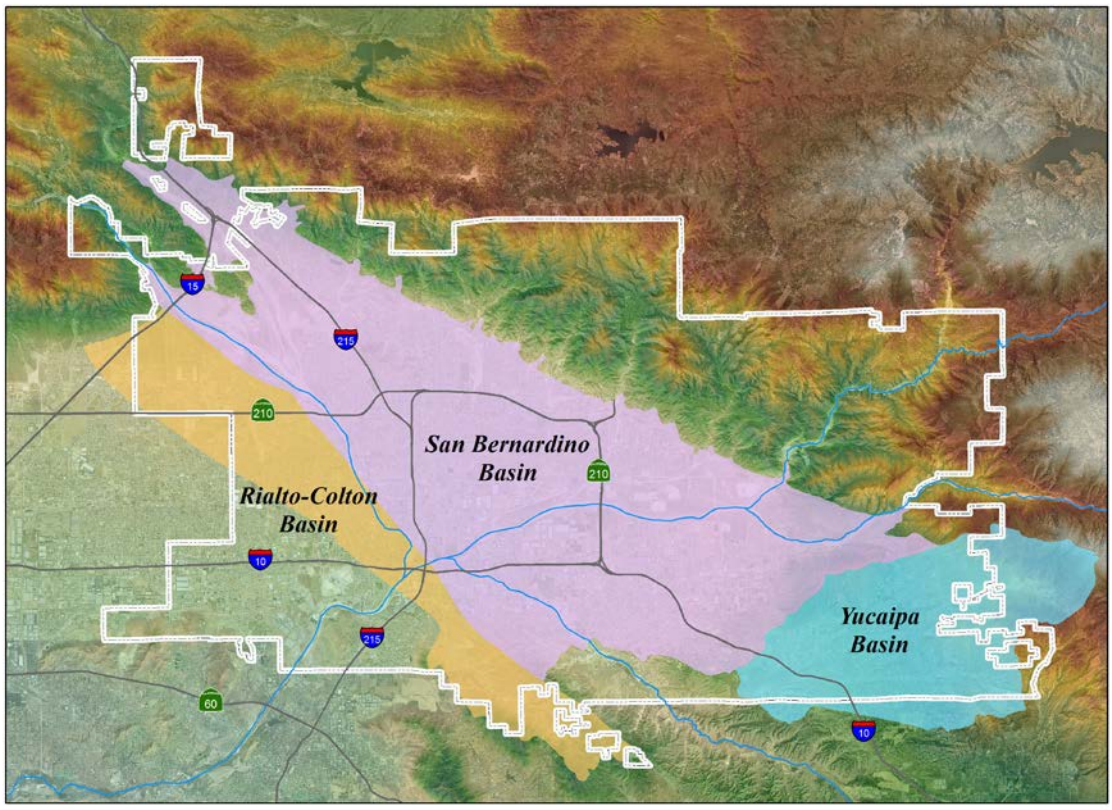
Change in Groundwater Storage for the San Bernardino, Rialto-Colton and Yucaipa Basins



March 2022

SAN BERNARDINO Valley MUNICIPAL WATER DISTRICT

Change in Groundwater Storage for the San Bernardino, Rialto-Colton And Yucaipa Basins

EXECUTIVE SUMMARY AND APPENDIX

March 2022

San Bernardino Valley Municipal Water District

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ACKNOWLEDGMENT

Many public and private water agencies and various individuals have cooperated with the San Bernardino Valley Municipal Water District in furnishing the essential information upon which the Change in Storage Calculation is based.

Change in Groundwater Storage For the San Bernardino, Rialto-Colton And Yucaipa Basins 1934 – 2021

EXECUTIVE SUMMARY AND APPENDIX

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SUMMARY OF RESULTS

Background

The Change in Storage calculation provides an indicator, or "gauge", of current groundwater supplies and how they compare to past years. The San Bernardino Valley Municipal Water District (SBVMWD) has been calculating the change in groundwater storage for the San Bernardino Basin (SBB) since 1970. The first calculation was completed for the years 1934 – 1960 by the State of California Department of Water Resources (DWR) and the results were summarized in Bulletin 104-5, Meeting Water Demands in the Bunker Hill-San Timoteo Area, Geology, Hydrology, and Operation-Economics Studies, Text and Plates (Olson, pp. 90 – 92). The DWR change in storage values were calculated using the Specific Yield Method (Olson, pp. 85 – 98) and a mathematical model developed by TRW, Incorporated, Redondo Beach, California (TRW). In 1980, SBVMWD updated the change in storage calculation to include the years 1961 – 1980 (Van Gelder). In the early 1990's, SBVMWD created a new change in storage model (SBVMWD Model) using software developed by Environmental Systems Research Institute (ESRI), Redlands, California. Like its predecessors, the SBVMWD Model calculates the change in groundwater storage (volume) using the Specific Yield Method which is based largely on the change in water level measurements and the soil porosity (for a detailed explanation of how the model works see Appendix: SBVMWD Change in Storage Methodology). In 2014, Valley District began calculating the change in storage for the Yucaipa and Rialto-Colton Basin.

In 2019, SBVMWD performed a study to determine the total amount of usable groundwater storage in the San Bernardino Basin (SBB) and Rialto-Colton Basin (RC) using the Upper Santa Ana River Integrated Groundwater Model (Integrated SAR Model). The usable groundwater storage is the theoretical maximum volume of groundwater that can be stored from the bottom elevation of the aquifer to the maximum water level in the basin **(Calculation details can be found in Appendix: Total Usable Storage)**. Storage in the SBB is constrained by the goal to minimize, or eliminate, liquefaction potential in the Pressure Zone Area. In order to achieve this goal, water levels in the Pressure Zone must not be shallower than 50 feet below ground surface. The estimated total usable storage in the SBB is 5,690,000 acre-feet, Rialto-Colton Basin is 1,749,000 acre-feet, and the Yucaipa Basin is 2,796,000 acre-feet.

Calculation

SBVMWD calculates the change in groundwater storage in the San Bernardino, Rialto-Colton and Yucaipa Basins annually. The change is groundwater storage is based upon the the Basins geology, and field water level measurements from wells throughout the Basins. Storage is a important metric that SBVMWD uses to gauge the effectiveness of various water resource management activities, such as groundwater recharge. The annual change in storage is then a comparison of the current year's change in groundwater storage with the previous year's value.

The wells used in the SBVMWD Model are shown on Figure 1 and the static water level data for these wells is illustrated on Figure 2. A comparison of current water levels to the first historic low water level/year is shown on Figure 3.

Summary of 2021 Results

The total usable storage for the San Bernardino Basin (SBB) continues to be near historic lows and Rialto-Colton Basin reached its historic low which is largely due to the current drought which began in about 1998. Given the below average precipitation index of 11.64 inches, or 38% of the historic average of 31.03 inches received in 2021 and relatively low amount of State Water Project imported by SBVMWD, the annual change in storage decreased for the SBB, Rialto-Colton and Yucaipa Basins in 2021. The reductions in each of the basins represent an approximate 1.1% decrease in total storage in 2021. Despite the continued dry conditions, the basins are 80% , or more, full.

The change in storage results are summarized in Table 2.

Table 2. Change in storage results

Basin	Annual Change in Storage (acre-feet)	2021 Total Storage (acre-feet)	Total Usable Storage (acre-feet)	Percent Full (%)
Rialto-Colton Basin	-23,338	1,516,691	1,749,000	86%
San Bernardino Basin	-84,340	4,751,118	5,690,000	84%
Yucaipa Basin	-8,355	2,245,078	2,796,000	80%

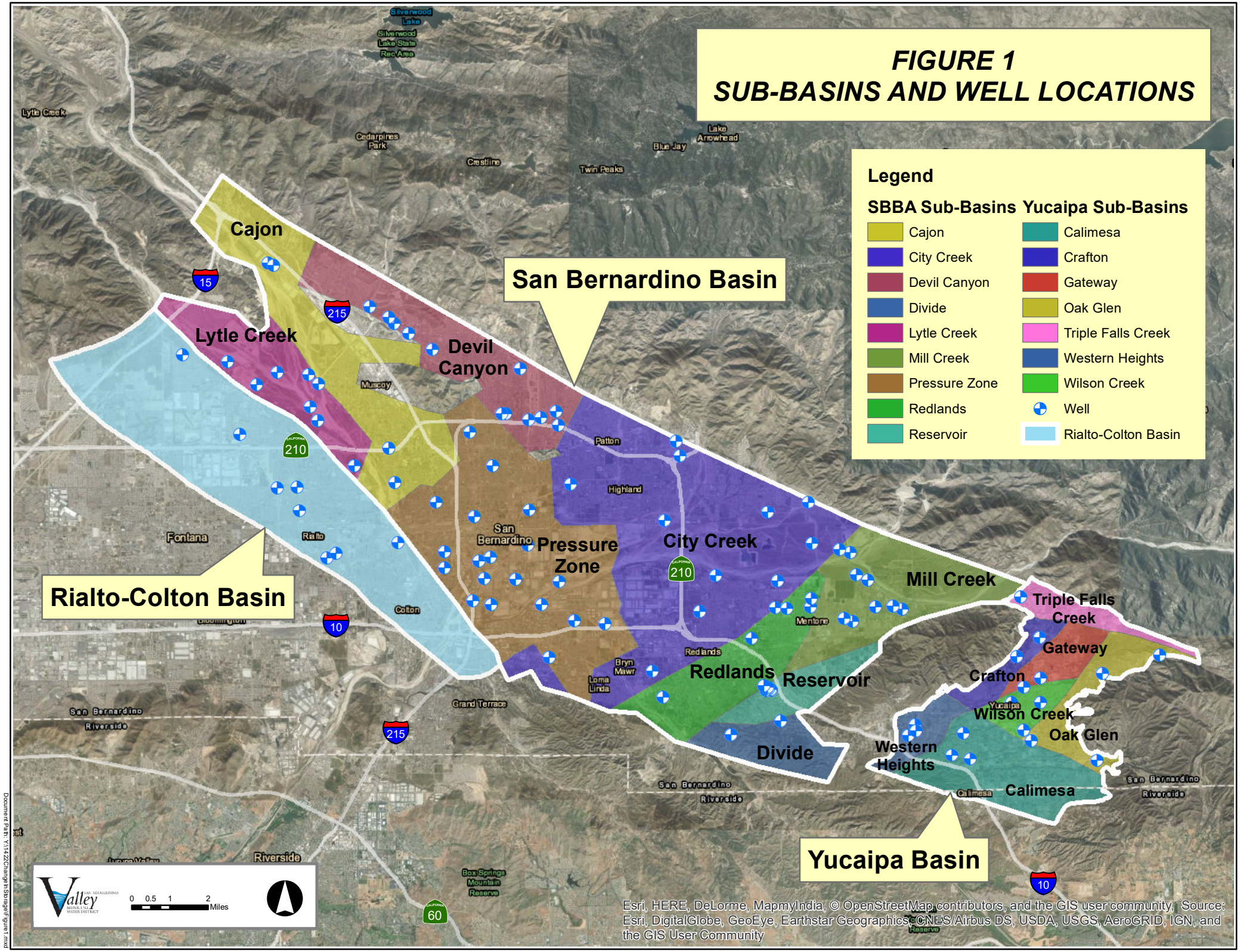
FIGURE 1
SUB-BASINS AND WELL LOCATIONS
Legend
SBBA Sub-Basins
Cajon
City Creek
Devil Canyon
Divide
Lytle Creek
Mill Creek
Pressure Zone
Redlands
Reservoir
Yucaipa Sub-Basins
Calimesa
Crafton
Gateway
Oak Glen
Triple Falls Creek
Western Heights
Wilson Creek
Well
Rialto-Colton Basin
San Bernardino Basin
Rialto-Colton Basin
Yucaipa Basin
Cajon
Lytle Creek
Devil Canyon
Pressure Zone
City Creek
Mill Creek
Triple Falls Creek
Gateway
Crafton
Wilson Creek
Oak Glen
Western Heights
Calimesa
Redlands
Reservoir
Divide
Silverwood Lake
Lytle Creek
Cedarpines Park
Crestline
Lake Arrowhead
Blue Jay
Twin Peaks
Muscoy
Patton
Highland
San Bernardino
Fontana
Rialto
Colton
Bloomington
Mentone
Bryn Mawr
Loma Linda
Grand Terrace
Yucaipa
Riverside
Box Springs Mountain Reserve
15
215
210
10
60
0 0.5 1 2 Miles
Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community, Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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FIGURE 2
DEPTH TO GROUNDWATER STATUS MAP
SEPTEMBER, 2021

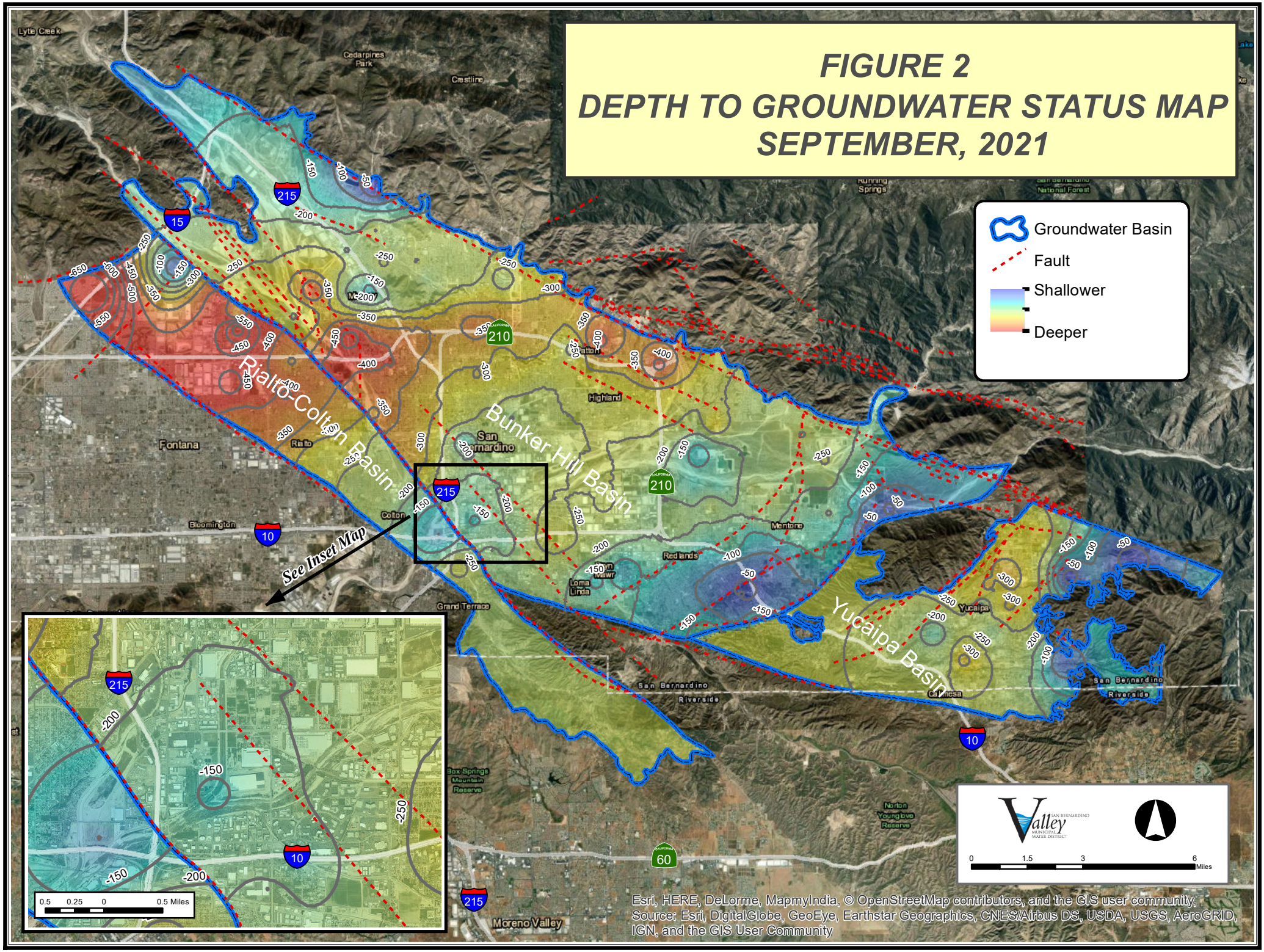

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FIGURE 3
COMPARISON OF CURRENT WATER LEVELS TO 1ST HISTORIC LOW

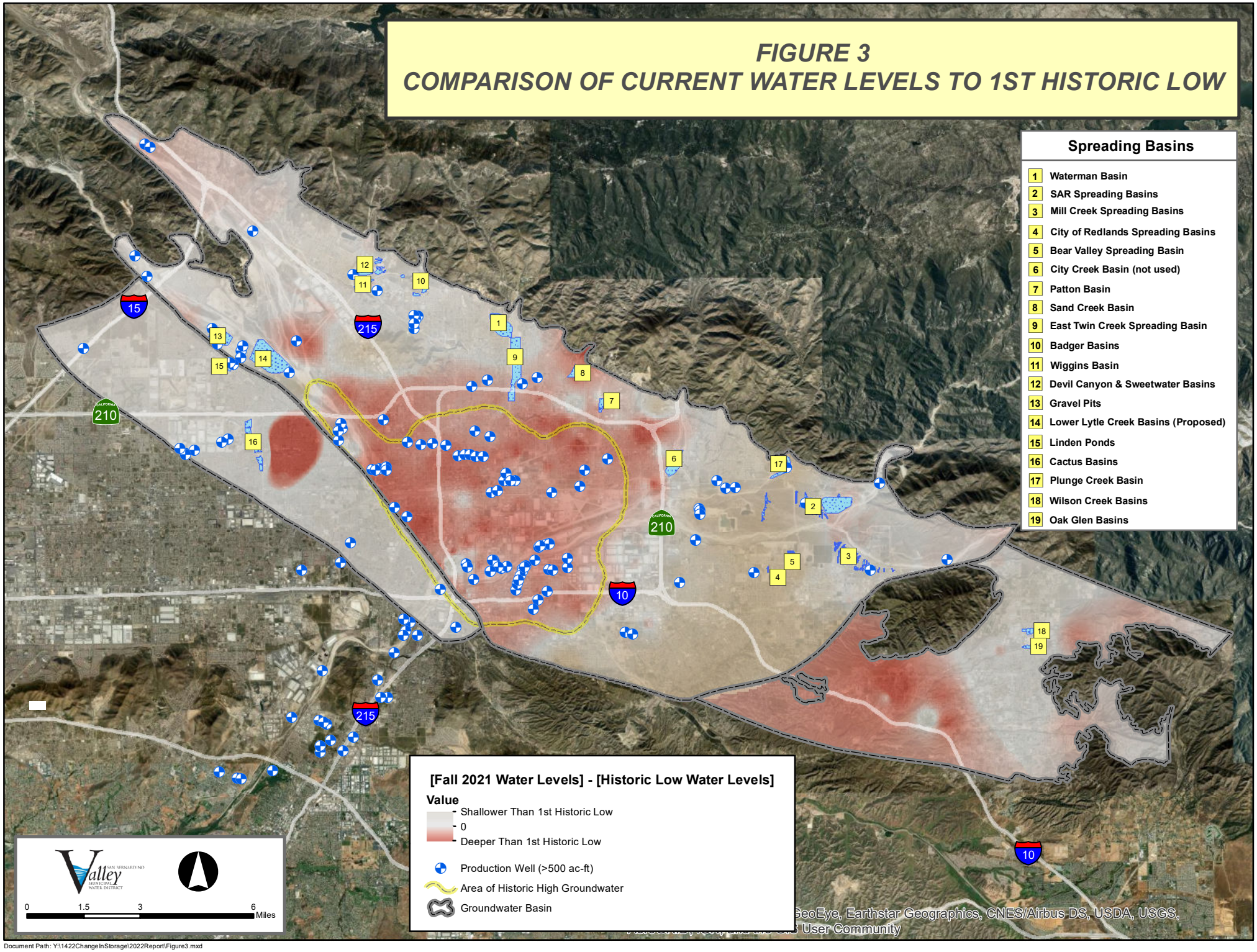

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Figure 4 Comparison of DWR, SBVWCD, USGS and SBVMWD San Bernardino Basin Change in Storage Results

