and well W243 with well W426.



Figure 2 – Production wells in Laws Wellfield

Table 1 – Groundwater pumping from wells in the vicinity of W247, west of Hwy 6 and total Laws Wellfield Pumping (AF/year)

Runoff Year	W246	W247	W248	W249	W398	Total Wellfield*
1971	1,219	560	1,855	1,124		No Data
1972	2,086	2,901	3,183	3,033		No Data
1973	1,061	1,644	1,516	1,619		No Data
1974	0	0	0	0		4,990
1975	1	125	99	83		11,202
1976	0	0	0	0		16,285
1977	5	1	1	3		15,038
1978	0	0	0	0		945
1979	682	1,609	1,220	1,116		17,933
1980	0	10	0	0		1,251
1981	1,467	3,169	2,680	2,382		25,313
1982	21	48	45	41		1,388
1983	0	2	0	0		1,113
1984	0	0	0	128		7,403
1985	364	947	710	852		17,369
1986	372	1,455	731	654		8,600
1987	1,742	3,009	3,422	3,012		38,241
1988	1,639	3,262	2,962	2,611		38,841
1989	1,288	3,062	2,604	2,521		34,757
1990	0	578	2	0		16,929
1991	0	385	0	1		10,940
1992		359	0	0	0	10,560
1993		1,760	1,585	1,334	0	12,560
1994		1,818	1,675	1,368	1,008	16,410
1995		581	1,638	1,282	136	8,244
1996		535	799	0	0	11,187

Runoff Year	W246	W247	W248	W249	W398	Total Wellfield*
1997		538	0	0	0	2,951
1998		426	0	0	0	483
1999		382	0	0	0	1,674
2000		318	0	0	0	3,975
2001		438	0	0	0	2,298
2002		404	0	0	0	4,395
2003		329	0	0	0	5,245
2004		281	0	0	0	7,202
2005		464	0	0	0	3,909
2006		0	513	736	0	4,507
2007		451	0	0	0	6,288
2008		787	0	0	0	7,883
2009		745	0	0	0	6,226
2010		0	0	0	0	6,431
2011		0	0	0	0	10,158
2012		0	0	0	0	6,616
2013		0	0	0	0	6,108
2014		0	0	0	0	6,292
2015		0	0	0	0	5,742
2016		0	0	0	0	6,017
2017		0	0	0	0	2,283
2018		953	980	1,030	0	12,184
2019		0	233	1,241	0	5,878
2020		942	19	1,077	0	9,650
2021		1,186	937	844	0	8,979
2022		783	324	386	0	7,901
1993-2022 Average	Offline	471	290	310	38	6,656

Gray cell indicates well was either offline or not yet constructed

*Includes domestic supply and enhancement/mitigation pumping

3.2.2 Surface Water

The main water features in Laws Wellfield include Owens River, McNally Canals, and Fish Slough, which recharge the groundwater aquifer. Owens River, which flows from the northwest to the southeast of the wellfield, is considered the southern and the western boundary of the wellfield. The weather station at LADWP's Bishop Yard is the closest station to Laws Wellfield with long-term average precipitation (from 1971 to 2022 hydro years, October to September) of 6.0 inches per year, slightly higher than the average precipitation of 5.8 inches per year in Owens Valley.

Table 2 lists the major surface water flow gauges and their associated flows in Laws Wellfield. The locations of the flow gauges are presented in **Figure 3**. In general, Laws Wellfield receives a low volume of recharge water in its creeks and ditches. It should be noted that LADWP operates McNally Canals to spread water in Laws Wellfield based on operational needs, typically in wet and very wet years.

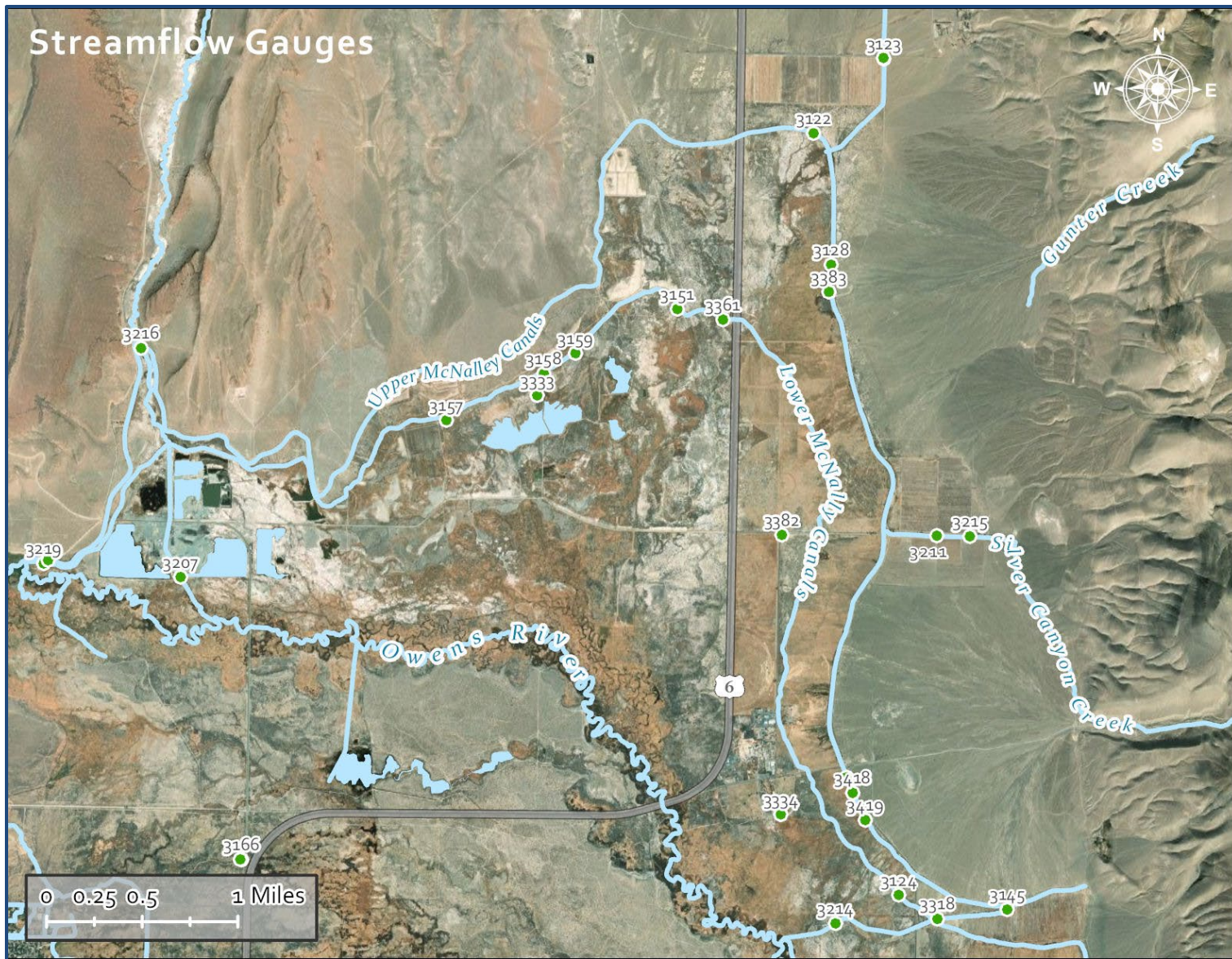


Figure 3 – Streamflow gauges in Laws Wellfield

Table 2 – Flow measurements in main Laws area measuring stations

Station ID	Station Name	Volume [AF/year] 1992-2021 ROY Average
3207	Fish Slough <i>At Owens River</i>	3,219
3216	Fish Slough <i>At L.A. Station #2</i>	3,742
3124	Lower McNally Canal <i>Return #5</i>	1,178
3157	Lower McNally Canal <i>Div. #5</i>	411
3158	Lower McNally Canal <i>Div. #7</i>	441
3159	Lower McNally Canal <i>Div. #8</i>	510
3151	Lower McNally Canal <i>Div. #12</i>	493
3219	Lower McNally Canal <i>At O.V.P.A. Station</i>	3,544
3361	Lower McNally Canal <i>Div. #13</i>	32
3122	Upper McNally Canal <i>Above W245</i>	2,862
3149	Upper McNally Canal <i>Div. #9</i>	61
3218	Upper McNally Canal <i>At O.V.P.A. Station</i>	4,866
3418	Upper McNally Canal <i>Div. #9A</i>	641
3419	Upper McNally Canal <i>Div. #9B</i>	440
3123	Coldwater Canyon Creek <i>Sprinkler Diversion</i>	126
3212	Coldwater Canyon Creek <i>At End of Pipeline</i>	396
3130	Silver Canyon Creek <i>Revegetation Pump Plant</i>	158
3211	Silver Canyon Creek <i>At Base of Mountains Station #2</i>	985
3215	Silver Canyon Creek <i>Above W365</i>	400
3383	W245 <i>Irrigation Div. E&M</i>	35
3128	W387 <i>Irrigation Div. E&M</i>	77
3145	Laws Ditch <i>Below Upper McNally Canal</i>	1,832
3318	Laws Ditch <i>Div. to Lower McNally Canal</i>	999
3382	Laws Pilot System	1,310
3430	Laws Pilot 94 & 95	25

4 ENVIRONMENTAL RESOURCES

4.1 Vegetation in the Vicinity of the Replacement Well

Vegetation parcels in the Laws area were inventoried from 1987 and later classified according to the Water Agreement based on water use with designations of Type A to Type E. Vegetation parcels in the vicinity of W247 are presented in **Figure 4**. According to the Green Book, Section II.A.2, "parcel boundary lines were transferred to orthophoto quadrangles at 1:24,000 scale. The final maps overlay the USGS 7.5-minute quads."