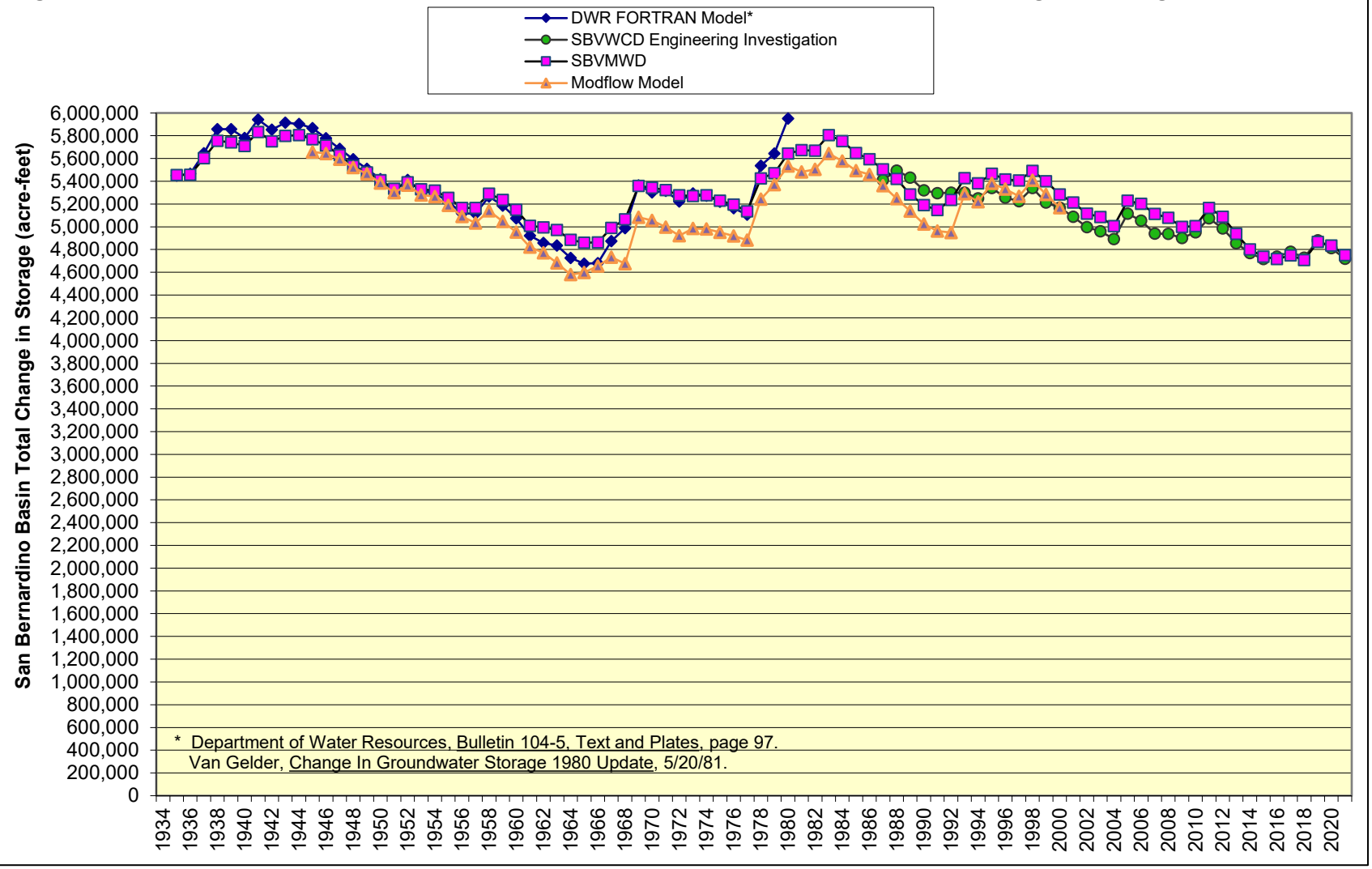


Figure 5. Rialto-Colton Basin Change in Storage Results (acre-feet)

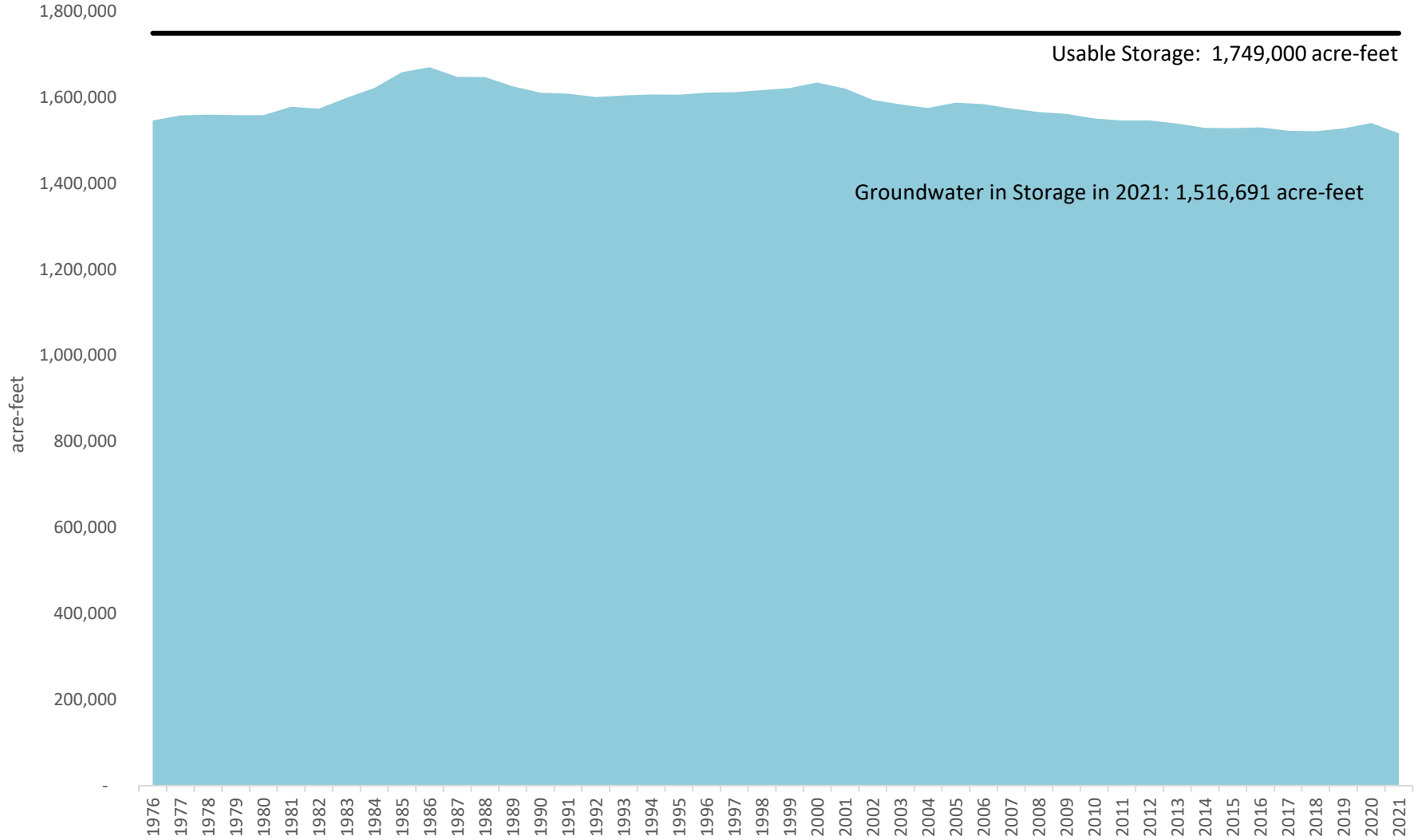


Figure 6. Yucaipa Basin Change in Storage Results (acre-feet)

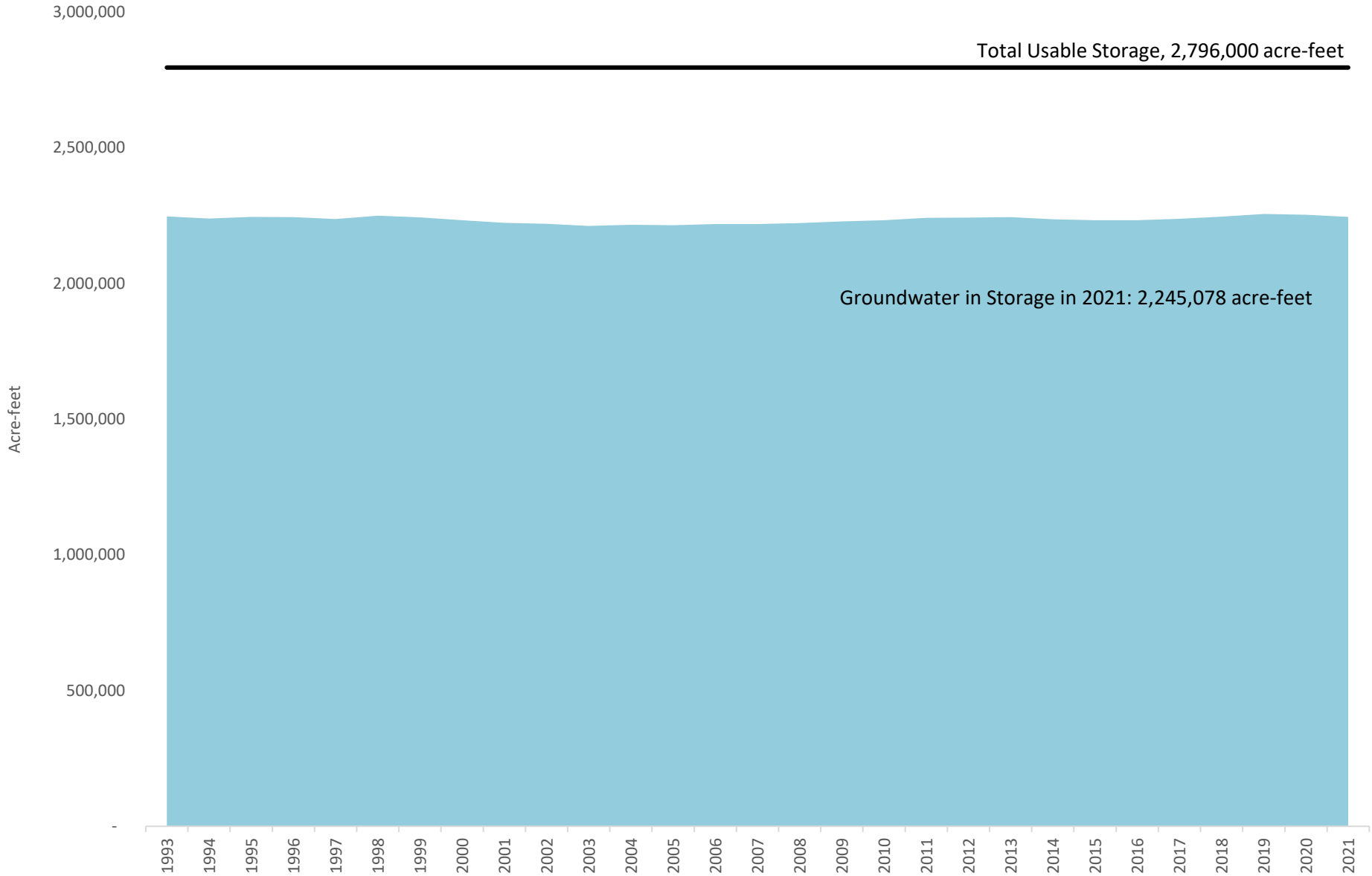
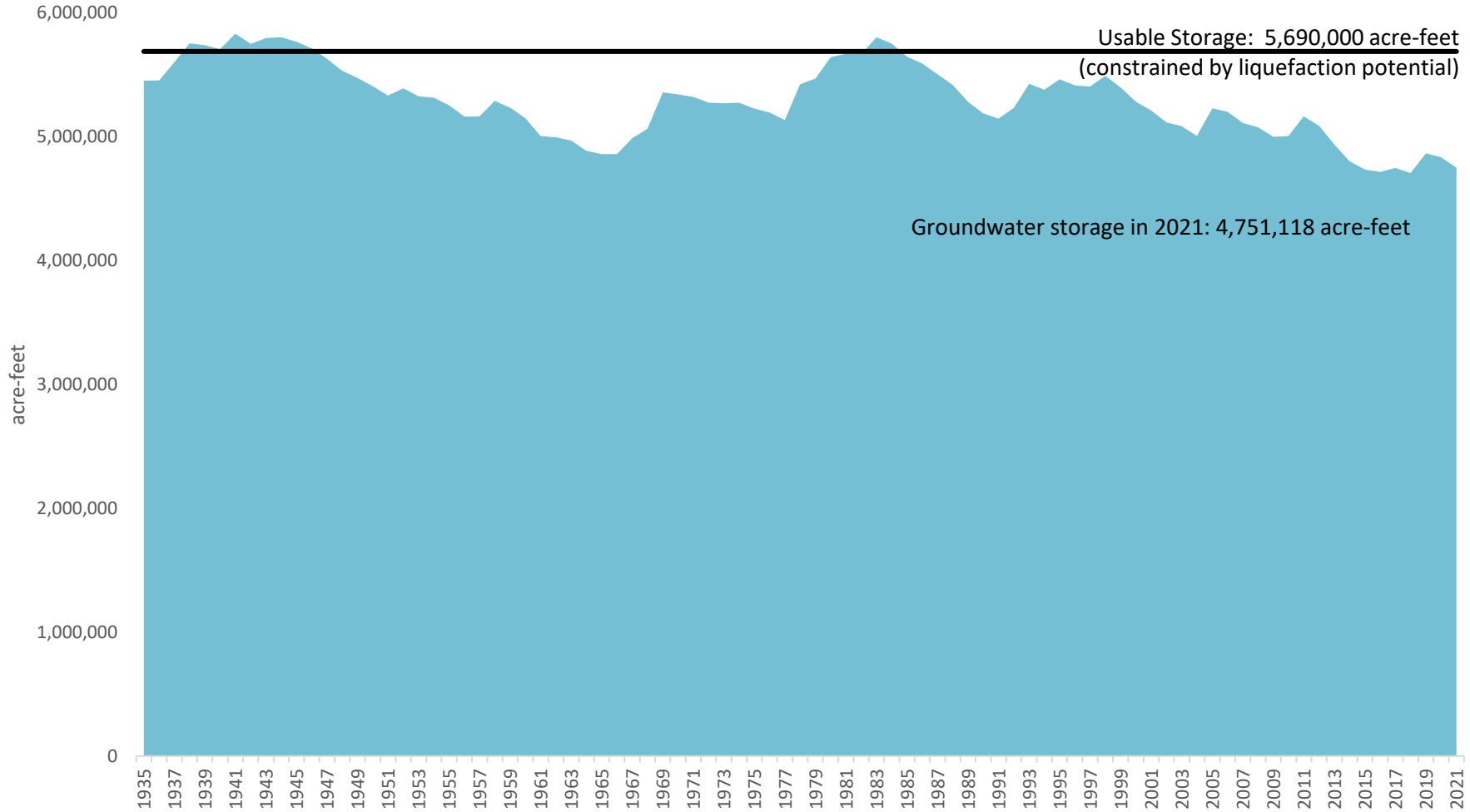


Figure 7. San Bernardino Basin Change in Storage Results (acre-feet)



The calculations in the SBB and Yucaipa are performed for each individual sub-basin. The increase or decrease of individual sub-basin change in storage values are influenced by a variety of factors such as local precipitation, groundwater production, groundwater recharge, proximity to river and creeks, and water conservation.

Figure 8. 2021 Change in Storage for the San Bernardino Basin, by sub-basin.

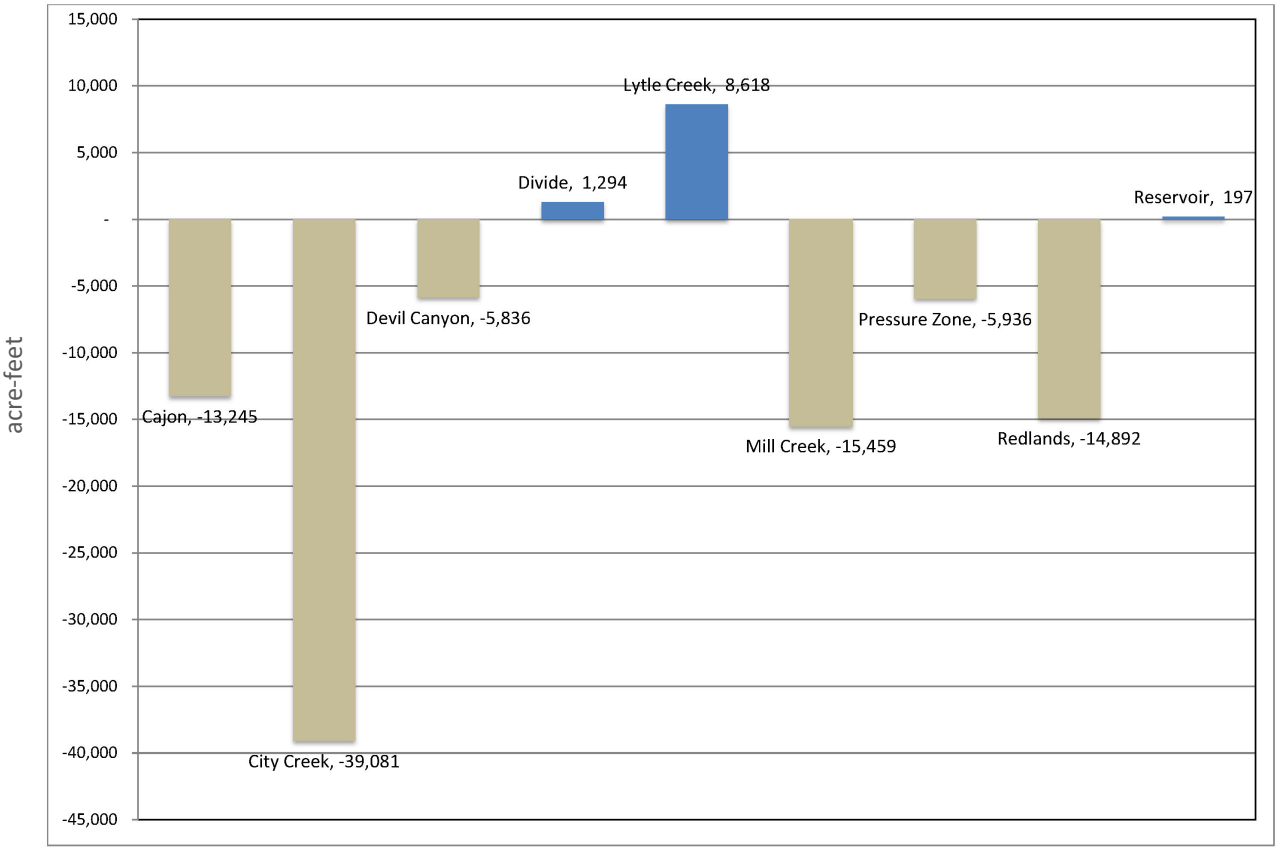
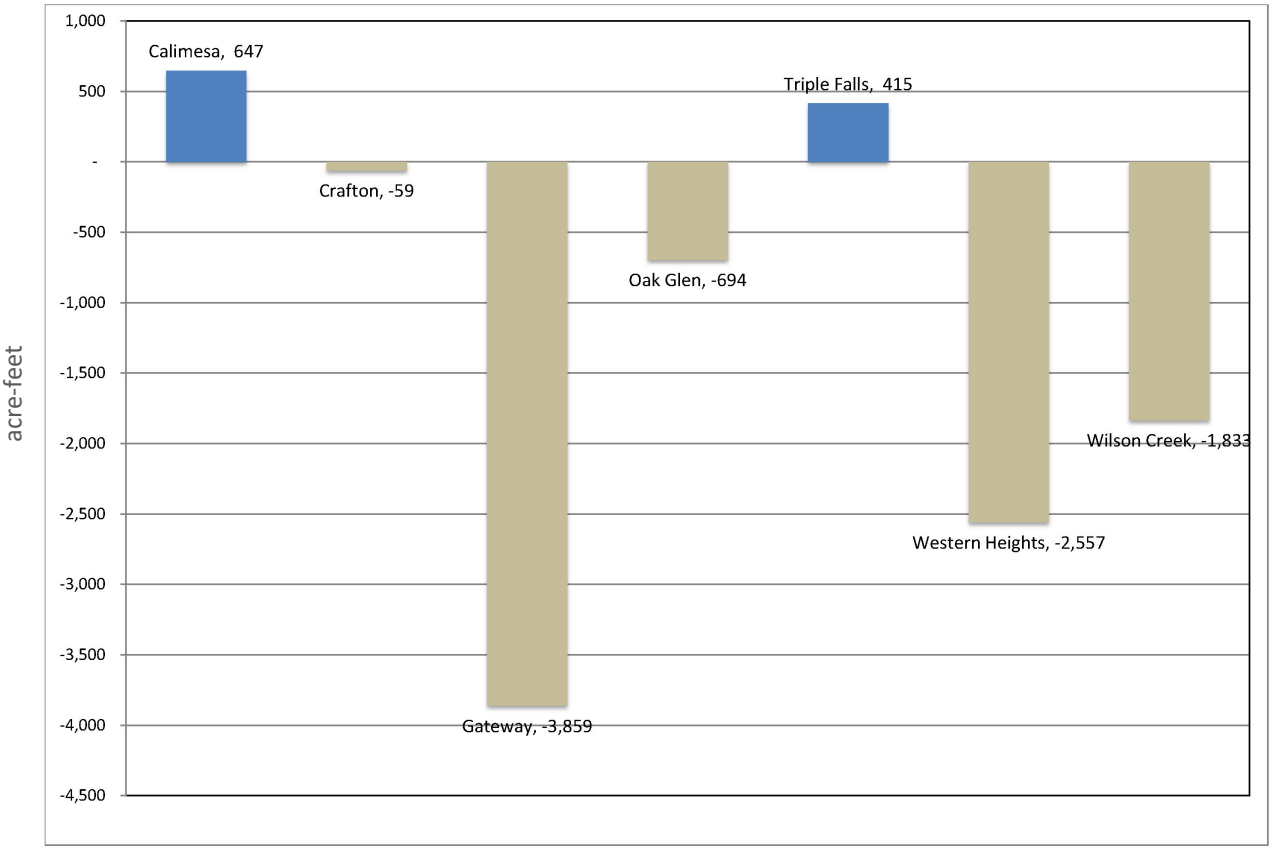


Figure 9. 2021 Change in Storage for the Yucaipa Basin, by sub-basin.



New for 2022

The following table summarizes the new content or changes made to the Change in Storage Report Plan last year:

New Content/Change	Purpose
Water levels for specific wells were estimated due to obstructions while measuring	Water Levels were estimated for the following wells: YVWD Wells 10 & 50 (unable to sound); City of Redlands Wells Mentone Acres, BV Judson, Lee, #32 (being rehabbed); EVWD Wells 6, 30 & 54; USGS Backyard & Valley College Wells
Triple Falls subbasin in the Yucaipa Basin was removed from the CIS report	YVWD Well 51 location was updated to be located in the San Bernardino Basin. YVWD Well 51 was the only well to calculate the CIS in the Triple Falls subbasin.

2. Bibliography

1) Basin Groundwater Storage Data, San Bernardino Valley Municipal Water District library call number GB 1025, C2 S26, 1934 – 1990.

2) Department of Water Resources (DWR), Meeting Water Demands in the Bunker Hill - San Timoteo Area, Geology, Hydrology, and Operation—Economics Studies, Text and Plates, February 1971.

3) Final Statement, 2011 Regional Water Management Plan, Basin Technical Advisory Committee, September 2011.

4) Motokane, Earl S., "Evaluation of the Base Period for the Bunker Hill-San Timoteo Area Investigation". Meeting Water Demands in the Bunker Hill - San Timoteo Area, Geology, Hydrology, and Operation—Economics Studies, Text and Plates, February 1971, pp. 123 – 129.

5) Olson, L.J. and Stig J. Johanson, "Specific Yield and Storage Determination". Meeting Water Demands in the Bunker Hill - San Timoteo Area, Geology, Hydrology, and Operation—Economics Studies, Text and Plates, February 1971.

6) San Bernardino Valley Water Conservation District (SBVWCD), Engineering Investigation of the Bunker Hill Basin, 2011-2012, March 2012.

7) Southern California Earthquake Center (SCEC), University of Southern California. Recommended Procedures for Implementation of DMG Special Publication 117 Guidelines for Analyzing and Mitigating Liquefaction Hazards in California, March 1999.

8) TRW, Incorporated. Simulation Program for Planned Utilization of the San Bernardino Valley and Riverside Ground Water Basins, Second Report, Report No. 07143-6001-R000, October 1967.

9) Utah Geological Survey web site (UGS):
http://geology.utah.gov/utahgeo/hazards/liquefy.htm

10) University of Washington (UW) web site:
http://www.ce.washington.edu/~liquefaction/html/what/what1.html

11) Van Gelder, Randy, Change in Groundwater Storage 1980 Update, May 20, 1981.

12) Western San Bernardino Watermaster (Watermaster), Annual Report of the Western-San Bernardino Watermaster for Calendar Year 1997, August 1, 2001.

APPENDIX

Change in Groundwater Storage Data for the San Bernardino Basin, Yucaipa Basin and Rialto-Colton Basin.

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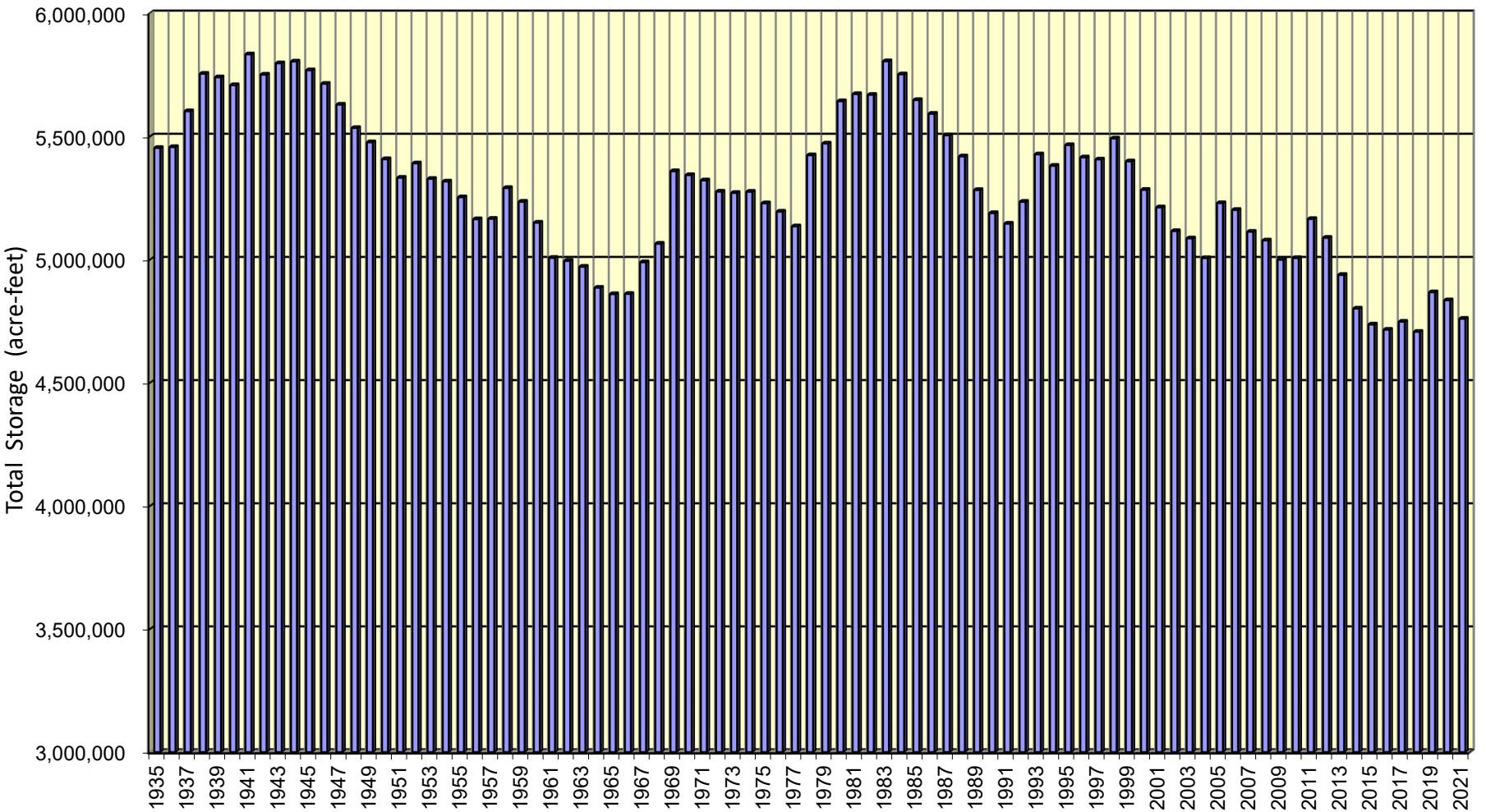
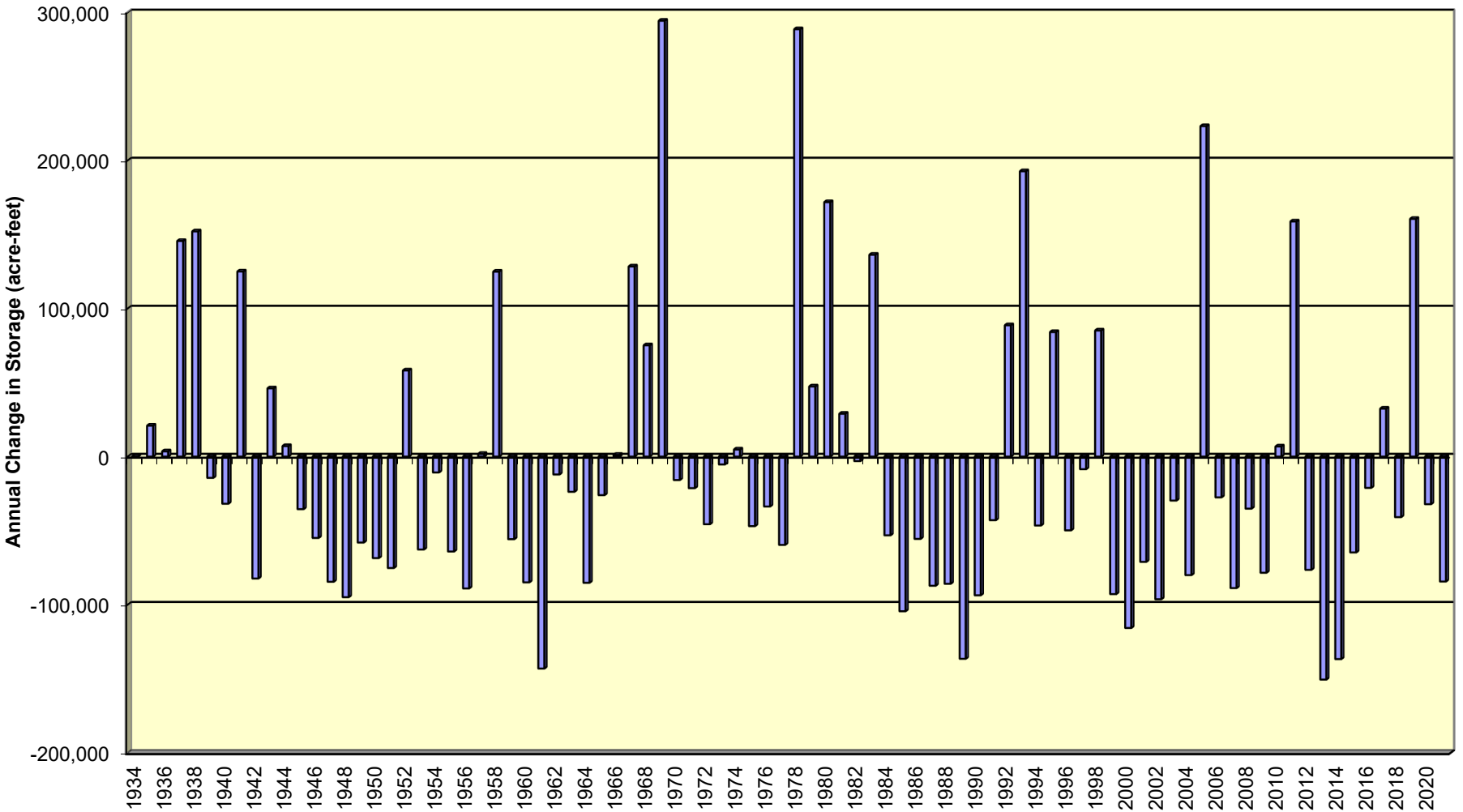
Total Storage for the San Bernardino Basin Area



Annual Change in Storage for the San Bernardino Basin Area



San Bernardino Valley Municipal Water District

Change In Storage for the San Bernardino Basin Area 1934 - Present

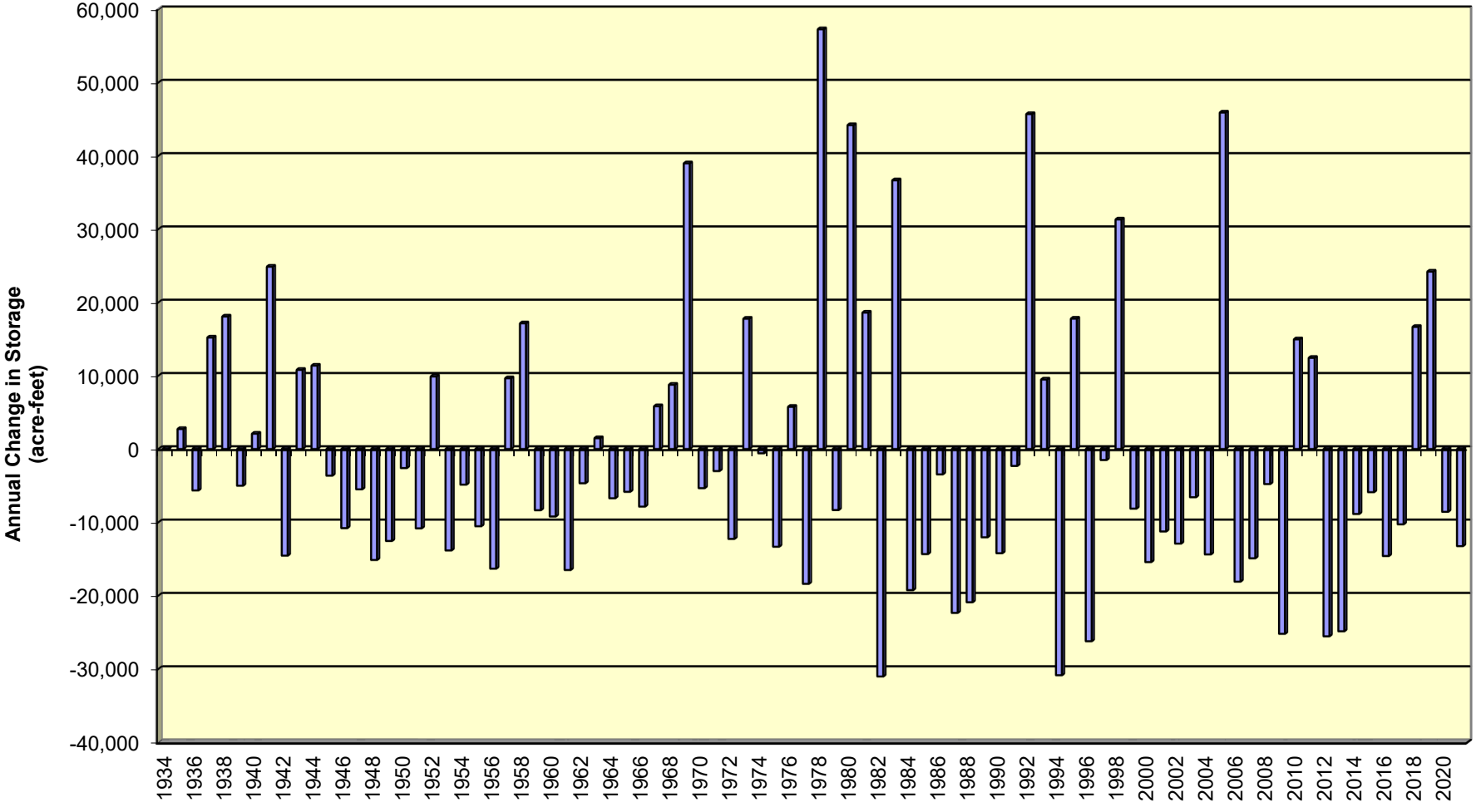
(1) Year	(2) Basin Index (ft.)	(3) Annual Change in Groundwater Storage (acre-feet)	(4) Cummulative Change in Groundwater Storage (acre-feet)
1934	n/a	n/a	0
1935	6	20,870	20,870
1936	2	3,523	24,393
1937	23	145,589	169,982
1938	22	152,096	322,078
1939	3	-14,377	307,701
1940	-5	-31,859	275,842
1941	17	125,012	400,854
1942	-11	-82,317	318,537
1943	7	46,073	364,610
1944	0	7,091	371,701
1945	-5	-35,507	336,194
1946	-9	-54,920	281,274
1947	-12	-84,528	196,746
1948	-16	-94,909	101,837
1949	-9	-58,045	43,792
1950	-13	-68,538	-24,746
1951	-12	-75,214	-99,960
1952	11	58,167	-41,793
1953	-7	-62,735	-104,528
1954	1	-10,727	-115,255
1955	-10	-64,100	-179,355
1956	-14	-89,030	-268,385
1957	0	1,777	-266,608
1958	20	124,903	-141,705
1959	-8	-55,773	-197,478
1960	-13	-84,913	-282,391
1961	-18	-143,069	-425,460
1962	4	-12,103	-437,563
1963	-6	-23,803	-461,366
1964	-12	-85,205	-546,571
1965	0	-26,059	-572,630
1966	4	1,190	-571,440
1967	19	128,403	-443,037
1968	9	75,169	-367,868
1969	39	294,367	-73,501
1970	2	-15,864	-89,365
1971	-4	-21,340	-110,705
1972	-7	-45,689	-156,394
1973	1	-5,303	-161,697
1974	1	4,776	-156,921
1975	-5	-46,965	-203,886
1976	-6	-33,740	-237,626
1977	-9	-59,633	-297,259
1978	38	288,634	-8,625
1979	5	47,368	38,743
1980	21	171,822	210,565
1981	2	28,937	239,502

San Bernardino Valley Municipal Water District

Change In Storage for the San Bernardino Basin Area 1934 - Present

(1) Year	(2) Basin Index (ft.)	(3) Annual Change in Groundwater Storage (acre-feet)	(4) Cummulative Change in Groundwater Storage (acre-feet)
1982	4	-3,042	236,460
1983	16	136,343	372,803
1984	-7	-53,164	319,639
1985	-13	-104,413	215,226
1986	-8	-55,577	159,649
1987	-12	-87,184	72,465
1988	-13	-85,879	-13,414
1989	-16	-136,477	-149,891
1990	-13	-93,632	-243,523
1991	0	-42,951	-286,474
1992	11	88,692	-197,782
1993	30	192,725	-5,057
1994	-6	-46,564	-51,621
1995	13	84,107	32,486
1996	-3	-49,809	-17,323
1997	-4	-8,523	-25,846
1998	4	85,136	59,290
1999	-10	-92,827	-33,537
2000	-13	-115,680	-149,217
2001	-11	-71,069	-220,286
2002	-15	-96,300	-316,586
2003	-6	-29,706	-346,292
2004	-8	-80,017	-426,309
2005	33	223,178	-203,131
2006	-2	-27,539	-230,670
2007	-14	-88,767	-319,437
2008	-4	-35,158	-354,595
2009	-16	-78,417	-433,012
2010	7	6,803	-426,209
2011	18	158,805	-267,404
2012	-13	-76,469	-343,873
2013	-22	-150,503	-494,376
2014	-11	-136,683	-631,059
2015	-9	-64,702	-695,761
2016	-1	-21,154	-716,915
2017	4	32,381	-684,534
2018	-6	-40,905	-725,439
2019	23	160,522	-564,917
2020	-4	-32,174	-597,091
2021	-9	-84,340	-681,431