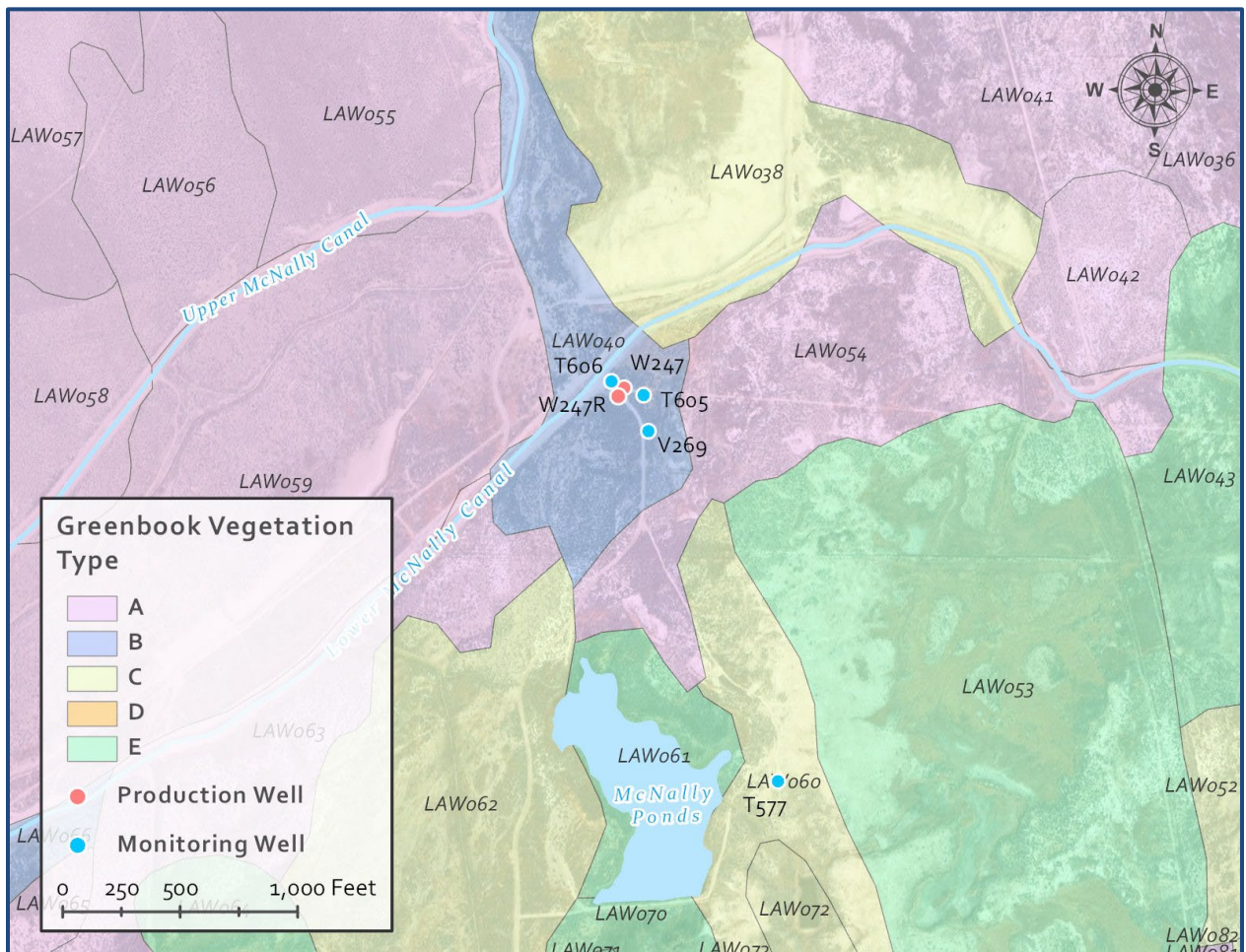


Figure 4 – Vegetation parcel in Laws Wellfield in the vicinity of W247

4.2 Springs, Seeps, Flowing Wells

Although parts of the deep semi-confined aquifer are under an artesian condition, there are no flowing (artesian) wells in Laws Wellfield. A number of flowing wells exist adjacent to Owens River, but because they are located just west of Owens River, they are considered in Bishop Cone. The closest flowing well west of Owens River is approximately 4 miles south of the proposed location of W247R and is not expected to be affected by the operation of this replacement well. No springs or seeps are in the Laws Wellfield. Seep DWP29, located on the hills southeast of Laws Wellfield, is completely disconnected from the groundwater system and is fed by runoff from the western flanks of the White Mountains.

4.3 Non-LADWP wells

As listed in **Table 3**, there are five known non-LADWP wells in the Laws Wellfield. Three are located in developments east of Highway 6, one southeast near Laws Museum, and one adjacent to Fish Slough Road. Information on non-LADWP wells is based on available data from the California State Department of Water Resources (DWR), and their locations are presented in **Figure 5**. These wells primarily supply water for domestic purposes. Based on the available data, there are no non-LADWP wells within a 2.5-mile distance from W247R, which should minimize any potential impact on non-LADWP wells from operating replacement Well W247R.

Table 1 – Non-LADWP Wells in Laws Wellfield

Latitude	Longitude	Total Depth (ft)	Top Screen (ft. bgs)	Bottom Screen (ft. bgs)	Diameter (in.)	Casing Material	Install Date
37.45761721	-118.3299184	530	245	530	6	PVC	5/17/1990
37.45669755	-118.328254	100	60	100	6	PVC	5/8/1990
37.46004265	-118.3267487	200	140	200	6	PVC	10/29/2004
37.40371738	-118.3457607	246	150	246	8	unknown	12/19/1986
37.42683815	-118.408747	160	unknown	unknown	unknown	unknown	unknown

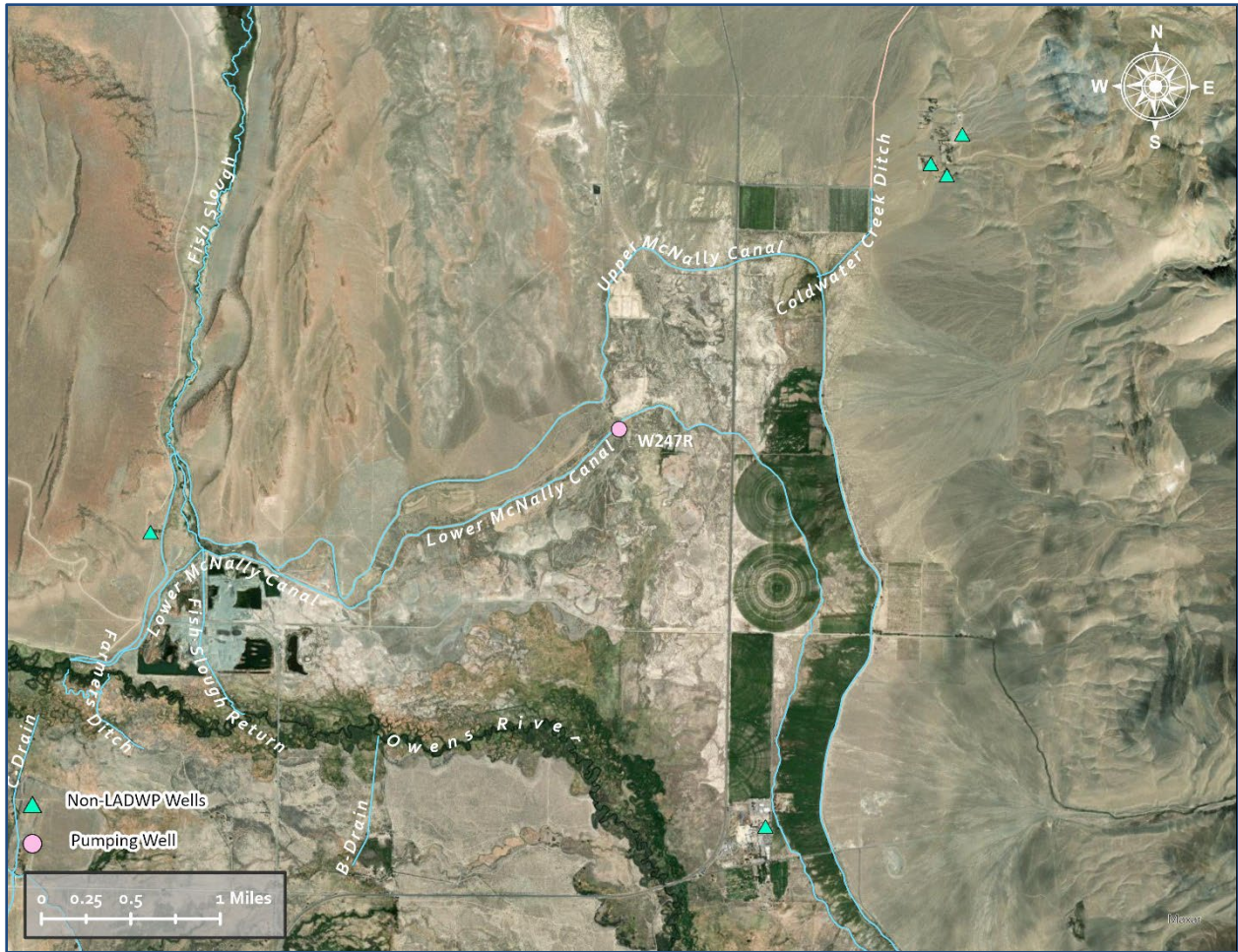


Figure 5 – Non-LADWP Wells in Laws Wellfield

5. CONSTRUCTION AND TESTING

5.1 New Well Design

An exploratory borehole for W247R will be drilled to approximately 700 feet-bgs. The total depth and screen length of the replacement well will be determined after reviewing lithologic and geophysical logs. The preliminary design of W247R with a screen interval of 350 to 700 feet-bgs is shown in **Figure 6**. This screen depth should ensure that W247R will draw water from the deep aquifer. The replacement well will be equipped with an 18-inch diameter casing and screen consisting of High-Strength/Low-Alloy steel.

Current industry standards for well drilling and design are incorporated in plans for the installation of the well. These plans include using a reverse mud rotary method for drilling and using a pre-fabricated casing and screen, along with placing a properly sized filter pack in the annular space between the screen and borehole wall. The appropriate screen slot size will be determined by performing a sieve analysis. The annular space between the casing and borehole, above the filter pack to the ground surface, will be sealed with cement to protect groundwater from potential surface contamination.

The initial pumping capacity of W247R is expected to be approximately 4.0 - 5.5 cfs. Analysis of the data from the well development and the planned aquifer test will be used to determine the actual pumping capacity of this well. It is also understood that the pumping capacity of W247R will decrease over time. If the pumping capacity of W247R is calculated to be higher than that of well W247, the replacement well will be equipped with a pump with the same or lower pumping capacity than that of the one it is replacing.

After the replacement well W247R is activated, the existing well will be converted to a monitoring well or plugged in compliance with the California well standards.

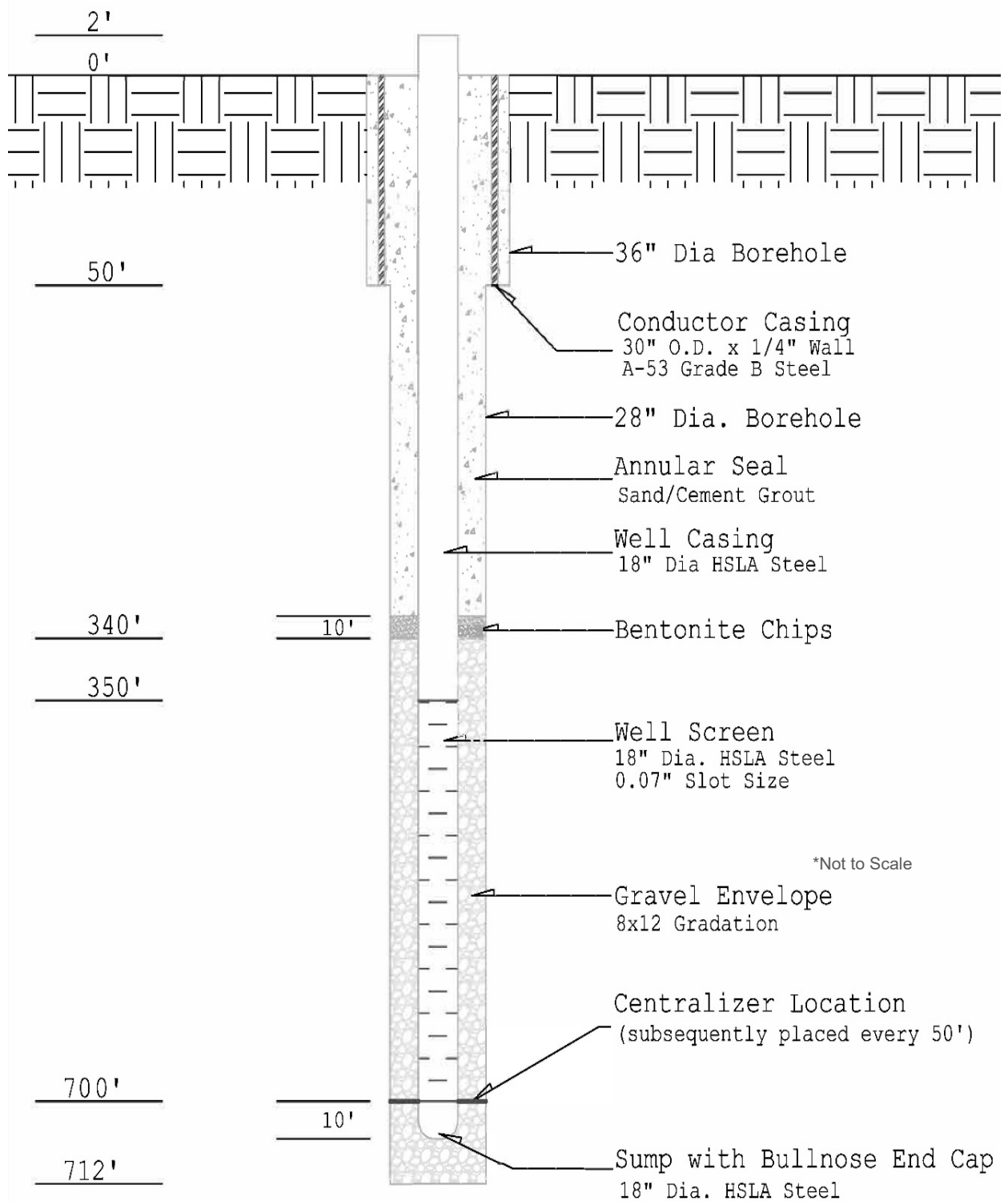


Figure 6 – Preliminary design for W247R in Laws Wellfield

5.2 Aquifer Test

Once the replacement well W247R is installed, the contractor will place a temporary pump in the well for pumping development and conducting a step-drawdown test with up to four steps. The step drawdown test data and analysis will determine the appropriate pumping rate during the constant-rate aquifer test. The aquifer test will include pumping for a minimum of 24 hours but will continue for 48 and up to 72 hours if the water levels in the designated monitoring well or wells have not stabilized. Appropriate portions of the monitoring plan will be implemented during the aquifer test.

6 POTENTIAL IMPACTS ON GROUNDWATER-DEPENDENT RESOURCES

6.1 Well Operation Simulations

The latest updated Bishop-Laws groundwater flow model was used to simulate the effect of pumping W247R for one year in an average runoff year that was developed for the Bishop and Laws Wellfields by MWH Americas, Inc. (now Stantec, Inc.), and updated several times with the latest update in 2020. This model covers both Bishop and Laws Wellfields because Owens River is not a boundary between the deeper aquifers in these wellfields. This MODFLOW-based groundwater model includes four layers, simulating the four aquifer layers. The uniform cell size in this model is 500 feet by 500 feet with grid refinements of up to 125 feet by 125 feet near the surface water features and pumping wells. The existing well W247 is primarily slotted in the shallow, intermediate, and deep aquifer zones (layers 1, 2, 3, and 4). Replacement well W247R is planned to be primarily screened in the deep aquifer zone (layer 4). Documentation on the initial and boundary conditions of the current model update are described in the Bishop/Laws Wellfields Groundwater Model Update: Model Documentation Report (Stantec, 2021).

Well W247 can be operated when vegetation monitoring Site LA1 is in ON status according to the Green Book procedure. LADWP operates W247 as needed to supply water for the Laws area uses and the aqueduct supply. According to the 1991 EIR, the well had an operational capacity of 5.3 cfs, which still holds generally true as of the

summer of 2020. Therefore, to determine the relative effect of pumping W247 compared with that of W247R, the simulated drawdowns resulting from pumping the existing W247 at an average rate of 5.3 cfs and the replacement well W247R at an average rate of 5.3 cfs were compared for one year of operation. Once the Bishop/Laws Wellfield model is updated and recalibrated using data collected from the aquifer test of W247R, other pumping scenarios can be simulated. This could include pumping scenarios during successive drought conditions.

The resulting one-year pumping simulation drawdown contours of groundwater levels in the shallow and deep aquifers are presented in Figures 7 and 8, respectively, with two sets of contours for the existing and replacement well operation. Based on these contour maps, the zone of influence of W247R pumping at 5.3 cfs is limited to less than a mile. Pumping W247R results in significantly less drawdown in shallow aquifer groundwater levels than that of existing W247. The drawdown simulation for W247R resulted in about 8 feet or less of drawdown within a 500-foot radius compared to the W247 simulation. Pumping W247R will result in more drawdown in the deep aquifer compared to W247. Within a 500-foot radius, W247R resulted in about 12 feet more drawdown than W247. The replacement well W247R is expected to have a lower pumping capacity as it will be screened only within the deep aquifer.