Annual Change in Storage for the Cajon Sub-Basin



San Bernardino Valley Municipal Water District

Change In Storage for the Cajon Sub-basin 1934 - Present

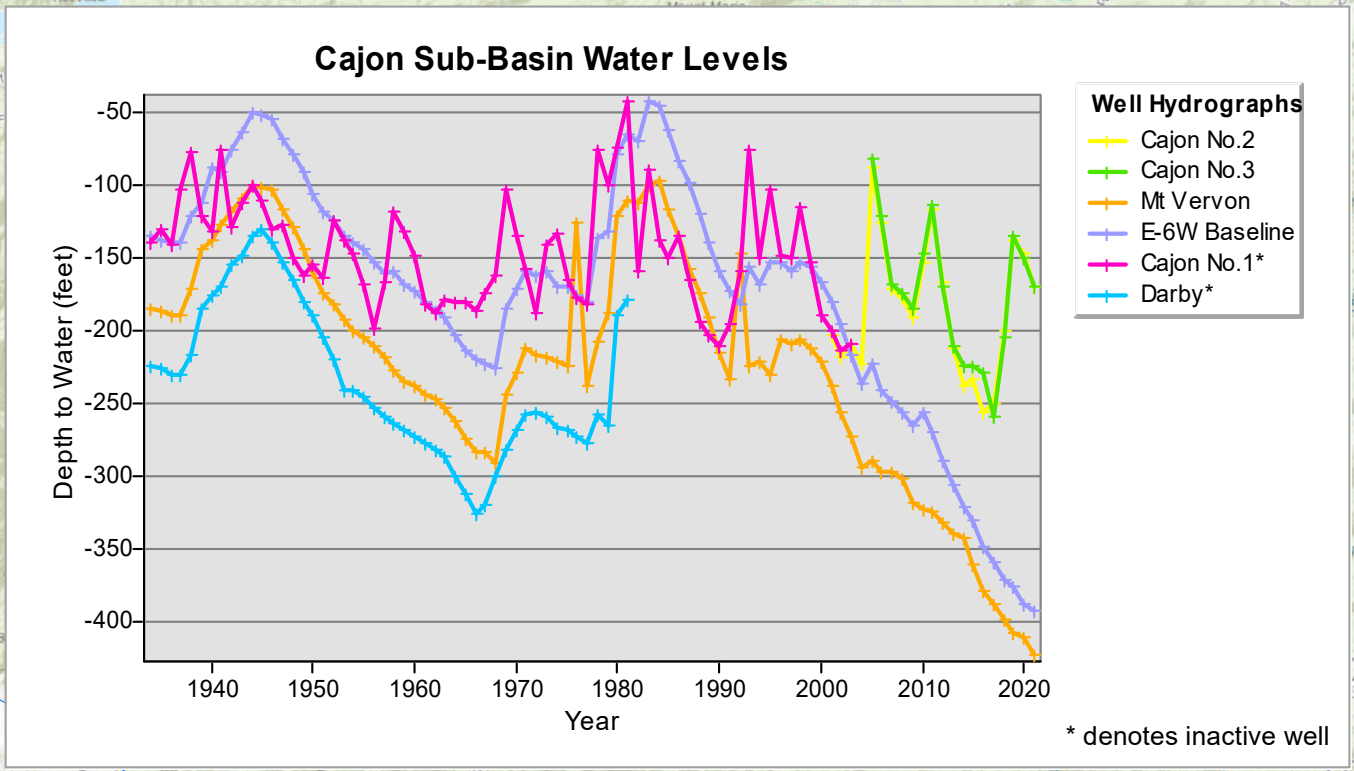
(1) Year	(2) Basin Index (ft.)	(3) Annual Change in Groundwater Storage (acre-feet)	(4) Cummulative Change in Groundwater Storage (acre-feet)
1934	0	n/a	0
1935	1	2,727	2,727
1936	-5	-5,653	-2,926
1937	10	15,215	12,289
1938	19	18,080	30,369
1939	6	-5,005	25,364
1940	8	2,091	27,455
1941	17	24,881	52,336
1942	-4	-14,541	37,795
1943	11	10,803	48,598
1944	12	11,376	59,974
1945	-3	-3,632	56,342
1946	-8	-10,790	45,552
1947	-9	-5,498	40,054
1948	-15	-15,133	24,921
1949	-14	-12,542	12,379
1950	-7	-2,595	9,784
1951	-13	-10,817	-1,033
1952	2	9,903	8,870
1953	-14	-13,833	-4,963
1954	-5	-4,860	-9,823
1955	-9	-10,534	-20,357
1956	-14	-16,316	-36,673
1957	3	9,655	-27,018
1958	9	17,153	-9,865
1959	-9	-8,349	-18,214
1960	-8	-9,204	-27,418
1961	-13	-16,502	-43,920
1962	-5	-4,666	-48,586
1963	-1	1,479	-47,107
1964	-9	-6,714	-53,821
1965	-8	-5,836	-59,657
1966	-9	-7,858	-67,515
1967	4	5,840	-61,675
1968	6	8,771	-52,904
1969	41	38,982	-13,922
1970	3	-5,336	-19,258
1971	4	-3,004	-22,262
1972	-9	-12,262	-34,524
1973	11	17,783	-16,741
1974	-3	-579	-17,320
1975	-9	-13,326	-30,646
1976	19	5,760	-24,886
1977	-32	-18,387	-43,273
1978	51	57,276	14,003
1979	-2	-8,324	5,679
1980	55	44,197	49,876
1981	17	18,611	68,487

San Bernardino Valley Municipal Water District

Change In Storage for the Cajon Sub-basin 1934 - Present

(1) Year	(2) Basin Index (ft.)	(3) Annual Change in Groundwater Storage (acre-feet)	(4) Cummulative Change in Groundwater Storage (acre-feet)
1982	-15	-31,017	37,470
1983	36	36,661	74,131
1984	-16	-19,249	54,882
1985	-16	-14,328	40,554
1986	-9	-3,458	37,096
1987	-22	-22,350	14,746
1988	-22	-20,895	-6,149
1989	-15	-12,038	-18,187
1990	-17	-14,210	-32,397
1991	-6	-2,305	-34,702
1992	38	45,699	10,997
1993	10	9,487	20,484
1994	-27	-30,849	-10,365
1995	17	17,786	7,421
1996	-7	-26,213	-18,792
1997	-3	-1,497	-20,289
1998	14	31,321	11,032
1999	7	-8,134	2,898
2000	-14	-15,417	-12,519
2001	-16	-11,244	-23,763
2002	-13	-12,902	-36,665
2003	-5	-6,578	-43,243
2004	-11	-14,377	-57,620
2005	61	45,908	-11,712
2006	-23	-18,090	-29,802
2007	-22	-14,901	-44,703
2008	-5	-4,780	-49,483
2009	-41	-25,204	-74,687
2010	20	14,969	-59,718
2011	13	12,439	-47,279
2012	-33	-25,541	-72,820
2013	-27	-24,855	-97,675
2014	-15	-8,858	-106,533
2015	-5	-5,889	-112,422
2016	-16	-14,595	-127,017
2017	-12	-10,269	-137,286
2018	21	16,661	-120,625
2019	30	24,209	-96,416
2020	-10	-8,563	-104,979
2021	-13	-13,245	-118,224

Cajon Sub-Basin & Wells



CAJON NO 3

CAJON NO 2

MT VERNON WELL

E-6W BASELINE

0 0.5 1 2 Miles

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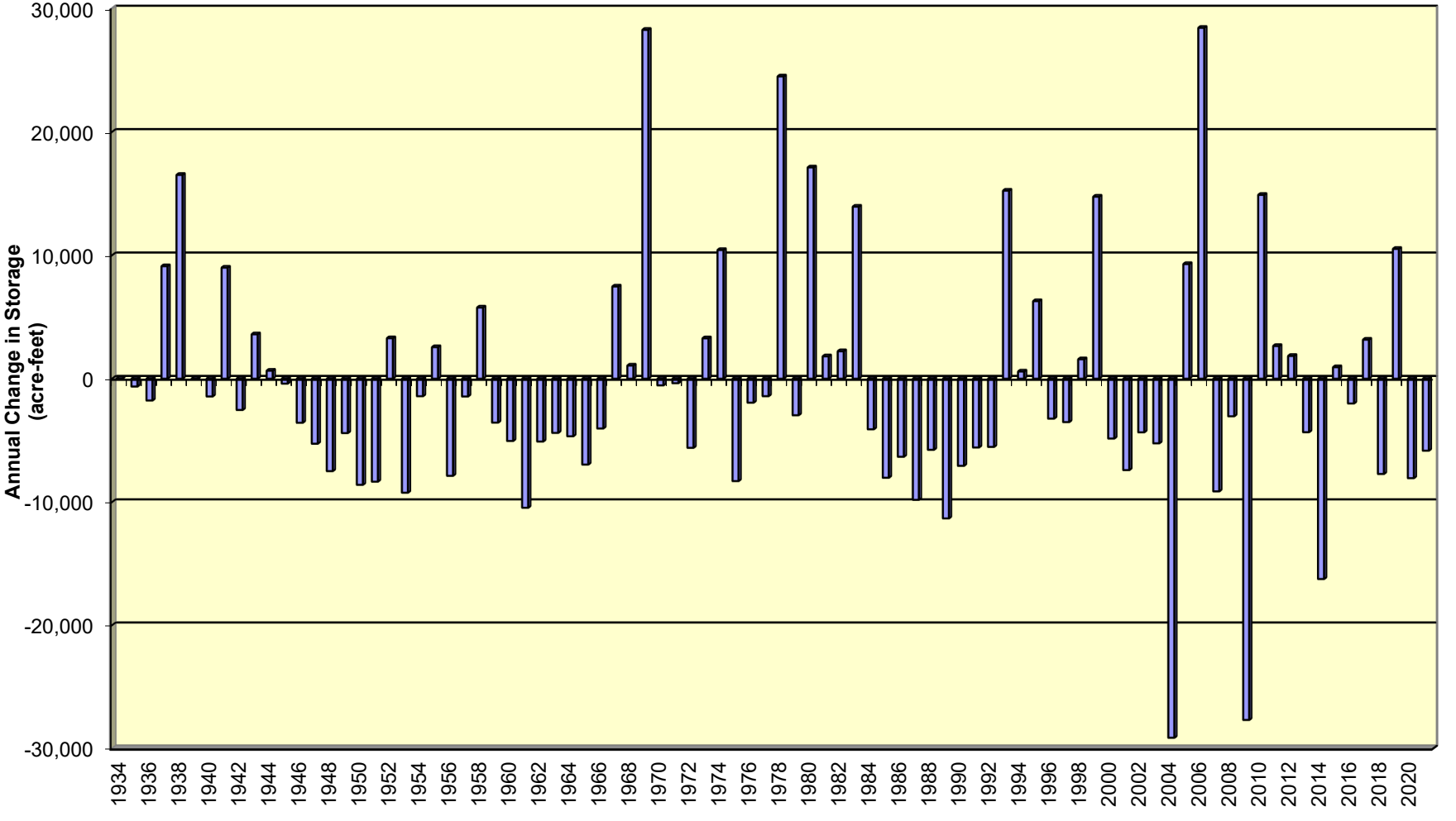
Annual Change in Storage for the Devil Canyon Sub-Basin



San Bernardino Valley Municipal Water District

Change In Storage for the Devil Canyon Sub-basin 1934 - Present

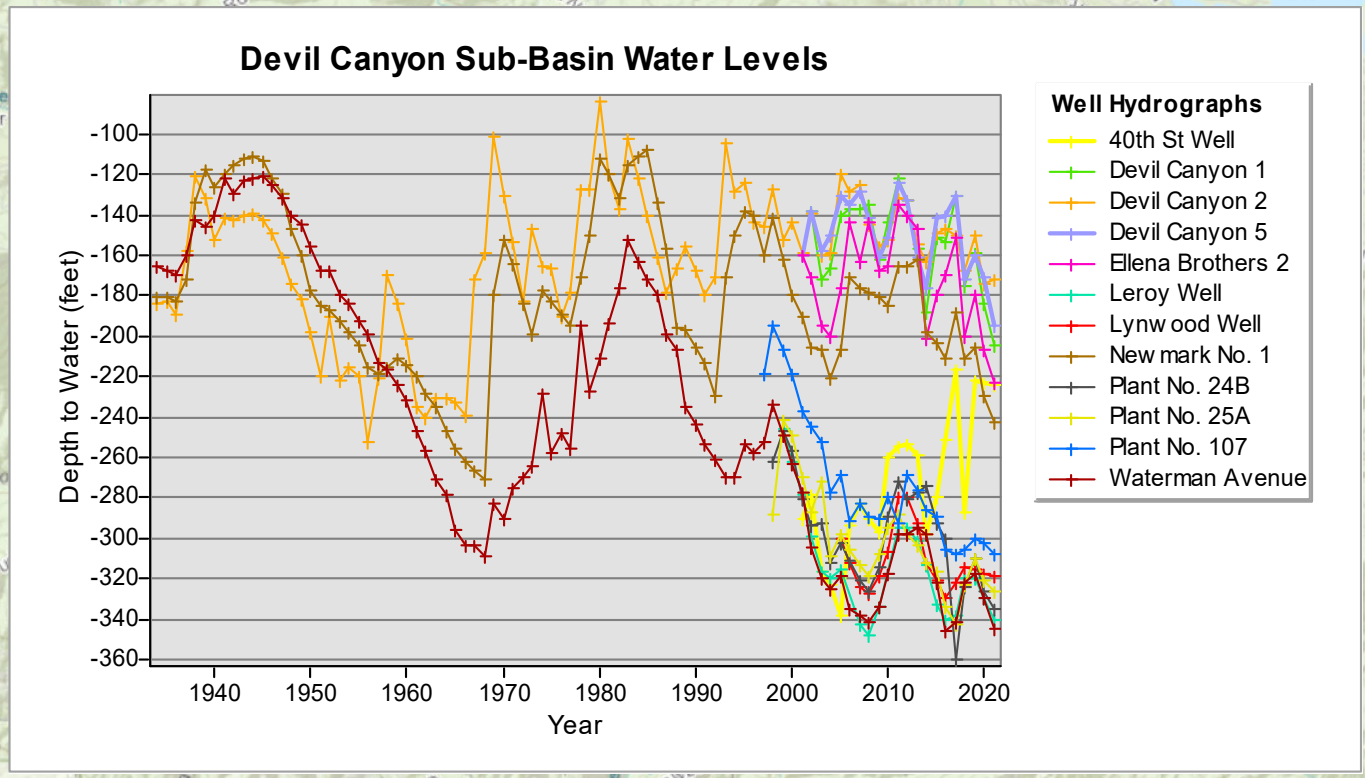
(1) Year	(2) Basin Index (ft.)	(3) Annual Change in Groundwater Storage (acre-feet)	(4) Cummulative Change in Groundwater Storage (acre-feet)
1934	0	n/a	0
1935	0	-635	-635
1936	-3	-1,769	-2,404
1937	17	9,114	6,710
1938	31	16,514	23,224
1939	1	-45	23,179
1940	-8	-1,440	21,739
1941	12	8,997	30,736
1942	-2	-2,536	28,200
1943	5	3,596	31,796
1944	1	646	32,442
1945	-2	-399	32,043
1946	-6	-3,572	28,471
1947	-9	-5,269	23,202
1948	-13	-7,490	15,712
1949	-8	-4,409	11,303
1950	-15	-8,602	2,701
1951	-14	-8,346	-5,645
1952	9	3,277	-2,368
1953	-17	-9,239	-11,607
1954	-1	-1,422	-13,029
1955	9	2,555	-10,474
1956	-14	-7,872	-18,346
1957	1	-1,442	-19,788
1958	13	5,764	-14,024
1959	-6	-3,562	-17,586
1960	-8	-5,048	-22,634
1961	-17	-10,460	-33,094
1962	-8	-5,093	-38,187
1963	-5	-4,393	-42,580
1964	-7	-4,666	-47,246
1965	-10	-6,959	-54,205
1966	-6	-4,037	-58,242
1967	16	7,468	-50,774
1968	3	1,062	-49,712
1969	47	28,267	-21,445
1970	-2	-542	-21,987
1971	-4	-364	-22,351
1972	-12	-5,604	-27,955
1973	7	3,270	-24,685
1974	12	10,425	-14,260
1975	-10	-8,298	-22,558
1976	-6	-1,945	-24,503
1977	-1	-1,418	-25,921
1978	36	24,493	-1,428
1979	-1	-2,963	-4,391
1980	29	17,117	12,726
1981	-1	1,812	14,538

San Bernardino Valley Municipal Water District

Change In Storage for the Devil Canyon Sub-basin 1934 - Present

(1) Year	(2) Basin Index (ft.)	(3) Annual Change in Groundwater Storage (acre-feet)	(4) Cummulative Change in Groundwater Storage (acre-feet)
1982	1	2,224	16,762
1983	22	13,938	30,700
1984	-7	-4,102	26,598
1985	-13	-8,029	18,569
1986	-11	-6,328	12,241
1987	-15	-9,819	2,422
1988	-8	-5,764	-3,342
1989	-15	-11,326	-14,668
1990	-11	-7,063	-21,731
1991	-9	-5,576	-27,307
1992	-8	-5,528	-32,835
1993	30	15,236	-17,599
1994	0	579	-17,020
1995	9	6,283	-10,737
1996	-6	-3,236	-13,973
1997	-10	-3,519	-17,492
1998	-12	1,572	-15,920
1999	13	14,749	-1,171
2000	-9	-4,853	-6,024
2001	-11	-7,407	-13,431
2002	-1	-4,345	-17,776
2003	-13	-5,237	-23,013
2004	-20	-29,138	-52,151
2005	8	9,289	-42,862
2006	21	28,432	-14,430
2007	-11	-9,131	-23,561
2008	-3	-3,047	-26,608
2009	-20	-27,693	-54,301
2010	20	14,894	-39,407
2011	10	2,648	-36,759
2012	-2	1,844	-34,915
2013	-9	-4,336	-39,251
2014	-20	-16,248	-55,499
2015	4	929	-54,570
2016	-4	-2,011	-56,581
2017	4	3,160	-53,421
2018	-12	-7,723	-61,144
2019	14	10,517	-50,627
2020	-13	-8,063	-58,690
2021	-8	-5,836	-64,526

Devil Canyon Sub-Basin & Wells



Devil Canyon Well No. 2
Devil Canyon Well No. 5
Devil Canyon Well No. 1
Ellena Brothers Well No. 2
Newmark No. 1
40th St Well
Leroy Well
Waterman Avenue
Lynwood Well
Plant No. 25A
Plant No. 24B
Plant No. 107

0 0.5 1 2 Miles

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

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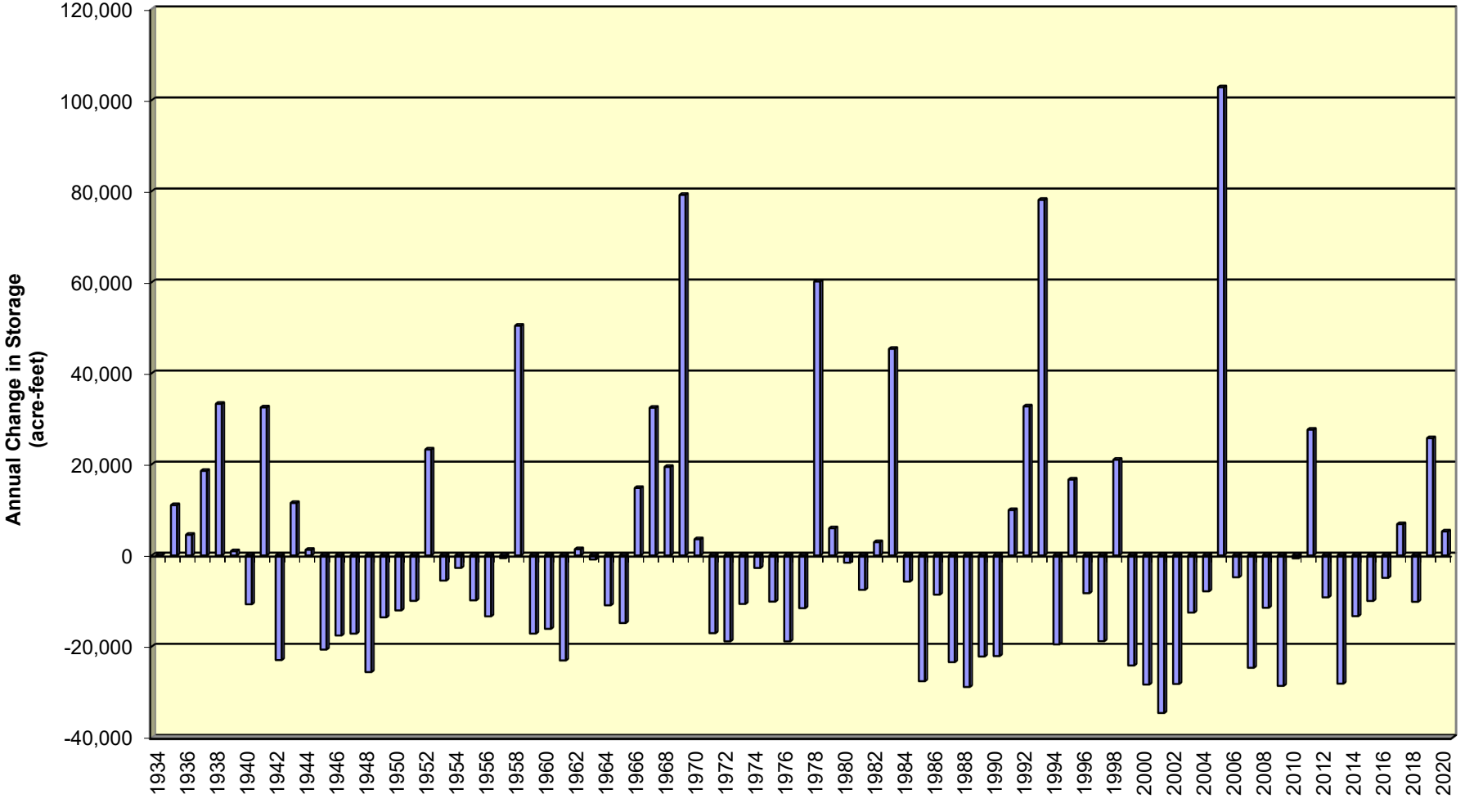
Annual Change in Storage for the Lytle Creek Sub-Basin