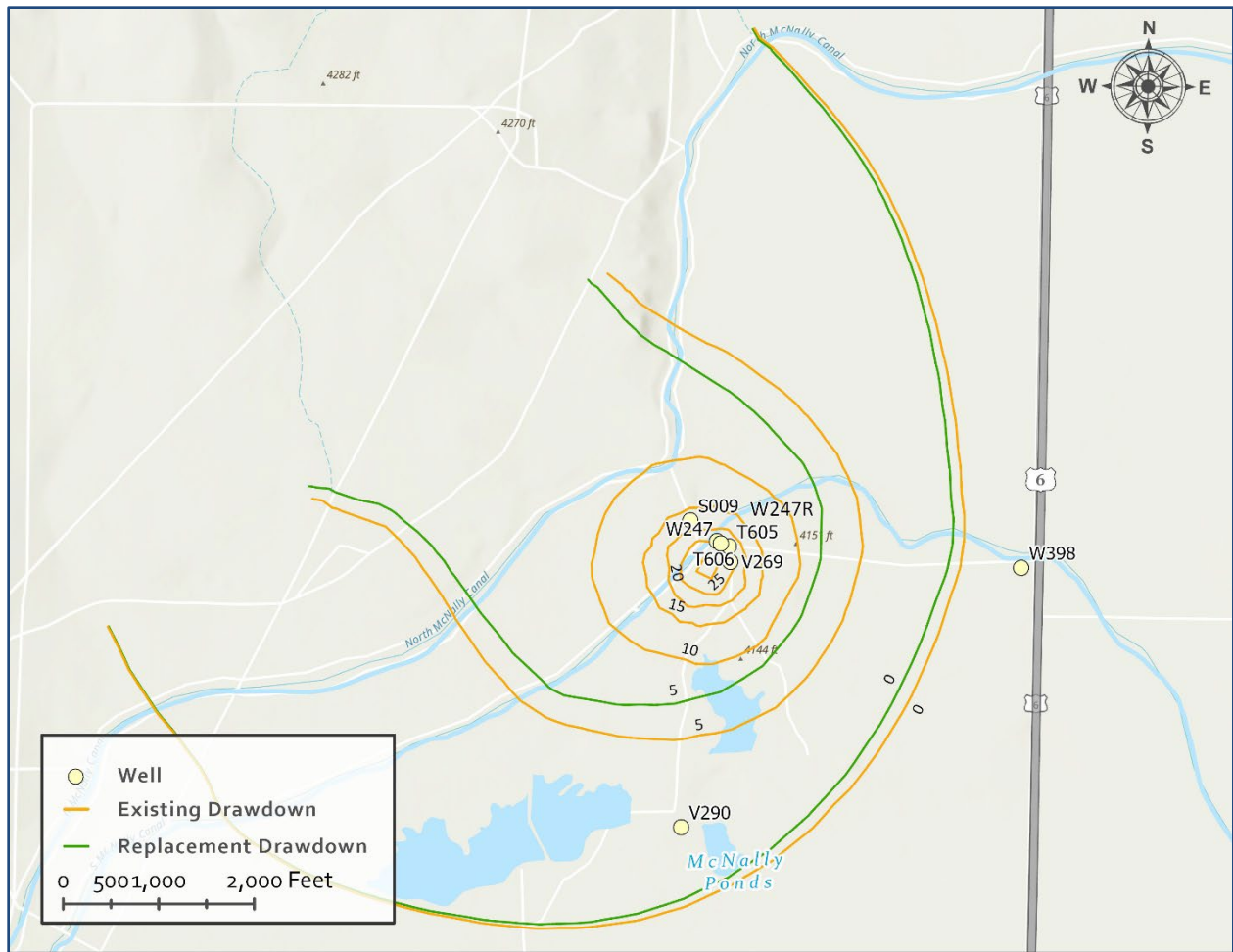


Figure 7 – Drawdown contours of groundwater levels in the **shallow** aquifer from pumping **existing** well W247 and replacement well W247R at 5.3 cfs for one year

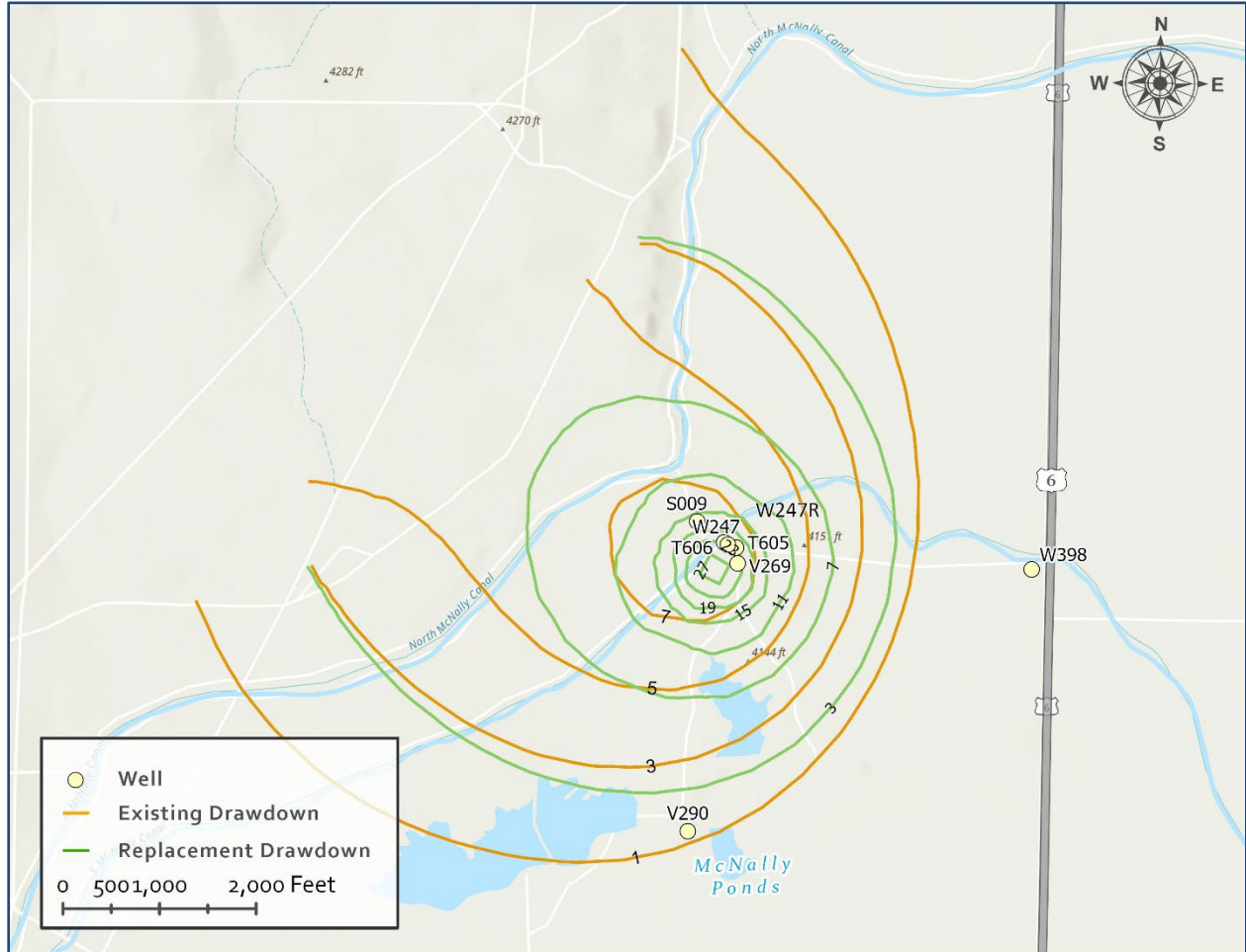


Figure 8 – Drawdown contours of groundwater levels in the *deep* aquifer from pumping *existing* well W247 and *replacement* well W247R at 5.3 cfs for one year

Once W247R is drilled and data from the constant rate aquifer test are analyzed, the calculated aquifer characteristics from the tests will be used to update and re-calibrate the Bishop/Laws Wellfields groundwater model in the area near W247R. This updated model should yield an improved estimate of aquifer characteristics and produce a more realistic effect of pumping on groundwater levels in the shallow and deep aquifer.

6.2 Potential Effects on Vegetation

The contours of drawdown in the shallow aquifer were superimposed on the Bishop area vegetation parcel map and are presented in **Figures 9 to 11** for the one-year pumping scenario. LAW040 is the nearest parcel of concern with type B vegetation (root zone of approximately 13 feet). Drawdown from pumping W247R on the shallow groundwater is expected to decrease by approximately 12 feet-bgs compared to the existing well.