San Bernardino Valley Municipal Water District

Change In Storage for the Lytle Creek Sub-basin 1934 - Present

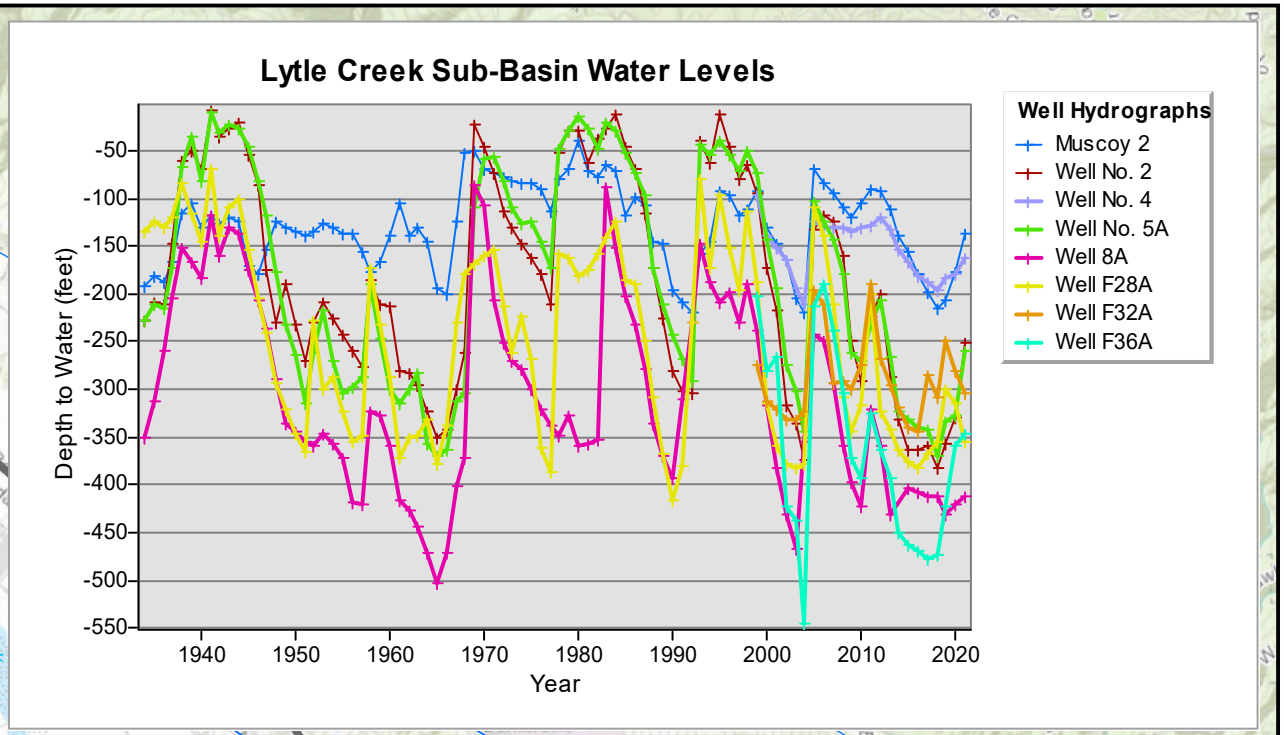
(1) Year	(2) Basin Index (ft.)	(3) Annual Change in Groundwater Storage (acre-feet)	(4) Cummulative Change in Groundwater Storage (acre-feet)
1934	0	n/a	0
1935	16	11,039	11,039
1936	3	4,524	15,563
1937	30	18,561	34,124
1938	62	33,297	67,421
1939	9	926	68,347
1940	-18	-10,717	57,630
1941	50	32,509	90,139
1942	-32	-22,956	67,183
1943	15	11,515	78,698
1944	2	1,224	79,922
1945	-32	-20,656	59,266
1946	-27	-17,567	41,699
1947	-27	-17,153	24,546
1948	-39	-25,594	-1,048
1949	-19	-13,579	-14,627
1950	-22	-12,057	-26,684
1951	-17	-9,964	-36,648
1952	30	23,256	-13,392
1953	-3	-5,523	-18,915
1954	-4	-2,738	-21,653
1955	-14	-9,853	-31,506
1956	-18	-13,361	-44,867
1957	-3	-596	-45,463
1958	68	50,451	4,988
1959	-26	-17,150	-12,162
1960	-22	-16,108	-28,270
1961	-28	-23,046	-51,316
1962	0	1,366	-49,950
1963	1	-885	-50,835
1964	-21	-10,938	-61,773
1965	-25	-14,831	-76,604
1966	18	14,805	-61,799
1967	53	32,429	-29,370
1968	33	19,431	-9,939
1969	129	79,194	69,255
1970	9	3,552	72,807
1971	-21	-17,053	55,754
1972	-27	-18,851	36,903
1973	-17	-10,643	26,260
1974	-7	-2,741	23,519
1975	-13	-10,131	13,388
1976	-26	-18,859	-5,471
1977	-20	-11,573	-17,044
1978	103	60,162	43,118
1979	10	5,964	49,082
1980	6	-1,588	47,494
1981	-18	-7,544	39,950

San Bernardino Valley Municipal Water District

Change In Storage for the Lytle Creek Sub-basin 1934 - Present

(1) Year	(2) Basin Index (ft.)	(3) Annual Change in Groundwater Storage (acre-feet)	(4) Cummulative Change in Groundwater Storage (acre-feet)
1982	1	2,912	42,862
1983	56	45,372	88,234
1984	-13	-5,730	82,504
1985	-38	-27,599	54,905
1986	-13	-8,602	46,303
1987	-36	-23,422	22,881
1988	-47	-28,867	-5,986
1989	-35	-22,178	-28,164
1990	-41	-22,083	-50,247
1991	5	9,959	-40,288
1992	35	32,721	-7,567
1993	139	78,106	70,539
1994	-21	-19,516	51,023
1995	30	16,655	67,678
1996	-13	-8,288	59,390
1997	-29	-18,815	40,575
1998	27	21,005	61,580
1999	-46	-24,144	37,436
2000	-57	-28,334	9,102
2001	-31	-34,576	-25,474
2002	-42	-28,205	-53,679
2003	-33	-12,542	-66,221
2004	-6	-7,866	-74,087
2005	153	102,835	28,748
2006	-9	-4,791	23,957
2007	-31	-24,651	-694
2008	-18	-11,482	-12,176
2009	-40	-28,620	-40,796
2010	0	-640	-41,436
2011	45	27,617	-13,819
2012	-27	-9,196	-23,015
2013	-38	-28,135	-51,150
2014	-4	-13,325	-64,475
2015	-17	-9,983	-74,458
2016	-9	-4,919	-79,377
2017	6	6,867	-72,510
2018	-12	-10,171	-82,681
2019	36	25,745	-56,936
2020	12	5,260	-51,676
2021	22	8,618	-43,058

Lytle Creek Sub-Basin & Wells



Well #32/F32A

Well #13/F36A

Well #3/F28A

Muscoy 2

Well No. 4

Well No. 2

Well No. 5A

Well 8A

0 0.5 1 2 Miles

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

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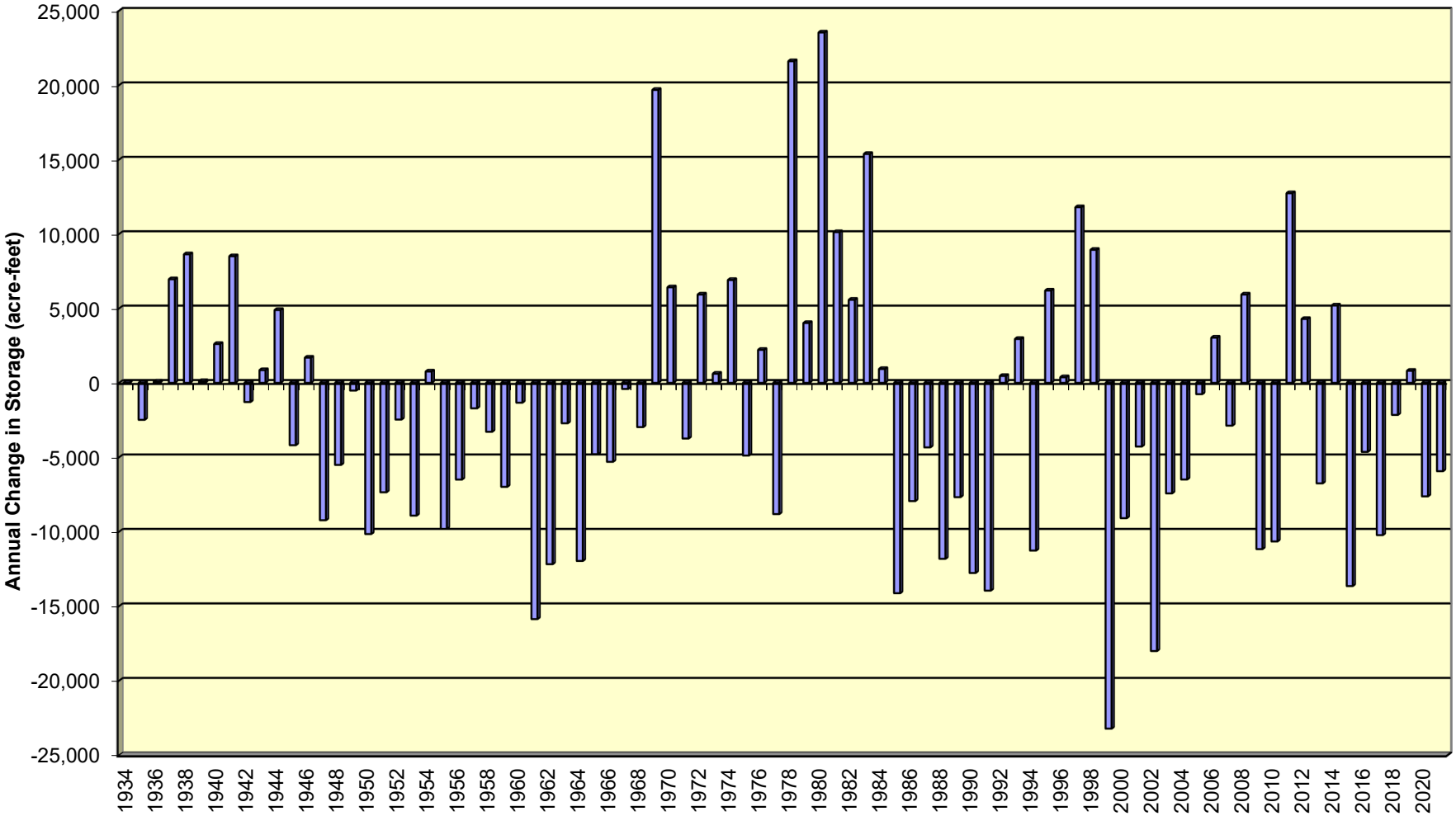
Annual Change in Storage for the Pressure Zone Sub-Basin



San Bernardino Valley Municipal Water District

Change In Storage for the Pressure Zone Sub-basin 1934 - Present

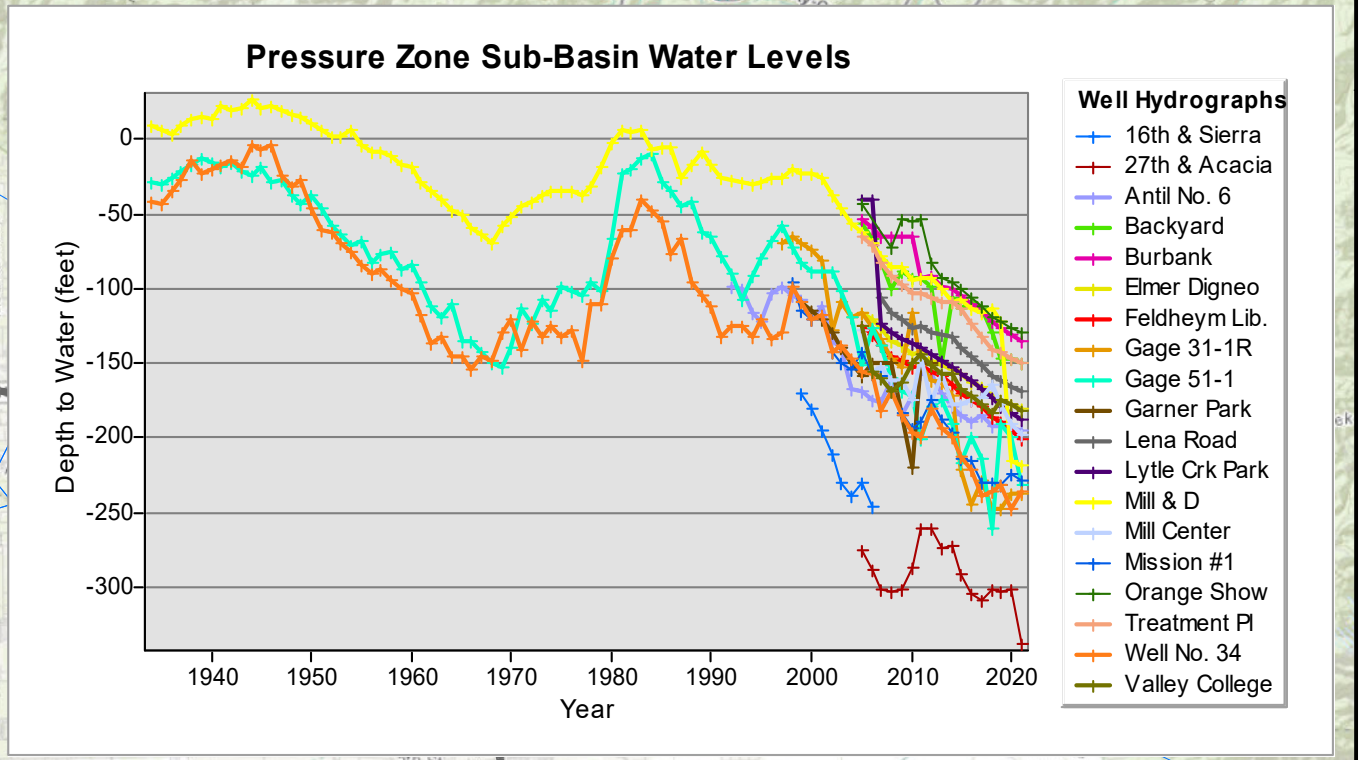
(1) Year	(2) Basin Index (ft.)	(3) Annual Change in Groundwater Storage (acre-feet)	(4) Cummulative Change in Groundwater Storage (acre-feet)
1934	0	n/a	0
1935	-3	-2,484	-2,484
1936	1	89	-2,395
1937	8	6,961	4,566
1938	9	8,638	13,204
1939	1	121	13,325
1940	2	2,610	15,935
1941	7	8,507	24,442
1942	-3	-1,289	23,153
1943	1	853	24,006
1944	6	4,893	28,899
1945	-6	-4,190	24,709
1946	3	1,694	26,403
1947	-11	-9,229	17,174
1948	-6	-5,514	11,660
1949	0	-519	11,141
1950	-7	-10,156	985
1951	-7	-7,354	-6,369
1952	-4	-2,467	-8,836
1953	-9	-8,921	-17,757
1954	2	763	-16,994
1955	-9	-9,810	-26,804
1956	-12	-6,500	-33,304
1957	1	-1,713	-35,017
1958	-5	-3,289	-38,306
1959	-9	-6,988	-45,294
1960	1	-1,334	-46,628
1961	-19	-15,866	-62,494
1962	-11	-12,182	-74,676
1963	-3	-2,718	-77,394
1964	-12	-11,963	-89,357
1965	-6	-4,795	-94,152
1966	-8	-5,307	-99,459
1967	-3	-412	-99,871
1968	-4	-2,972	-102,843
1969	20	19,683	-83,160
1970	6	6,418	-76,742
1971	1	-3,741	-80,483
1972	5	5,932	-74,551
1973	2	612	-73,939
1974	7	6,910	-67,029
1975	-2	-4,883	-71,912
1976	3	2,218	-69,694
1977	-9	-8,818	-78,512
1978	22	21,610	-56,902
1979	5	4,020	-52,882
1980	25	23,540	-29,342
1981	15	10,127	-19,215

San Bernardino Valley Municipal Water District

Change In Storage for the Pressure Zone Sub-basin 1934 - Present

(1) Year	(2) Basin Index (ft.)	(3) Annual Change in Groundwater Storage (acre-feet)	(4) Cummulative Change in Groundwater Storage (acre-feet)
1982	6	5,581	-13,634
1983	14	15,379	1,745
1984	1	930	2,675
1985	-15	-14,130	-11,455
1986	-13	-7,945	-19,400
1987	-3	-4,335	-23,735
1988	-8	-11,820	-35,555
1989	-9	-7,680	-43,235
1990	-13	-12,770	-56,005
1991	-13	-13,955	-69,960
1992	-1	463	-69,497
1993	0	2,947	-66,550
1994	-9	-11,268	-77,818
1995	5	6,202	-71,616
1996	9	376	-71,240
1997	6	11,802	-59,438
1998	4	8,938	-50,500
1999	-26	-23,219	-73,719
2000	-9	-9,093	-82,812
2001	-8	-4,280	-87,092
2002	-20	-18,009	-105,101
2003	-9	-7,427	-112,528
2004	-9	-6,495	-119,023
2005	-1	-762	-119,785
2006	1	3,037	-116,748
2007	-4	-2,876	-119,624
2008	-7	5,932	-113,692
2009	-10	-11,169	-124,861
2010	-2	-10,655	-135,516
2011	4	12,742	-122,774
2012	-2	4,292	-118,482
2013	0	-6,753	-125,235
2014	-3	5,195	-120,040
2015	-11	-13,648	-133,688
2016	-5	-4,638	-138,326
2017	-7	-10,231	-148,557
2018	-6	-2,155	-150,712
2019	0	810	-149,902
2020	-10	-7,629	-157,531
2021	-6	-5,936	-163,467

Pressure Zone Sub-Basin & Wells



27th/Acacia Well
16th Street and Sierra Way
Garner Park
Antil Well No. 6
Feldheym Library
Lena Road
Lytle Creek Park
Burbank Elementary
Mill & D
Valley College
Orange Show
Mill Center
Gage Well 31-1R
Backyard
Gage Well 51-1
Treatment Plant
34
Mission #1
Elmer Digneo Park