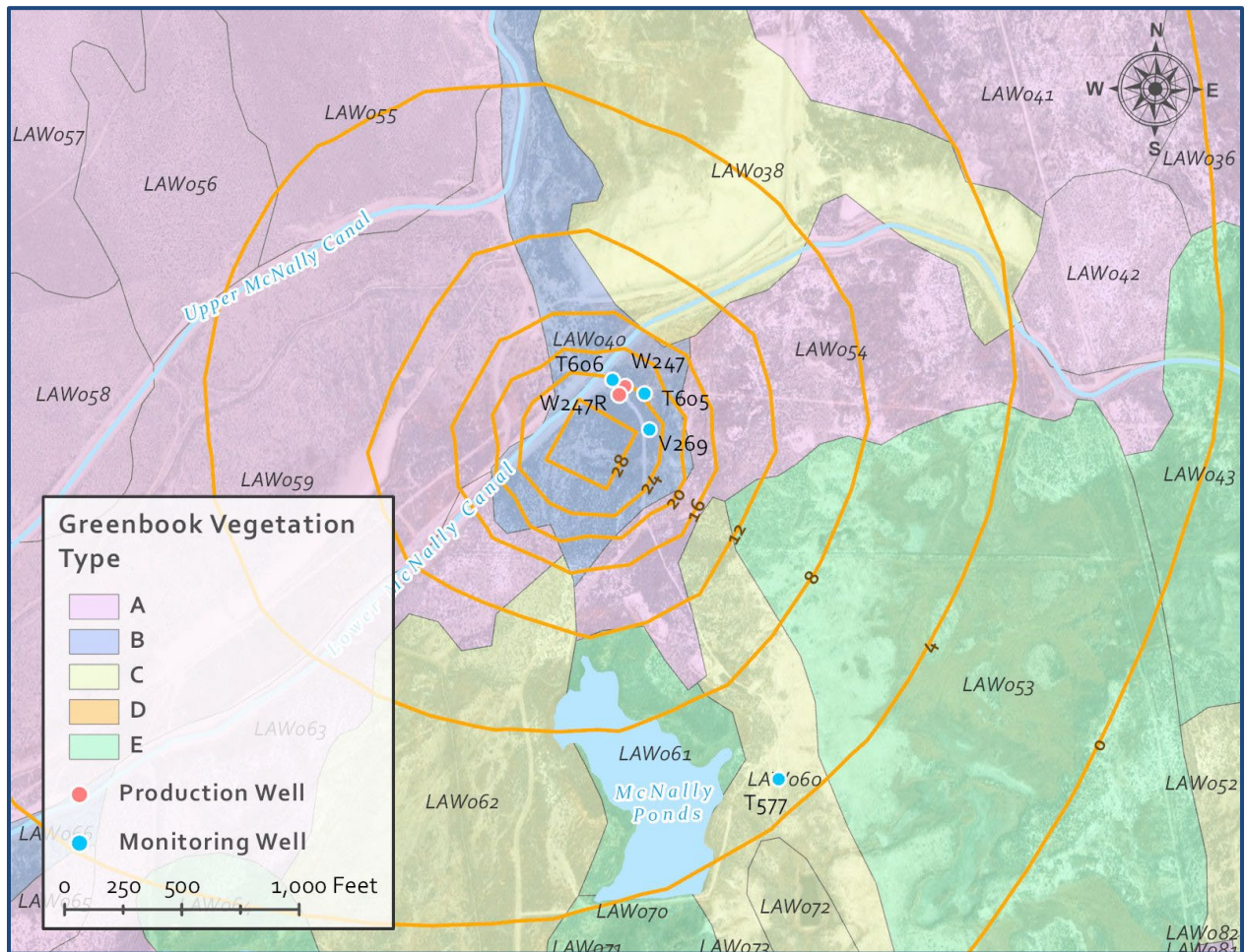


Figure 13 – Vegetation parcels and drawdown contours in the **shallow** aquifer from pumping **existing** W247 at 5.3 cfs for one year

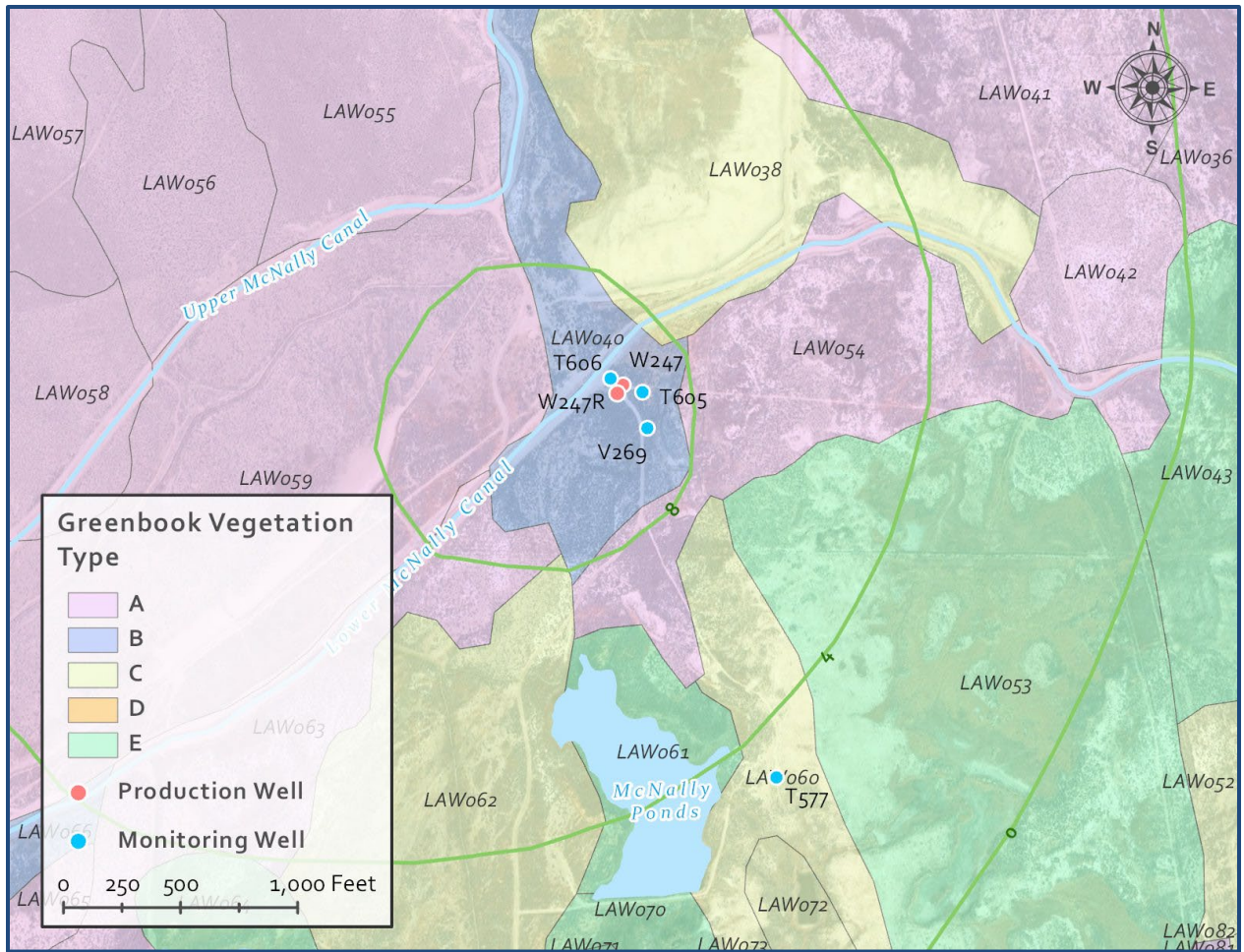
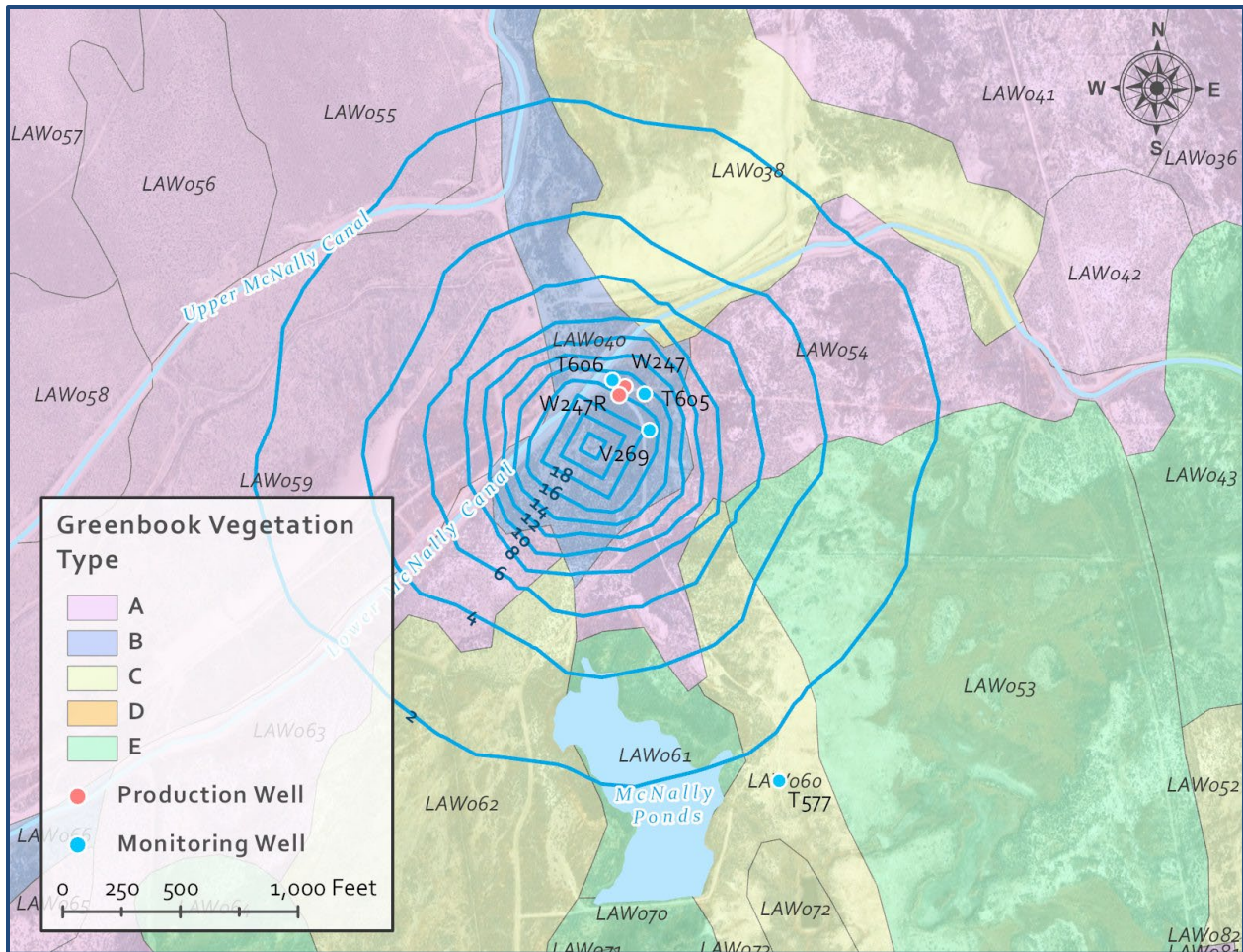


Figure 14 – Vegetation parcels and drawdown contours in the **shallow** aquifer from pumping replacement W247R at 5.3 cfs for one year



*Figure 15 – Vegetation parcels and contours of the **difference** in **shallow** aquifer groundwater levels between the one-year pumping simulations of W247 and W247R, indicating less drawdown resulting from W247R pumping*

6.3 Potential Effects on non-LADWP wells

As the nearest non-LADWP well is over 2 miles away from the replacement well and outside the expected zone of influence, no effects are expected from operating W247R on non-LADWP wells in the Laws Wellfield.

6.4 Potential Effect on Springs and Flowing Well

There are no springs or flowing wells within the zone influence of replacement well W247R. The closest flowing well is located four miles south of W247R. The seep DWP29, located on the base of the White Mountains, is disconnected from the groundwater system and is four miles southeast of W247R. No effect of operating W247R on springs or flowing wells is expected.

7. OPERATION

Pump equipment will be designed and installed in the well using the results of the analysis of the data collected during the pumping tests and the calculated pumping capacity. Operation of W247R is subject to the ON/OFF protocols of the Water Agreement as described in Section 2.1 of this report. Similar to the existing well W247, the operation of W247R will be controlled by the status of the vegetation monitoring site L1. As the sole source of water for the McNally Pasture E/M Project, the Inyo/LA Technical Group may exempt W247R to allow supplying water to the McNally Pasture E/M project even when vegetation monitoring site L1 is in OFF status.

According to the Water Agreement, the Technical Group is responsible for developing and implementing a monitoring plan during the initial operation. The monitoring plan will include both hydrologic and vegetation monitoring. The goal of the initial operation is to determine the potential long-term impacts of operating the well.

After the completion of the initial operation phase of W247R, the regular operation of this well will be included in LADWP's annual operation plan for Owens Valley.

8. ENVIRONMENTAL ASSESSMENT

Well W247R will replace an existing well and will be located adjacent to the existing well. The well will draw from the deeper aquifer and pumped water will be used for the same purposes as the well it is replacing. Computer simulations indicate that the operation of the replacement well W247R will have less effect than the existing well on the groundwater levels in the shallow aquifer that supports vegetation. Additional assessment will not be conducted for the replacement well W247R, and LADWP will file a Notice of Exemption under Class 2 of the California Environmental Quality Act with the Inyo County Recorder's Office. A Class 2 exemption consists of replacing or reconstructing existing structures and facilities where the new structure will be located on the same site as the structure replaced and will have substantially the same purpose and capacity as the structure replaced.

9. REFERENCES

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Appendix Table A – Groundwater pumping from LADWP wells in Laws Wellfield (AF/year)

Runoff Year	W236	W239	W240	W241	W242	W243	W244	W245	W246	W247	W248	W249	W365	W385	W386	W398	W399	Total
1971	1,506	908	1,213	925	1,194	463	1,166	1,272	1,219	560	1,855	1,124						13,405
1972	2,802	2,325	2,277	1,668	793	1,810	2,111	2,156	2,086	2,901	3,183	3,033						27,145
1973	1,762	1,487	626	483	551	989	1,349	1,532	1,061	1,644	1,516	1,619						14,619
1974	680	379	80	413	482	548	499	636	0	0	0	0						3,717
1975	1,322	1,060	1,217	1,365	1,082	1,337	415	1,946	1	125	99	83						10,052
1976	2,688	2,439	2,262	1,550	683	1,521	1,868	2,297	0	0	0	0						15,308
1977	2,312	2,008	1,582	1,204	840	1,946	2,001	1,804	5	1	1	3	1,311					15,018
1978	0	0	0	0	0	0	0	0	0	0	0	0	907					907
1979	1,796	1,639	1,488	1,186	931	1,649	1,482	1,374	682	1,609	1,220	1,116	1,726					17,898
1980	0	0	0	0	0	0	0	0	0	10	0	0	1,218					1,228
1981	2,015	1,888	1,807	1,448	1,031	2,020	1,878	1,723	1,467	3,169	2,680	2,382	1,775					25,283
1982	0	0	27	21	15	54	54	84	21	48	45	41	946					1,356
1983	0	1	0	1	0	0	0	0	0	2	0	0	1,085					1,089
1984	969	836	713	569	404	662	984	847	0	0	0	128	1,265					7,377
1985	2,134	2,052	1,745	1,036	972	1,957	1,847	1,693	364	947	710	852	1,030					17,339
1986	712	618	532	404	322	592	407	431	372	1,455	731	654	1,343					8,573
1987	2,506	2,218	1,940	1,307	830	2,009	552	1,256	1,742	3,009	3,422	3,012	1,360	1,148	1,817			28,128
1988	2,542	2,377	1,969	1,054	817	2,044	937	1,172	1,639	3,262	2,962	2,611	1,245	2,525	3,248			30,404
1989	1,969	2,255	1,710	762	933	1,814	1,995	915	1,288	3,062	2,604	2,521	1,172	0	63			23,063
1990	726	751	1,032	546	519	567	634	687	0	578	2	0	581	0	0			6,623
1991	1	0	882	500	392	0	0	602	0	385	0	1	739	3	2			3,507
1992	31	0	886	435		18	0	433		359	0	0	502	0	0	0	380	3,044
1993	1	1	705	646		0	0	312		1,760	1,585	1,334	2	1,344	754	0	475	8,919
1994	1	2	1,487	725		1	1	818		1,818	1,675	1,368	1	0	0	1,008	541	9,446
1995	244	171	0	0		152	11	74		581	1,638	1,282	87	1	1	136	0	4,378
1996	0	0	0	0		0	0	0		535	799	0	0	0	0	0	0	1,334
1997	0	0	0	0		0	0	0		538	0	0	0	0	0	0	33	571

Runoff Year	W236	W239	W240	W241	W242	W243	W244	W245	W246	W247	W248	W249	W365	W385	W386	W398	W399	Total
1998	0	0	0	0		0	0	0		426	0	0	0	0	0	0	0	426
1999	0	0	0	0		0	0	133		382	0	0	0	0	0	0	14	529
2000	0	0	0	0		0	0	487		318	0	0	597	0	0	0	0	1,402
2001	0	0	0	2		0	0	290		438	0	0	236	0	0	0	0	966
2002	0	0	0	0		0	0	413		404	0	0	1,624	0	0	0	0	2,441
2003	1,626	959	0	0		0	869	120		329	0	0	836	0	0	0	0	4,739
2004	1,293	732	0	0		0	1,019	389		281	0	0	512	0	0	0	0	4,226
2005	1,021	50	0	0		0	135	81		464	0	0	449	0	0	0	0	2,200
2006	1,293	0	0	0		0	0	130		0	513	736	466	0	0	0	6	3,144
2007	1,107	0	0	0		0	0	622		451	0	0	543	0	0	0	17	2,740
2008	962	0	0	0		0	7	668		787	0	0	732	1	0	0	18	3,175
2009	1,066	0	0	0		0	432	442		745	0	0	609	0	0	0	3	3,297
2010	993	197	0	0		0	579	687		0	0	0	673	0	0	0	0	3,129
2011	2,175	1,321	503	0		0	1,526	562		0	0	0	350	0	0	0	12	6,449
2012	1,371	917	51	57		0	418	521		0	0	0	199	0	0	0	43	3,578
2013	1,315	546	0	0		0	551	507		0	0	0	496	0	0	0	10	3,427
2014	1,160	492	0	0		0	579	255		0	0	0	286	0	0	0	5	2,781
2015	1,023	746	0	0		0	368	330		0	0	0	0	1	0	0	24	2,496
2016	1,040	946	0	0		0	511	60		0	0	0	0	0	0	0	26	2,585
2017	1,104	6,015	0	0		0	0	0		0	0	0	0	0	0	0	54	1,165
2018	686	918	920	821		0	657	610		953	980	1,030	0	0	0	0	29	7,609
2019	1,188	184	492	132			80	61		0	233	1,241	0	463	0	0	86	4,164
2020	307	1,101	479	453			878	496		942	19	1,077	0	0	0	0	38	5,789
2021	827	1,145	70	0			608	685		1,186	937	844	0	0	0	0	25	6,327
2022	854	508	288	130			601	487		783	324	386	0	0	0	0	15	4,376
1993-2022 Average	755	365	166	99	0	6	328	341	0	471	290	310	290	60	25	38	49	3,594

Table excludes domestic supply and enhancement/mitigation pumping wells

Gray cell indicates well was either offline or not yet constructed

Well W247R - Replacement for W247

Laws Wellfield, Owens Valley

Monitoring Plan

For

First Season of Operation

Eastern Sierra Environmental Group

Water Operations Division

Los Angeles Department of Water and Power

May 2024

1. PURPOSE

The City of Los Angeles Department of Water and Power (LADWP) plans to drill and construct a well to replace the existing Well W247 located in Laws Wellfield. The replacement well will supply water for the same uses as the existing well. This monitoring plan satisfies the requirement of Section VI of the Inyo County/Los Angeles Water Agreement and Section IV.B of the Greenbook (the Technical Appendix to the Water Agreement), Guidelines for Drilling and Activating New Production Wells. This document describes the monitoring program for the first season of operating the W247 replacement well (W247R).