0 0.5 1 2 Miles

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

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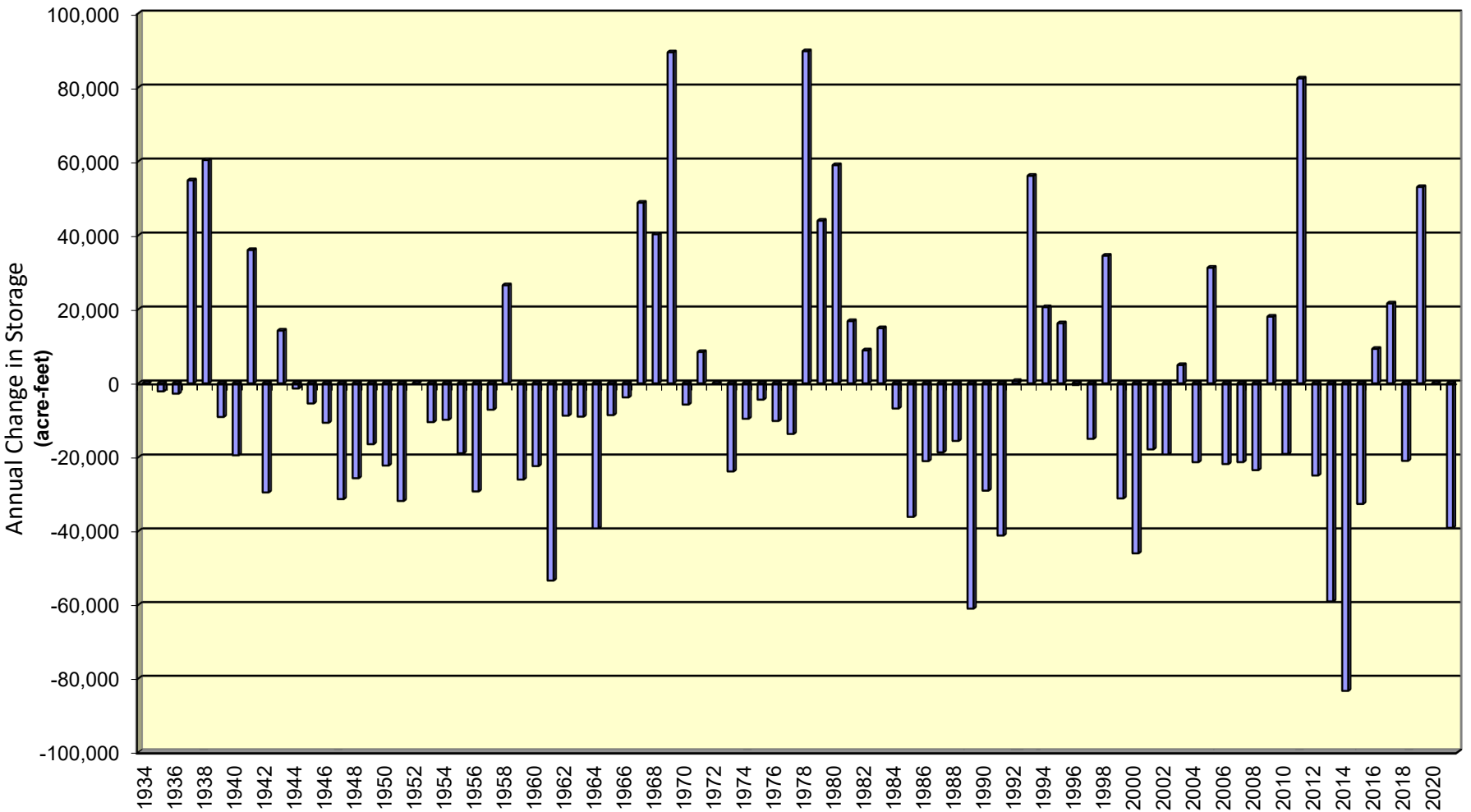
Annual Change in Storage for the City Creek Sub-Basin



San Bernardino Valley Municipal Water District

Change In Storage for the City Creek Sub-basin 1934 - Present

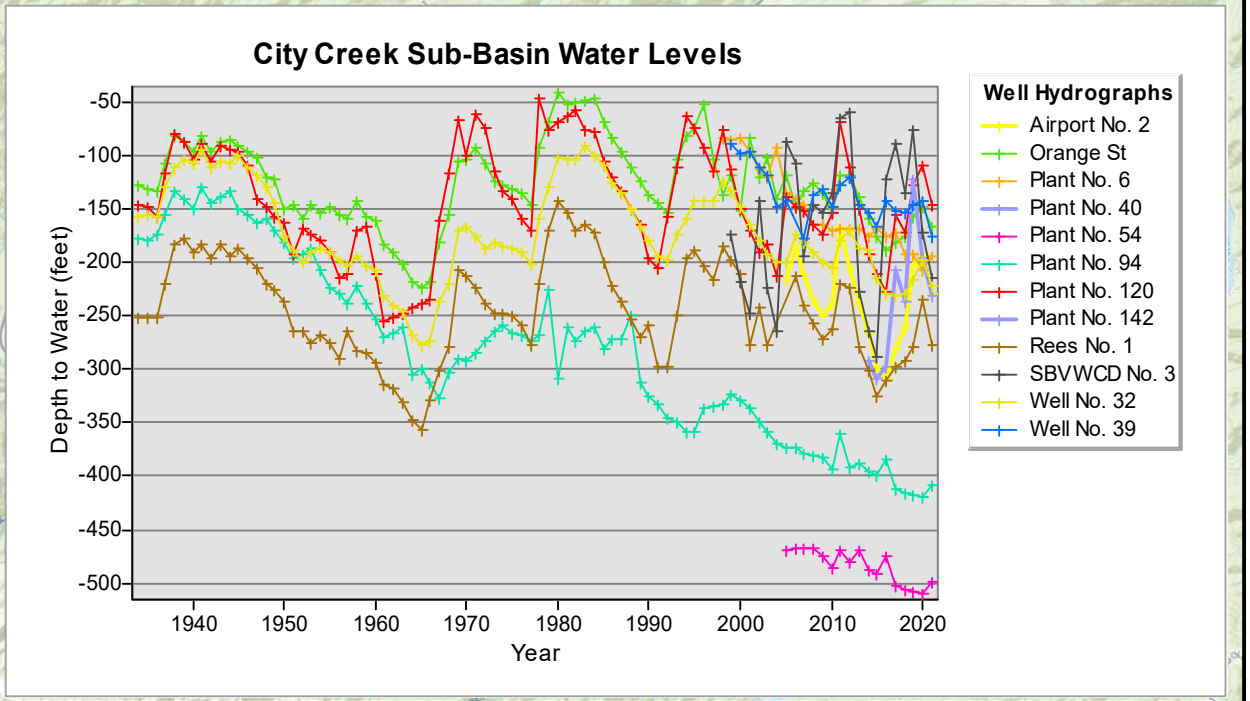
(1) Year	(2) Basin Index (ft.)	(3) Annual Change in Groundwater Storage (acre-feet)	(4) Cummulative Change in Groundwater Storage (acre-feet)
1934	0	n/a	0
1935	-1	-2,179	-2,179
1936	-1	-2,802	-4,981
1937	24	54,853	49,872
1938	26	60,340	110,212
1939	-3	-9,101	101,111
1940	-8	-19,467	81,644
1941	15	36,016	117,660
1942	-13	-29,496	88,164
1943	7	14,244	102,408
1944	-1	-1,406	101,002
1945	-2	-5,458	95,544
1946	-6	-10,667	84,877
1947	-12	-31,299	53,578
1948	-10	-25,663	27,915
1949	-7	-16,455	11,460
1950	-16	-22,241	-10,781
1951	-13	-31,812	-42,593
1952	-1	-21	-42,614
1953	-4	-10,500	-53,114
1954	-4	-9,873	-62,987
1955	-8	-18,914	-81,901
1956	-12	-29,231	-111,132
1957	-2	-7,142	-118,274
1958	9	26,490	-91,784
1959	-11	-26,023	-117,807
1960	-9	-22,382	-140,189
1961	-21	-53,413	-193,602
1962	-4	-8,760	-202,362
1963	-5	-9,015	-211,377
1964	-17	-39,262	-250,639
1965	-4	-8,605	-259,244
1966	-1	-3,808	-263,052
1967	20	48,813	-214,239
1968	17	40,290	-173,949
1969	40	89,460	-84,489
1970	-1	-5,746	-90,235
1971	2	8,443	-81,792
1972	-1	-318	-82,110
1973	-8	-23,831	-105,941
1974	-3	-9,592	-115,533
1975	-2	-4,410	-119,943
1976	-5	-10,186	-130,129
1977	-7	-13,696	-143,825
1978	36	89,758	-54,067
1979	22	43,951	-10,116
1980	21	58,966	48,850
1981	7	16,804	65,654

San Bernardino Valley Municipal Water District

Change In Storage for the City Creek Sub-basin 1934 - Present

(1) Year	(2) Basin Index (ft.)	(3) Annual Change in Groundwater Storage (acre-feet)	(4) Cummulative Change in Groundwater Storage (acre-feet)
1982	2	8,897	74,551
1983	6	14,890	89,441
1984	-3	-6,823	82,618
1985	-16	-36,130	46,488
1986	-9	-21,038	25,450
1987	-8	-18,659	6,791
1988	-6	-15,578	-8,787
1989	-26	-61,028	-69,815
1990	-11	-29,017	-98,832
1991	-16	-41,190	-140,022
1992	-2	616	-139,406
1993	23	56,087	-83,319
1994	10	20,573	-62,746
1995	8	16,221	-46,525
1996	0	-453	-46,978
1997	-7	-15,021	-61,999
1998	15	34,478	-27,521
1999	-14	-31,118	-58,639
2000	-20	-46,018	-104,657
2001	-15	-17,857	-122,514
2002	1	-19,242	-141,756
2003	-5	4,923	-136,833
2004	-8	-21,327	-158,160
2005	1	31,225	-126,935
2006	-2	-21,828	-148,763
2007	-17	-21,308	-170,071
2008	-5	-23,474	-193,545
2009	1	18,017	-175,528
2010	-3	-19,089	-194,617
2011	44	82,409	-112,208
2012	-7	-24,934	-137,142
2013	-40	-59,051	-196,193
2014	-23	-83,353	-279,546
2015	-18	-32,605	-312,151
2016	12	9,302	-302,849
2017	8	21,585	-281,264
2018	-7	-20,972	-302,236
2019	24	53,058	-249,178
2020	0	-135	-249,313
2021	-19	-39,081	-288,394

City Creek Sub-Basin & Wells



Plant No. 54
Plant No. 94
Plant No. 6
Plant No. 142
Plant No. 120
Plant No. 40
SBVWCD No. 3
Orange St.
Airport No. 2
Well No. 32
Rees No. 1
Well No. 39

0 0.5 1 2 Miles

Report

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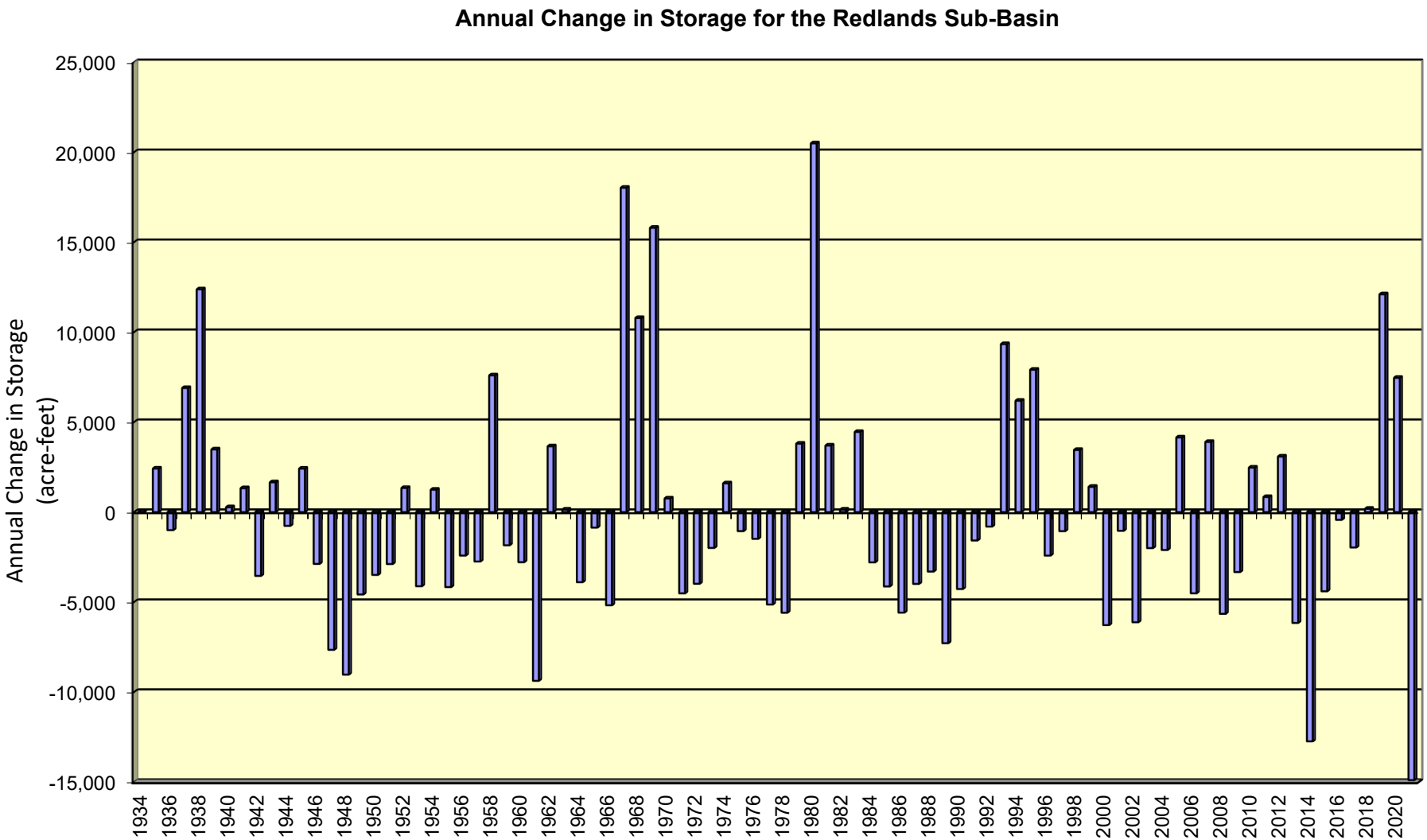
Annual Change in Storage for the Redlands Sub-Basin
Annual Change in Storage (acre-feet)
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
1934
1936
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2018
2020

San Bernardino Valley Municipal Water District

Change In Storage for the Redlands Sub-basin 1934 -Present

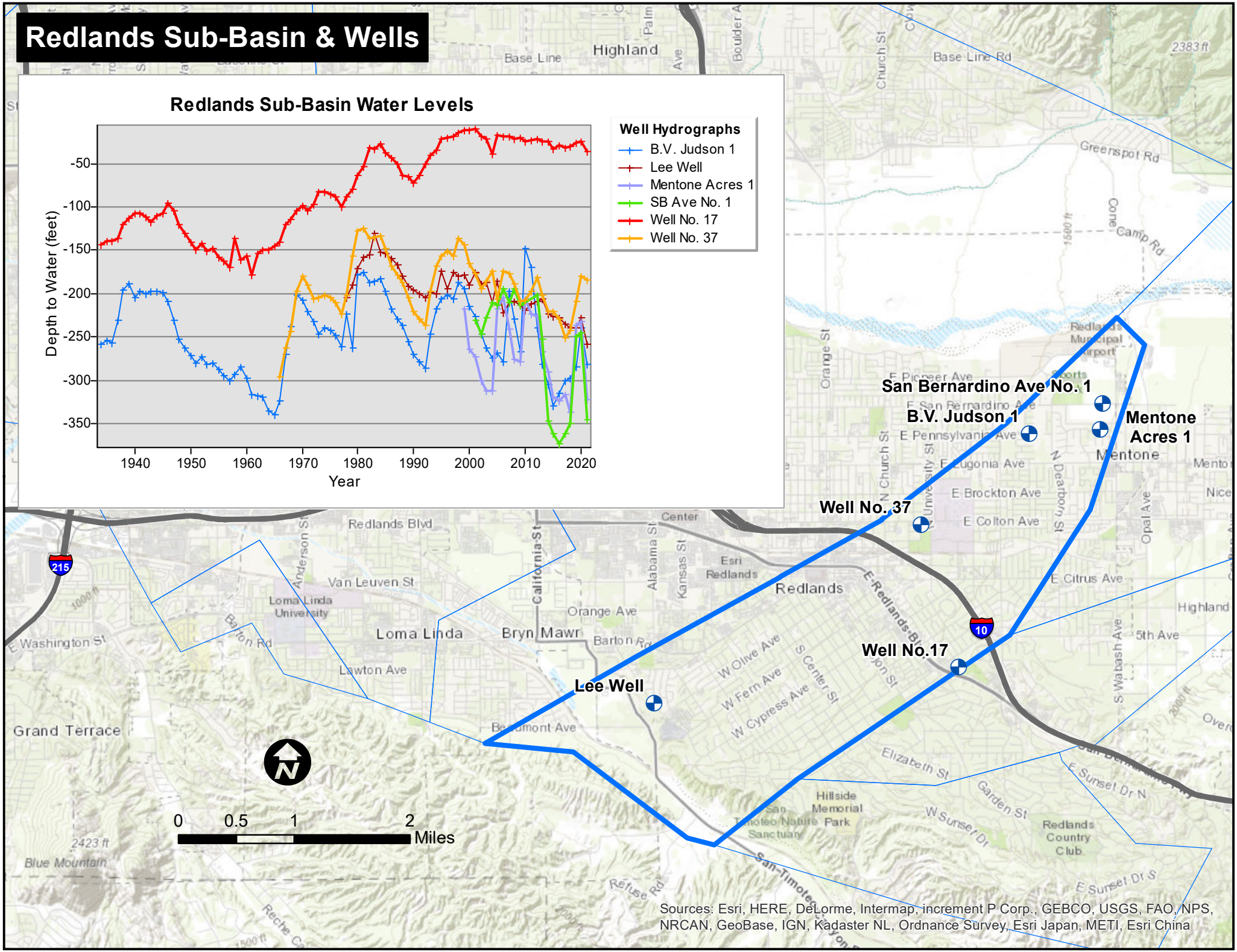
(1) Year	(2) Basin Index (ft.)	(3) Annual Change in Groundwater Storage (acre-feet)	(4) Cummulative Change in Groundwater Storage (acre-feet)
1934	0	n/a	0
1935	5	2,422	2,422
1936	-2	-1,000	1,422
1937	16	6,898	8,320
1938	28	12,380	20,700
1939	8	3,484	24,184
1940	-1	272	24,456
1941	3	1,330	25,786
1942	-8	-3,543	22,243
1943	4	1,658	23,901
1944	-2	-764	23,137
1945	5	2,417	25,554
1946	-7	-2,877	22,677
1947	-17	-7,651	15,026
1948	-20	-9,030	5,996
1949	-10	-4,575	1,421
1950	-8	-3,489	-2,068
1951	-6	-2,885	-4,953
1952	3	1,342	-3,611
1953	-9	-4,118	-7,729
1954	3	1,246	-6,483
1955	-9	-4,166	-10,649
1956	-5	-2,414	-13,063
1957	-6	-2,745	-15,808
1958	15	7,599	-8,209
1959	-2	-1,842	-10,051
1960	-7	-2,781	-12,832
1961	-20	-9,375	-22,207
1962	7	3,658	-18,549
1963	0	140	-18,409
1964	-9	-3,892	-22,301
1965	-2	-860	-23,161
1966	13	-5,177	-28,338
1967	39	18,026	-10,312
1968	23	10,790	478
1969	34	15,801	16,279
1970	3	759	17,038
1971	-10	-4,512	12,526
1972	-8	-3,981	8,545
1973	-3	-1,990	6,555
1974	4	1,601	8,156
1975	-3	-1,055	7,101
1976	-4	-1,485	5,616
1977	-12	-5,133	483
1978	24	-5,591	-5,108
1979	7	3,805	-1,303
1980	22	20,494	19,191
1981	9	3,700	22,891

San Bernardino Valley Municipal Water District

Change In Storage for the Redlands Sub-basin 1934 -Present

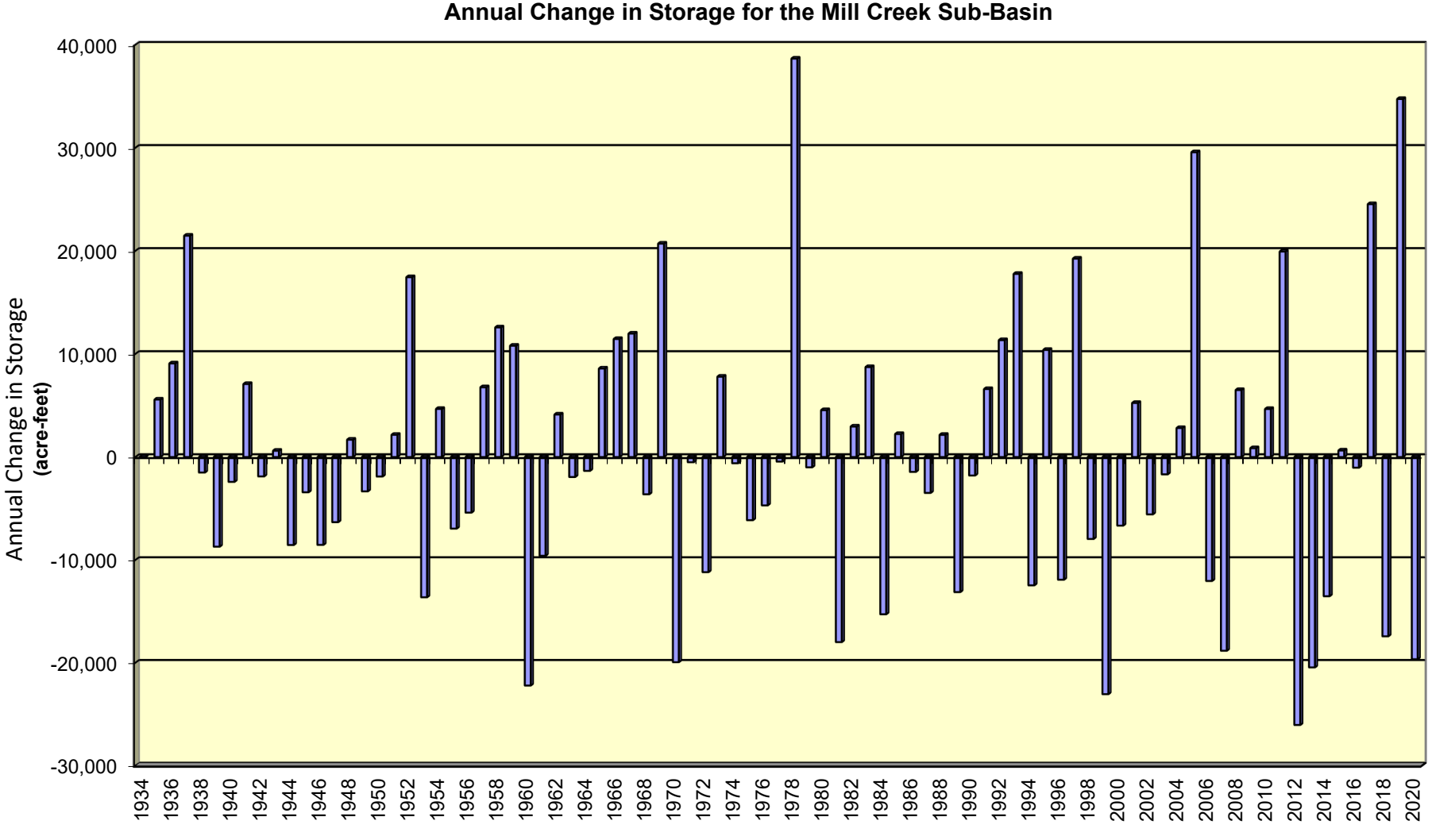
(1) Year	(2) Basin Index (ft.)	(3) Annual Change in Groundwater Storage (acre-feet)	(4) Cummulative Change in Groundwater Storage (acre-feet)
1982	4	140	23,031
1983	9	4,455	27,486
1984	-5	-2,791	24,695
1985	-9	-4,131	20,564
1986	-11	-5,586	14,978
1987	-8	-3,988	10,990
1988	-11	-3,303	7,687
1989	-10	-7,285	402
1990	-9	-4,273	-3,871
1991	-1	-1,576	-5,447
1992	1	-802	-6,249
1993	18	9,337	3,088
1994	12	6,189	9,277
1995	17	7,913	17,190
1996	-5	-2,416	14,774
1997	-15	-1,057	13,717
1998	14	3,457	17,174
1999	-2	1,407	18,581
2000	-15	-6,279	12,302
2001	-15	-1,040	11,262
2002	-24	-6,120	5,142
2003	-3	-2,001	3,141
2004	-4	-2,104	1,037
2005	21	4,150	5,187
2006	6	-4,510	677
2007	5	3,900	4,577
2008	-15	-5,652	-1,075
2009	-14	-3,331	-4,406
2010	5	2,475	-1,931
2011	-4	840	-1,091
2012	-15	3,089	1,998
2013	-26	-6,156	-4,159
2014	-20	-12,738	-16,897
2015	-13	-4,400	-21,297
2016	1	-428	-21,725
2017	-2	-1,965	-23,690
2018	-2	186	-23,504
2019	30	12,107	-11,397
2020	18	7,464	-3,933
2021	-29	-14,892	-18,825

Redlands Sub-Basin & Wells



Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China

Path: Y:\1422ChangeInStorage\2021Report\SubBasinMaps\Redlands.mxd


Annual Change in Storage for the Mill Creek Sub-Basin
Annual Change in Storage
(acre-feet)
40,000
30,000
20,000
10,000
0
-10,000
-20,000
-30,000
1934
1936
1938
1940
1942
1944
1946
1948
1950
1952
1954
1956
1958
1960
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1964
1966
1968
1970
1972
1974
1976
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1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020

San Bernardino Valley Municipal Water District

Change In Storage for the Mill Creek Sub-basin 1934 - Present

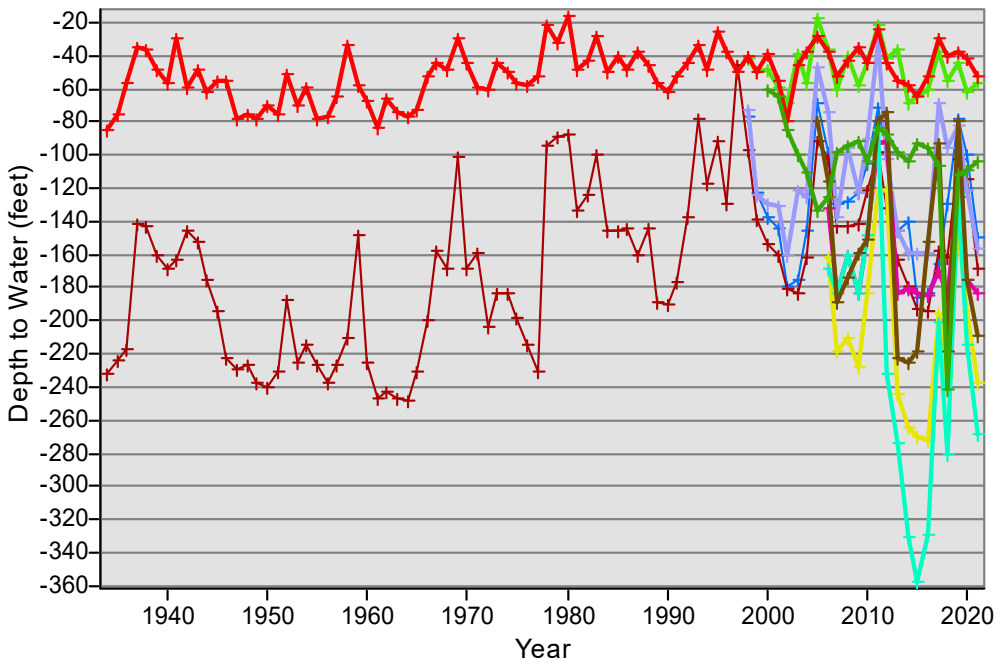
(1) Year	(2) Basin Index (ft.)	(3) Annual Change in Groundwater Storage (acre-feet)	(4) Cummulative Change in Groundwater Storage (acre-feet)
1934	0	n/a	0
1935	11	5,575	5,575
1936	20	9,081	14,656
1937	30	21,472	36,128
1938	-4	-1,506	34,622
1939	-16	-8,705	25,917
1940	-3	-2,412	23,505
1941	15	7,081	30,586
1942	-8	-1,883	28,703
1943	3	608	29,311
1944	-14	-8,542	20,769
1945	-3	-3,421	17,348
1946	-13	-8,531	8,817
1947	-13	-6,322	2,495
1948	4	1,677	4,172
1949	-5	-3,332	840
1950	-5	-1,890	-1,050
1951	3	2,151	1,101
1952	29	17,447	18,548
1953	-22	-13,629	4,919
1954	8	4,664	9,583
1955	-13	-6,947	2,636
1956	-11	-5,394	-2,758
1957	14	6,767	4,009
1958	25	12,574	16,583
1959	10	10,797	27,380
1960	-32	-22,220	5,160
1961	-17	-9,592	-4,432
1962	8	4,121	-311
1963	-3	-1,939	-2,250
1964	-3	-1,344	-3,594
1965	17	8,585	4,991
1966	18	11,449	16,440
1967	17	11,973	28,413
1968	-6	-3,615	24,798
1969	31	20,705	45,503
1970	-29	-19,947	25,556
1971	-3	-507	25,049
1972	-15	-11,184	13,865
1973	12	7,794	21,659
1974	-1	-605	21,054
1975	-11	-6,130	14,924
1976	-7	-4,694	10,230
1977	4	-440	9,790
1978	53	38,652	48,442
1979	-3	-1,001	47,441
1980	10	4,546	51,987
1981	-29	-17,993	33,994

San Bernardino Valley Municipal Water District

Change In Storage for the Mill Creek Sub-basin 1934 - Present

(1) Year	(2) Basin Index (ft.)	(3) Annual Change in Groundwater Storage (acre-feet)	(4) Cummulative Change in Groundwater Storage (acre-feet)
1982	4	2,958	36,952
1983	14	8,723	45,675
1984	-23	-15,284	30,391
1985	5	2,232	32,623
1986	-3	-1,445	31,178
1987	-5	-3,482	27,696
1988	1	2,148	29,844
1989	-20	-13,125	16,719
1990	-3	-1,796	14,923
1991	12	6,593	21,516
1992	16	11,338	32,854
1993	26	17,767	50,621
1994	-19	-12,468	38,153
1995	17	10,390	48,543
1996	-18	-11,923	36,620
1997	24	19,248	55,868
1998	-16	-7,957	47,911
1999	-27	-23,059	24,852
2000	0	-6,656	18,196
2001	-7	5,243	23,439
2002	-20	-5,565	17,874
2003	3	-1,681	16,193
2004	5	2,811	19,004
2005	43	29,567	48,571
2006	-18	-12,042	36,529
2007	-35	-18,835	17,694
2008	15	6,498	24,192
2009	-8	856	25,048
2010	18	4,657	29,705
2011	43	19,938	49,643
2012	-32	-26,058	23,585
2013	-54	-20,455	3,130
2014	-14	-13,527	-10,397
2015	-8	629	-9,768
2016	11	-1,035	-10,803
2017	46	24,536	13,733
2018	-42	-17,429	-3,696
2019	72	34,735	31,039
2020	-38	-19,658	11,381
2021	-28	-15,459	-4,078

Mill Creek Sub-Basin & Wells



SBVWCD No. 2
Observation Well
Mill Creek Monitoring #5
Mill Creek Monitoring #2
YVWD Well No. 51
East Lugonia No. 6
East Lugonia No. 4
Maguet #2
Agate #1
Crafton Ave Well

0 0.5 1 2 Miles

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

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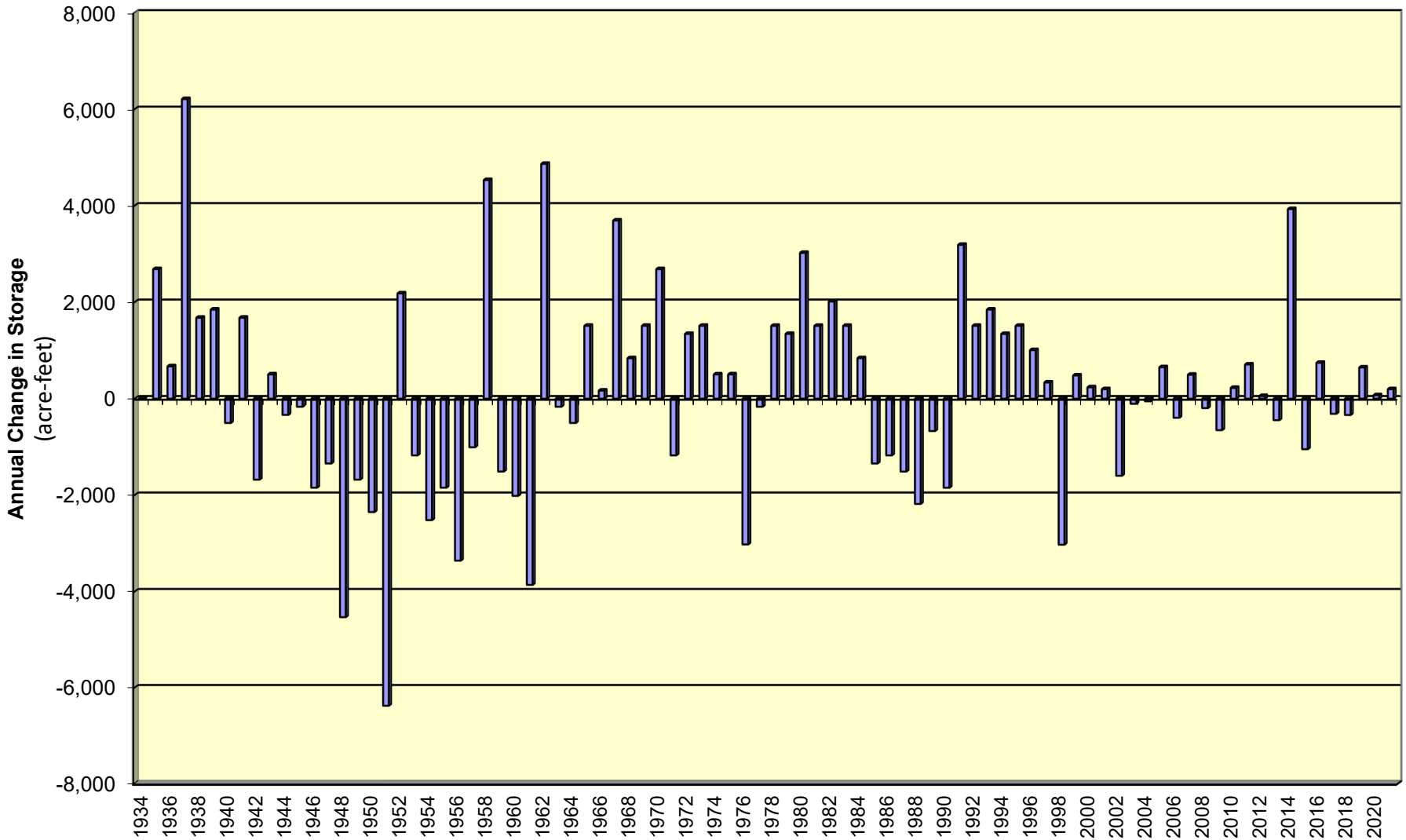
Annual Change in Storage for the Reservoir Sub-Basin



San Bernardino Valley Municipal Water District

Change In Storage for the Reservoir Sub-basin 1934 - Present

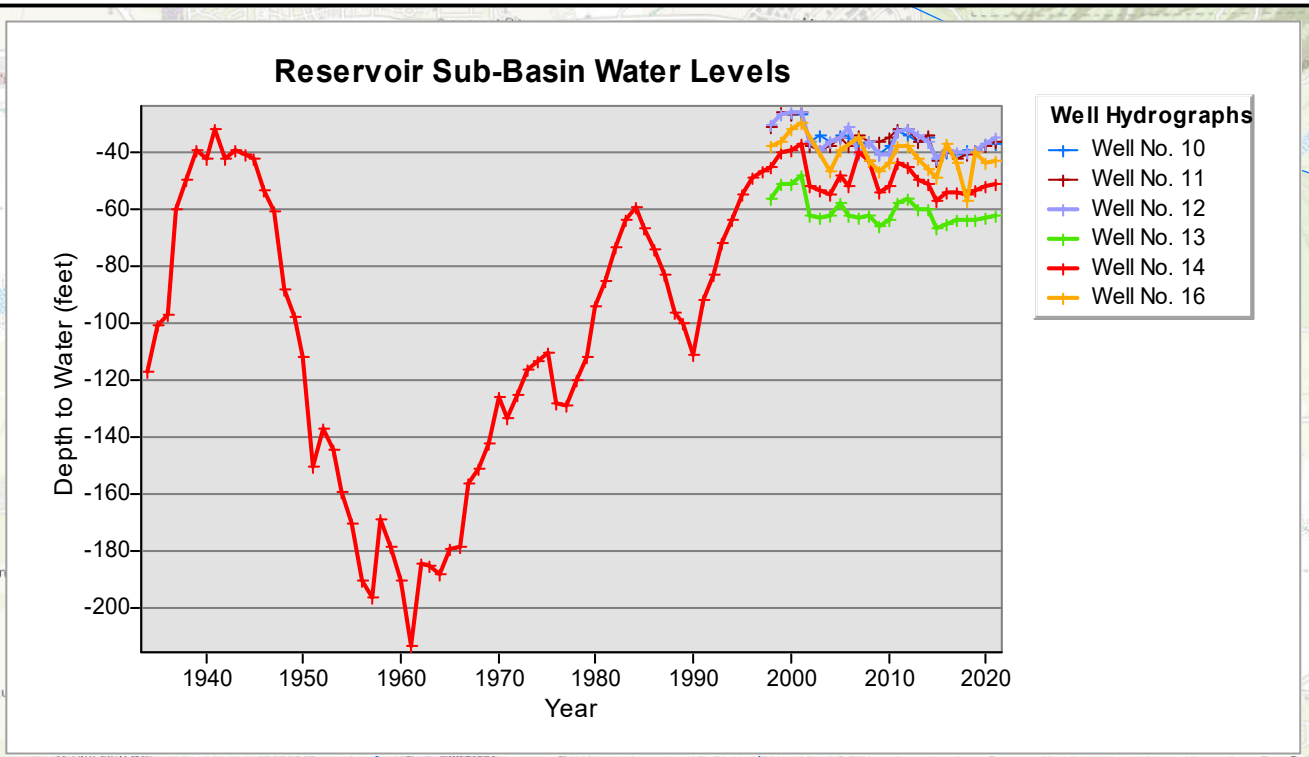
(1) Year	(2) Basin Index (ft.)	(3) Annual Change in Groundwater Storage (acre-feet)	(4) Cummulative Change in Groundwater Storage (acre-feet)
1934	0	n/a	0
1935	16	2,686	2,686
1936	4	671	3,357
1937	37	6,211	9,568
1938	10	1,678	11,246
1939	11	1,847	13,093
1940	-3	-504	12,589
1941	10	1,679	14,268
1942	-10	-1,679	12,589
1943	3	504	13,093
1944	-2	-336	12,757
1945	-1	-168	12,589
1946	-11	-1,846	10,743
1947	-8	-1,343	9,400
1948	-27	-4,532	4,868
1949	-10	-1,679	3,189
1950	-14	-2,350	839
1951	-38	-6,378	-5,539
1952	13	2,182	-3,357
1953	-7	-1,175	-4,532
1954	-15	-2,518	-7,050
1955	-11	-1,846	-8,896
1956	-20	-3,358	-12,254
1957	-6	-1,007	-13,261
1958	27	4,532	-8,729
1959	-9	-1,510	-10,239
1960	-12	-2,015	-12,254
1961	-23	-3,860	-16,114
1962	29	4,868	-11,246
1963	-1	-168	-11,414
1964	-3	-504	-11,918
1965	9	1,511	-10,407
1966	1	168	-10,239
1967	22	3,693	-6,546
1968	5	839	-5,707
1969	9	1,511	-4,196
1970	16	2,685	-1,511
1971	-7	-1,175	-2,686
1972	8	1,343	-1,343
1973	9	1,511	168
1974	3	503	671
1975	3	504	1,175
1976	-18	-3,021	-1,846
1977	-1	-168	-2,014
1978	9	1,510	-504
1979	8	1,343	839
1980	18	3,022	3,861
1981	9	1,510	5,371