2. BACKGROUND

2.1 Location

Production well W247 is among the four production wells located along McNally Canals, west of Hwy 6 in the Laws Wellfield, north of Bishop. All four wells discharge water to McNally Canal for enhancement and mitigation (E&M) project irrigation uses. This production well primarily supplies the McNally Pasture, and the goal is to minimize the effects of pumping on the shallow aquifer that supports vegetation. **Figure 1** shows the location of the existing W247 adjacent to the McNally Canal and the proposed location of W247R. The replacement well will be used for the same purposes as the existing well. LADWP plans to drill W247R using the current industry standards for well construction and improve LADWP's operational flexibility in managing water resources in Owens Valley.

2.2 Water Agreement

The purpose of this monitoring plan is to describe the monitoring program during the first season of operating W247R. According to Section VI of the Inyo/LA Long-Term Water Agreement (Water Agreement),

During this initial period of operation, the Technical Group shall monitor water levels and vegetation conditions in accordance with a jointly developed monitoring program. Additional wells may be installed by the Department in the area if operation of the initial well indicates no impacts that would be inconsistent with these goals and principles. Monitoring wells shall be installed as necessary to evaluate any potential effects of the operation of the new well or wells not owned by the Department.

The applicable components of the monitoring plan can be implemented during the aquifer testing following the installation of the production well.

Monitoring Phases

The monitoring plan for the planned replacement well W247R is developed in a multi-phased adaptive approach to minimize potential impacts on nearby environmental resources, including vegetation, private wells, flowing wells, and springs. The phases in the development and updating of the monitoring plan include:

- 1) Preparing a draft monitoring plan before installation of the replacement well,
- 2) Revising and updating the plan based on aquifer test data analysis, and results of model simulations after recalibrating the Bishop/Laws Wellfields Model, and
- 3) Developing a long-term operation plan to protect nearby non-LADWP wells after the first season of operation.

This report represents the first-phase draft monitoring plan, which will be considered by the Technical Group before the installation of the replacement well. The second phase of the monitoring plan will be utilized during the first season of operating the replacement well.

3. **AQUIFER TEST**

Once the replacement well W247R is installed, the contractor will place a temporary pump in the well for development and conduct a step drawdown test with up to four steps. The step drawdown test data and analysis will determine the appropriate pumping rate during the constant-rate aquifer test. The constant-rate test will consist of pumping for 24 and up to 72 hours if the water levels in the designated monitoring well(s) have not stabilized.

To ensure groundwater level measurements are not affected by the operation of other nearby wells, production wells W248, W249, and W398 will not be operated at least from one week before to one week after the aquifer testing. The pumping and monitoring wells in Table 1 will be monitored manually or automatically, utilizing pressure transducers. If monitoring is performed manually, the measurement frequency will be 1, 2, 3, 5, 10, 15, 20, 25, 30, 40, 50, and 60 minutes after the start of the pump

and every half hour afterward. The same measurement frequency will be implemented during the recovery period for at least 2 hours after pumping stops. If the groundwater measurements are performed using a pressure transducer, the measurement frequency will be set to every 5 minutes. Both manual and automatic groundwater measurements will be conducted in the pumping well.

4. COMPONENTS OF THE MONITORING PLAN

During the initial operational period, the monitoring plan will include hydrologic and vegetation monitoring.

4.1 Hydrologic Monitoring

Hydrologic monitoring will include groundwater and surface water monitoring. The groundwater monitoring will include shallow and deep aquifer wells in the anticipated zone of influence of W247R.



Figure 1 – Locations of existing well W247 and replacement W247R in Laws Wellfield

4.1.1 Groundwater Monitoring

A review of lithological and geophysical logs of wells near W247R indicates a likely semi-confined aquifer in the northern Laws Wellfield. **Table 1** lists and **Figure 2** shows locations of representative shallow and deep wells that will be monitored during the first season of W247R operation.

To improve understanding of this semi-confinement aquifer, the existing W247 may be converted to a monitoring well, measuring groundwater levels in the deep aquifer.

Table 1 – Monitoring wells to be monitored during the aquifer testing and the initial season of operation

Well Number	Depth (feet)	Direction	Distance (feet)
S009	50 - Shallow	Northwest	250
T577	31 - Shallow	Southeast	1,800
T578	20 – Shallow	North	2,000
T605	21 – Shallow	East	2,500
T606	39- Shallow	Northeast	50
T733	200+ - Deep	Southwest	14,000
T758	575 - Deep	Southwest	16,500
T795	27 - Shallow	Southwest	3,200
V269	98 - Shallow	Southeast	2,100
V275	91 - Shallow	Northeast	4,600
V290	140 - Intermediate	South	750
W247	470 - Deep	East	200
W398	550 - Deep	East	1,300

4.1.2 Surface Water Monitoring

The surface water features are unlikely to be affected by the W247R operation. LADWP conducts regular flow monitoring of the surface water features near W247R. Therefore, no additional monitoring of surface water features is planned.

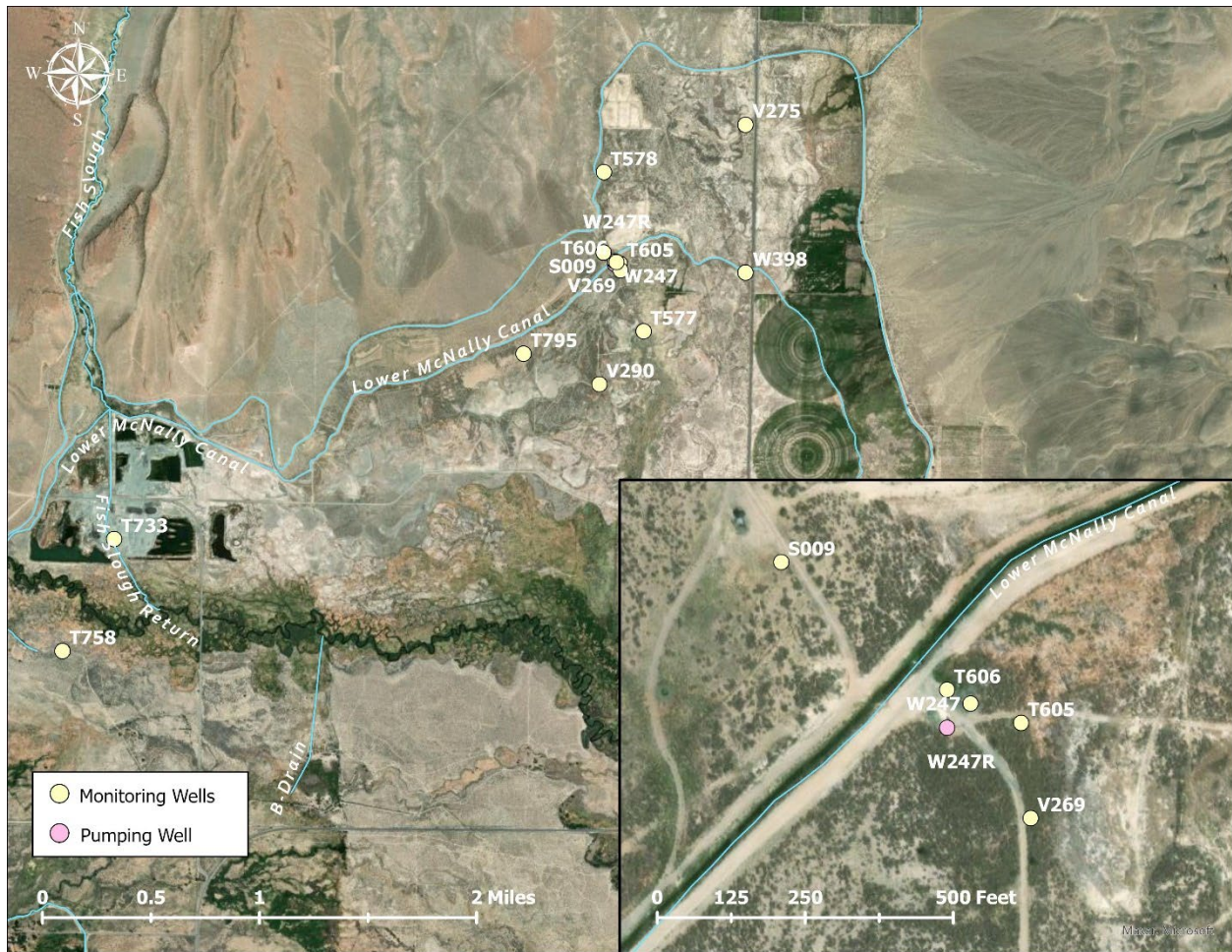


Figure 2 – Monitoring locations for the first season of W247R operation

4.2 Vegetation Monitoring

Vegetation parcels in the vicinity of W247R, including types A, B, C, and E vegetation, are shown in **Figure 3**. Given the planned deep screen zone for W247R and the preliminary results of groundwater modeling, the operation of W247R is not expected to affect the groundwater levels in the shallow aquifer supporting vegetation.

As part of vegetation monitoring during the first season of W247R operation, the Normalized Difference Vegetation Index (NDVI) derived from remote sensing data from Sentinel and Landsat satellites will be utilized to compare the health of vegetation before and after the completion of the first season of W247R operation. LADWP and

ICWD staff will continue the annual monitoring of the vegetation parcel LAW040 utilizing line point transects.

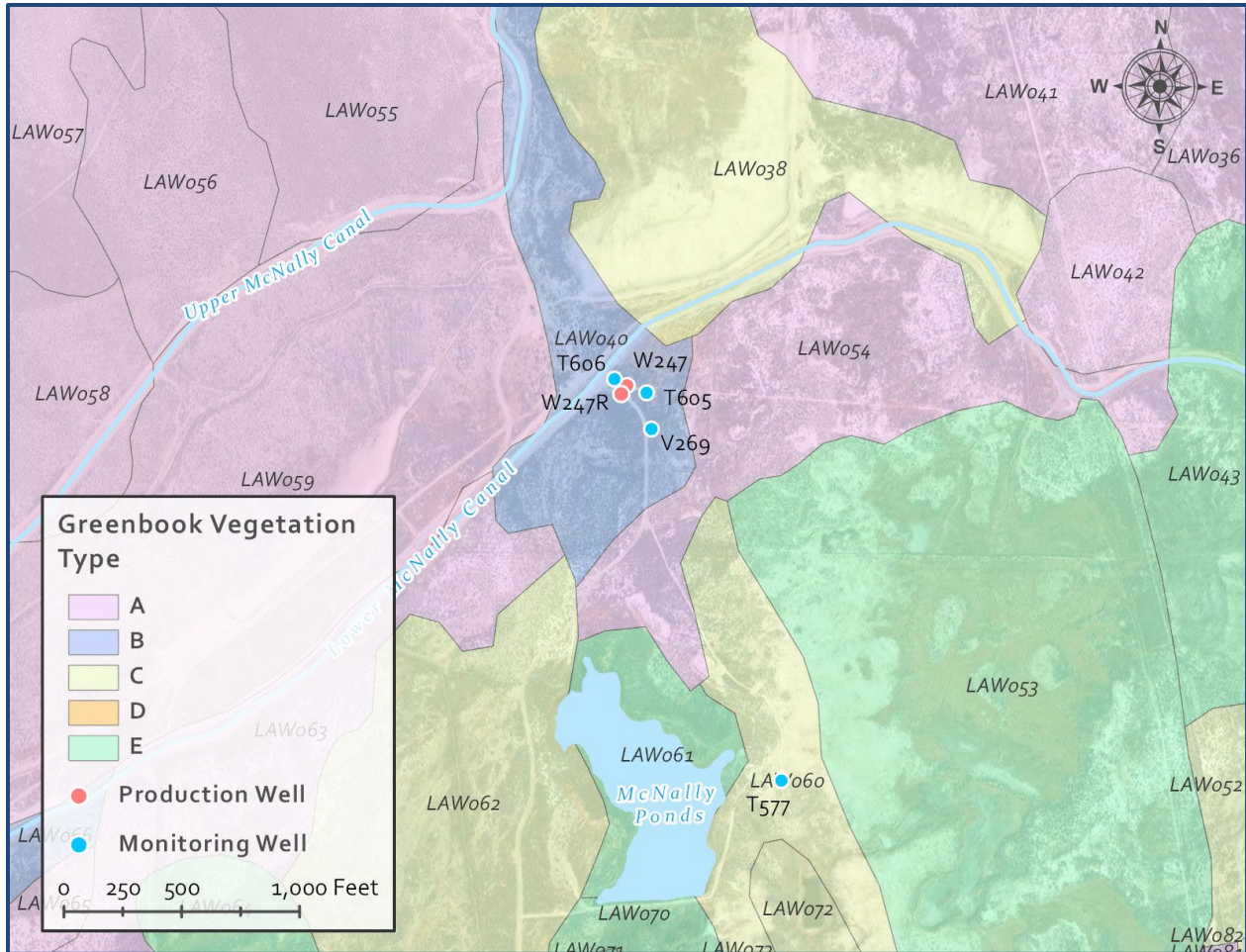


Figure 3 – Vegetation parcel in Laws Wellfield in the vicinity of W247

4.3 Springs, Seeps, Flowing Wells

No known flowing wells or springs exist in the Laws Wellfield; however, there are seven flowing wells adjacent to the Owens River southeast of W247R. The closest flowing well, F136, is four miles south of W247R and is not expected to be affected by W247R operations. Seep area DWP27 east of Laws Wellfield is located on the alluvial fans and fed by runoff from the White Mountains. Therefore, no additional monitoring of these groundwater-dependent resources is planned during the first season of W247R operation. LADWP personnel will continue monthly monitoring of flowing wells along Owens River.

4.4 Non-LADWP Wells

A few private wells in the Laws area provide water for domestic purposes. The approximate locations of known non-LADWP wells in the vicinity of W247R based on available data from the California State Department of Water Resources (DWR) are presented in **Figure 4**. Based on the available data, there are no non-LADWP wells within a two-mile radius of the replacement Well W247R, and no impact from pumping W247R is expected. If access is granted by the owners, LADWP staff will monitor nearby non-LADWP wells before and after the first season of W247R operation.

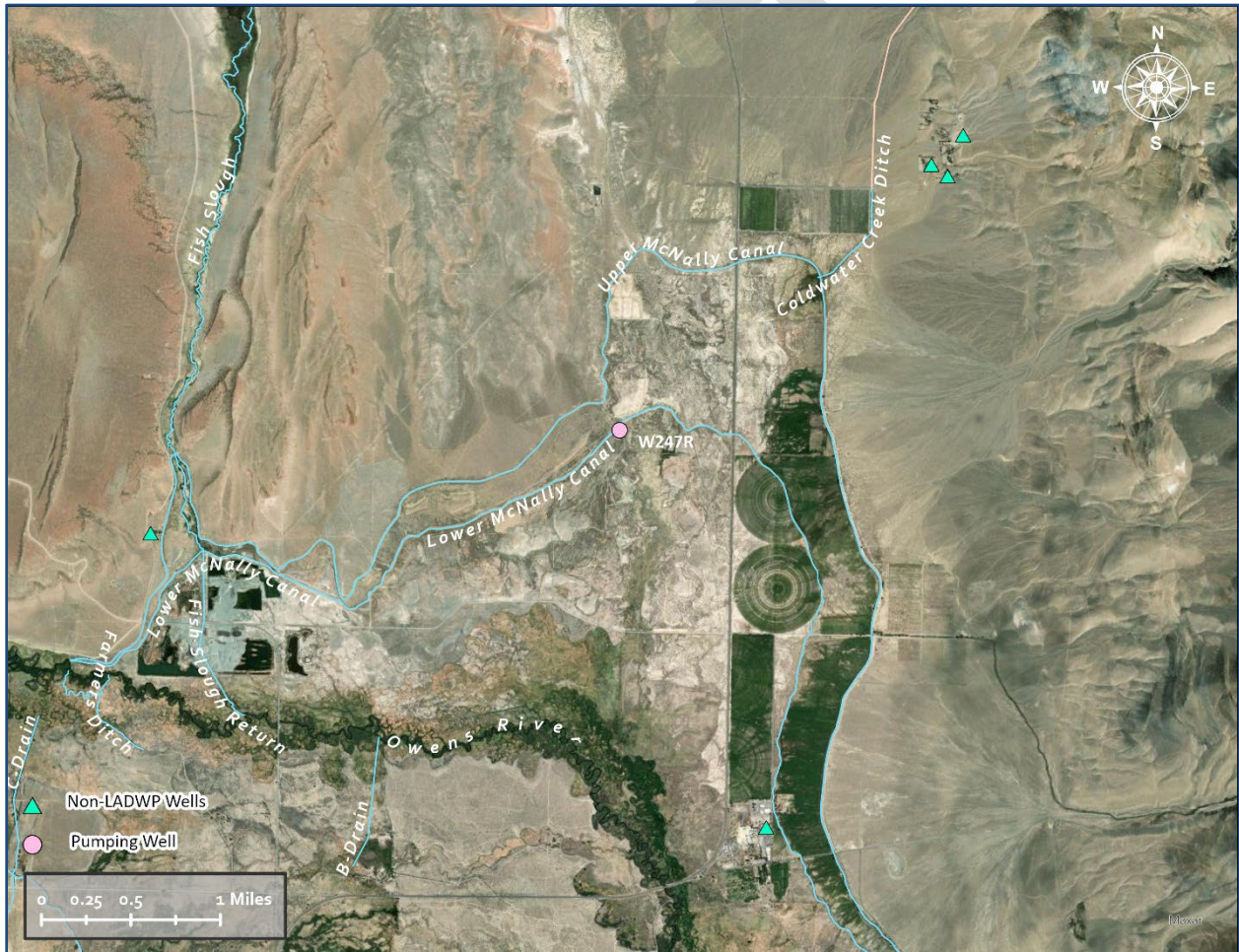


Figure 4 – Non-LADWP Wells in the Laws Wellfield