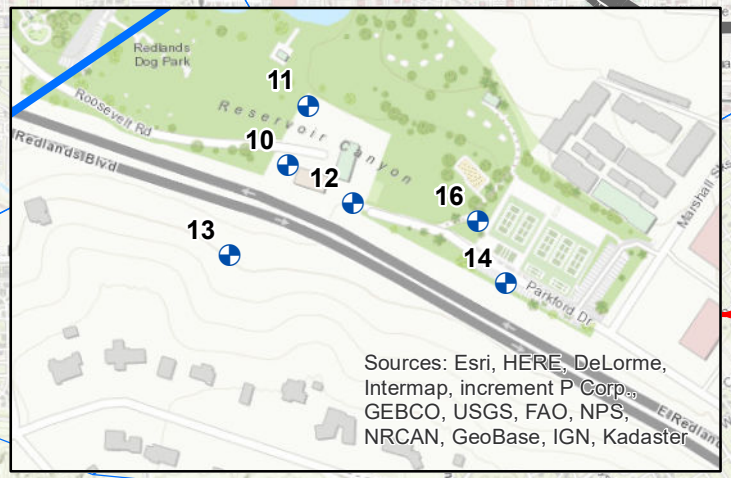
San Bernardino Valley Municipal Water District

Change In Storage for the Reservoir Sub-basin 1934 - Present

(1) Year	(2) Basin Index (ft.)	(3) Annual Change in Groundwater Storage (acre-feet)	(4) Cummulative Change in Groundwater Storage (acre-feet)
1982	12	2,015	7,386
1983	9	1,510	8,896
1984	5	840	9,736
1985	-8	-1,343	8,393
1986	-7	-1,175	7,218
1987	-9	-1,511	5,707
1988	-13	-2,182	3,525
1989	-4	-671	2,854
1990	-11	-1,847	1,007
1991	19	3,189	4,196
1992	9	1,511	5,707
1993	11	1,847	7,554
1994	8	1,342	8,896
1995	9	1,511	10,407
1996	6	1,007	11,414
1997	2	336	11,750
1998	-13	-3,027	8,723
1999	4	481	9,204
2000	2	236	9,440
2001	1	197	9,637
2002	-12	-1,598	8,039
2003	-1	-106	7,933
2004	0	-54	7,879
2005	4	652	8,531
2006	-2	-396	8,135
2007	2	497	8,632
2008	-1	-195	8,437
2009	-5	-652	7,785
2010	2	224	8,009
2011	6	708	8,717
2012	0	55	8,773
2013	-4	-446	8,327
2014	-1	3,931	12,258
2015	-6	-1,047	11,211
2016	4	743	11,954
2017	-2	-314	11,640
2018	-2	-338	11,302
2019	4	647	11,949
2020	1	72	12,021
2021	1	197	12,218

Reservoir Sub-Basin & Wells





Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI,

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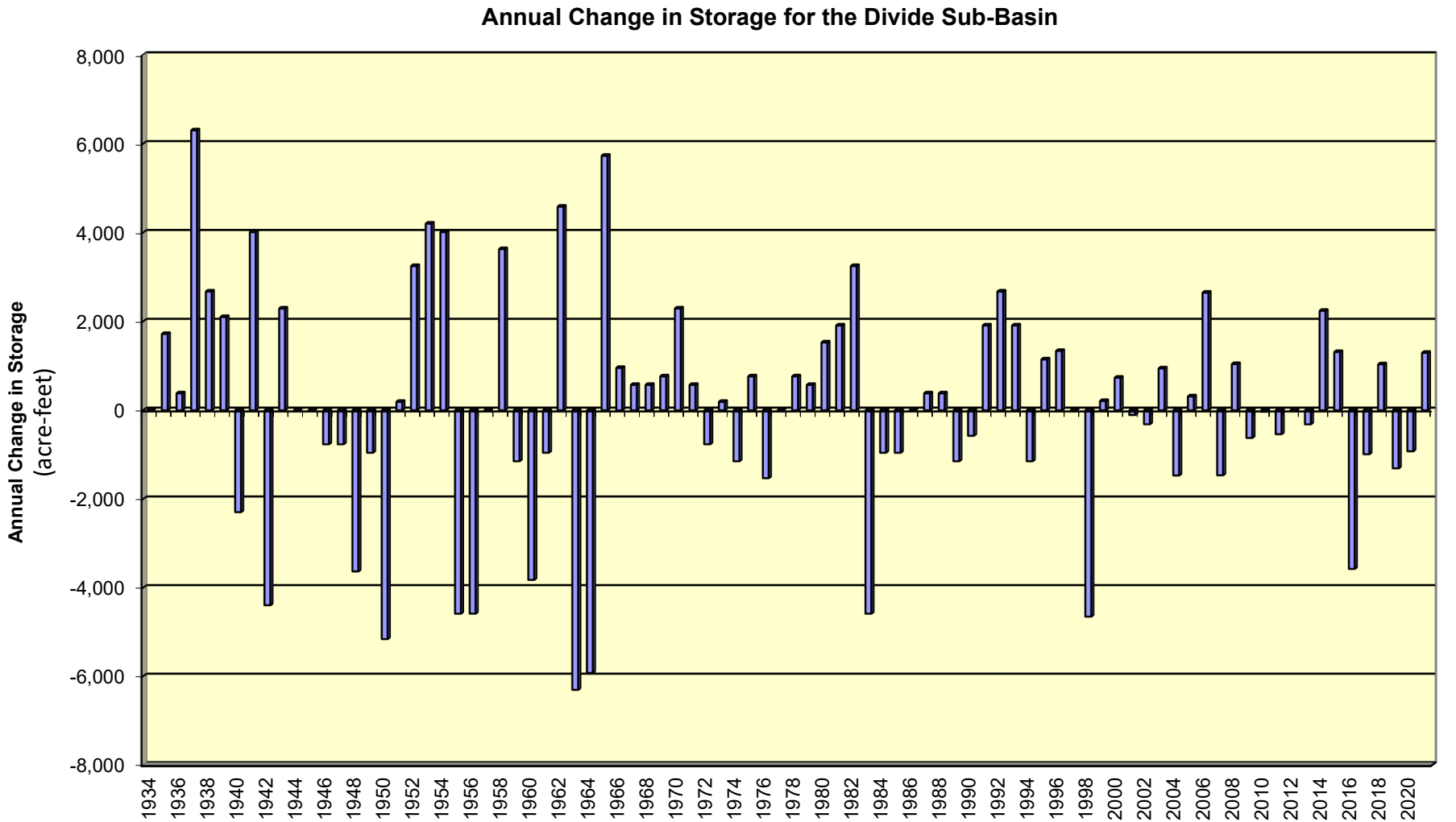
Annual Change in Storage for the Divide Sub-Basin
Annual Change in Storage
(acre-feet)
8,000
6,000
4,000
2,000
0
-2,000
-4,000
-6,000
-8,000
1934
1936
1938
1940
1942
1944
1946
1948
1950
1952
1954
1956
1958
1960
1962
1964
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2014
2016
2018
2020

San Bernardino Valley Municipal Water District

Change In Storage for the Divide Sub-basin 1934 - Present

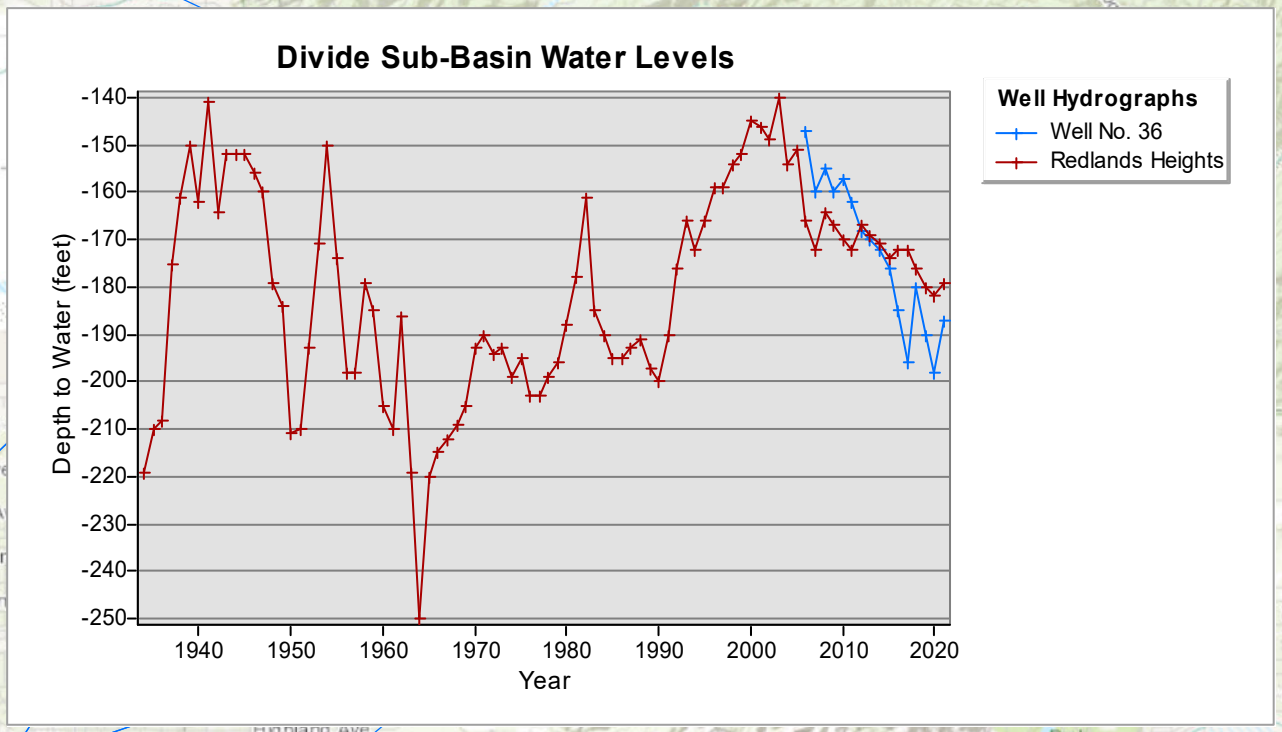
(1) Year	(2) Basin Index (ft.)	(3) Annual Change in Groundwater Storage (acre-feet)	(4) Cummulative Change in Groundwater Storage (acre-feet)
1934	0	n/a	0
1935	9	1,719	1,719
1936	2	382	2,101
1937	33	6,304	8,405
1938	14	2,675	11,080
1939	11	2,101	13,181
1940	-12	-2,292	10,889
1941	21	4,012	14,901
1942	-23	-4,394	10,507
1943	12	2,292	12,799
1944	0	0	12,799
1945	0	0	12,799
1946	-4	-764	12,035
1947	-4	-764	11,271
1948	-19	-3,630	7,641
1949	-5	-955	6,686
1950	-27	-5,158	1,528
1951	1	191	1,719
1952	17	3,248	4,967
1953	22	4,203	9,170
1954	21	4,011	13,181
1955	-24	-4,585	8,596
1956	-24	-4,584	4,012
1957	0	0	4,012
1958	19	3,629	7,641
1959	-6	-1,146	6,495
1960	-20	-3,821	2,674
1961	-5	-955	1,719
1962	24	4,585	6,304
1963	-33	-6,304	0
1964	-31	-5,922	-5,922
1965	30	5,731	-191
1966	5	955	764
1967	3	573	1,337
1968	3	573	1,910
1969	4	764	2,674
1970	12	2,293	4,967
1971	3	573	5,540
1972	-4	-764	4,776
1973	1	191	4,967
1974	-6	-1,146	3,821
1975	4	764	4,585
1976	-8	-1,528	3,057
1977	0	0	3,057
1978	4	764	3,821
1979	3	573	4,394
1980	8	1,528	5,922
1981	10	1,910	7,832

San Bernardino Valley Municipal Water District

Change In Storage for the Divide Sub-basin 1934 - Present

(1) Year	(2) Basin Index (ft.)	(3) Annual Change in Groundwater Storage (acre-feet)	(4) Cummulative Change in Groundwater Storage (acre-feet)
1982	17	3,248	11,080
1983	-24	-4,585	6,495
1984	-5	-955	5,540
1985	-5	-955	4,585
1986	0	0	4,585
1987	2	382	4,967
1988	2	382	5,349
1989	-6	-1,146	4,203
1990	-3	-573	3,630
1991	10	1,910	5,540
1992	14	2,674	8,214
1993	10	1,911	10,125
1994	-6	-1,146	8,979
1995	6	1,146	10,125
1996	7	1,337	11,462
1997	0	0	11,462
1998	5	-4,651	6,811
1999	2	210	7,021
2000	7	734	7,755
2001	-1	-105	7,650
2002	-3	-314	7,336
2003	9	943	8,279
2004	-14	-1,467	6,812
2005	3	314	7,126
2006	5	2,649	9,775
2007	-10	-1,462	8,313
2008	7	1,042	9,355
2009	-4	-621	8,734
2010	0	-32	8,702
2011	-4	-537	8,165
2012	-1	-20	8,145
2013	-2	-315	7,830
2014	-2	2,240	10,070
2015	-4	1,312	11,382
2016	-4	-3,573	7,809
2017	-6	-988	6,821
2018	6	1,036	7,857
2019	-7	-1,306	6,551
2020	2	-922	5,629
2021	2	1,294	6,923

Divide Sub-Basin & Wells



Redlands Heights Well

36

0 0.5 1 2 Miles

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

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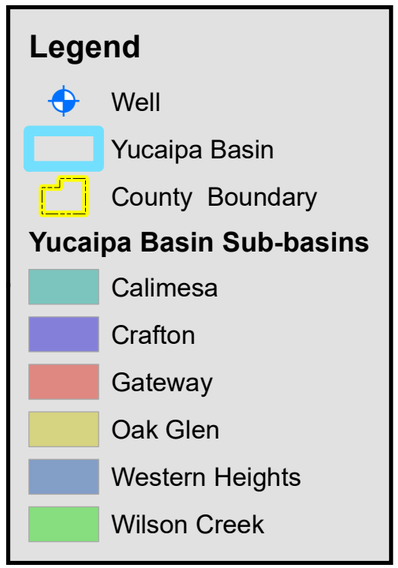

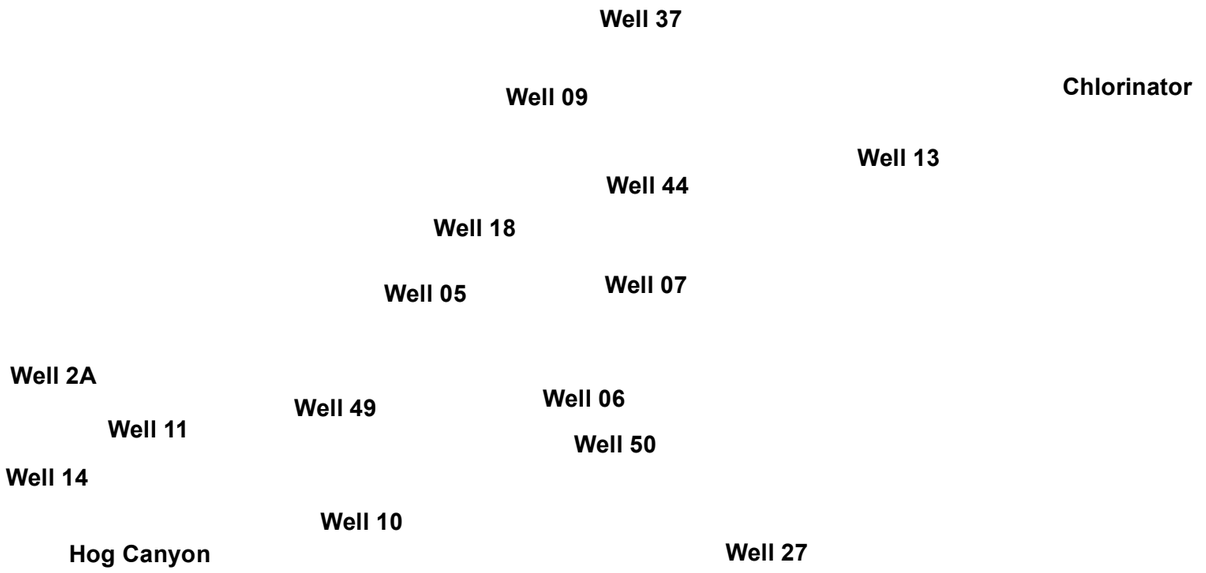

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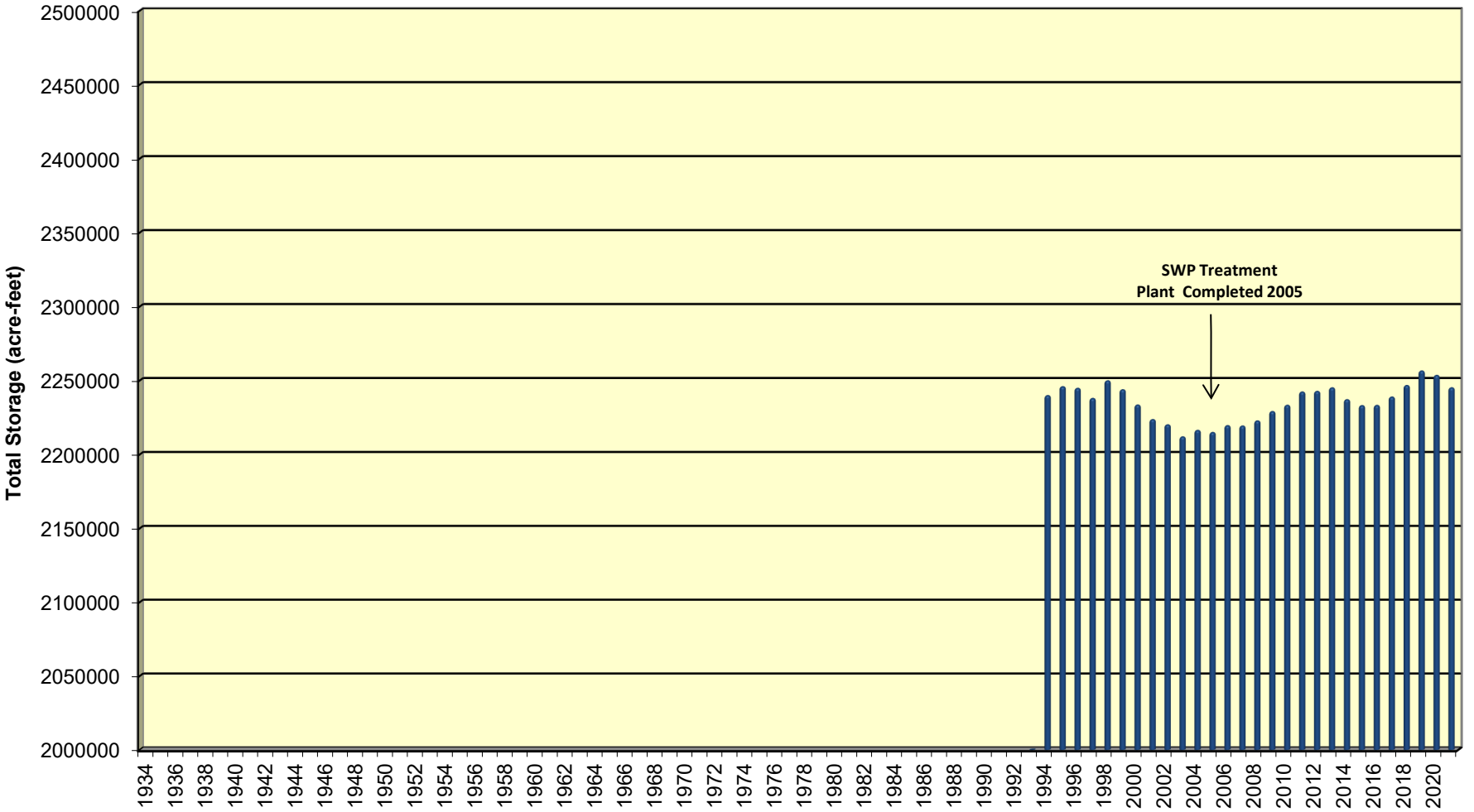
YUCAIPA BASIN SUB-BASINS AND WELL LOCATIONS

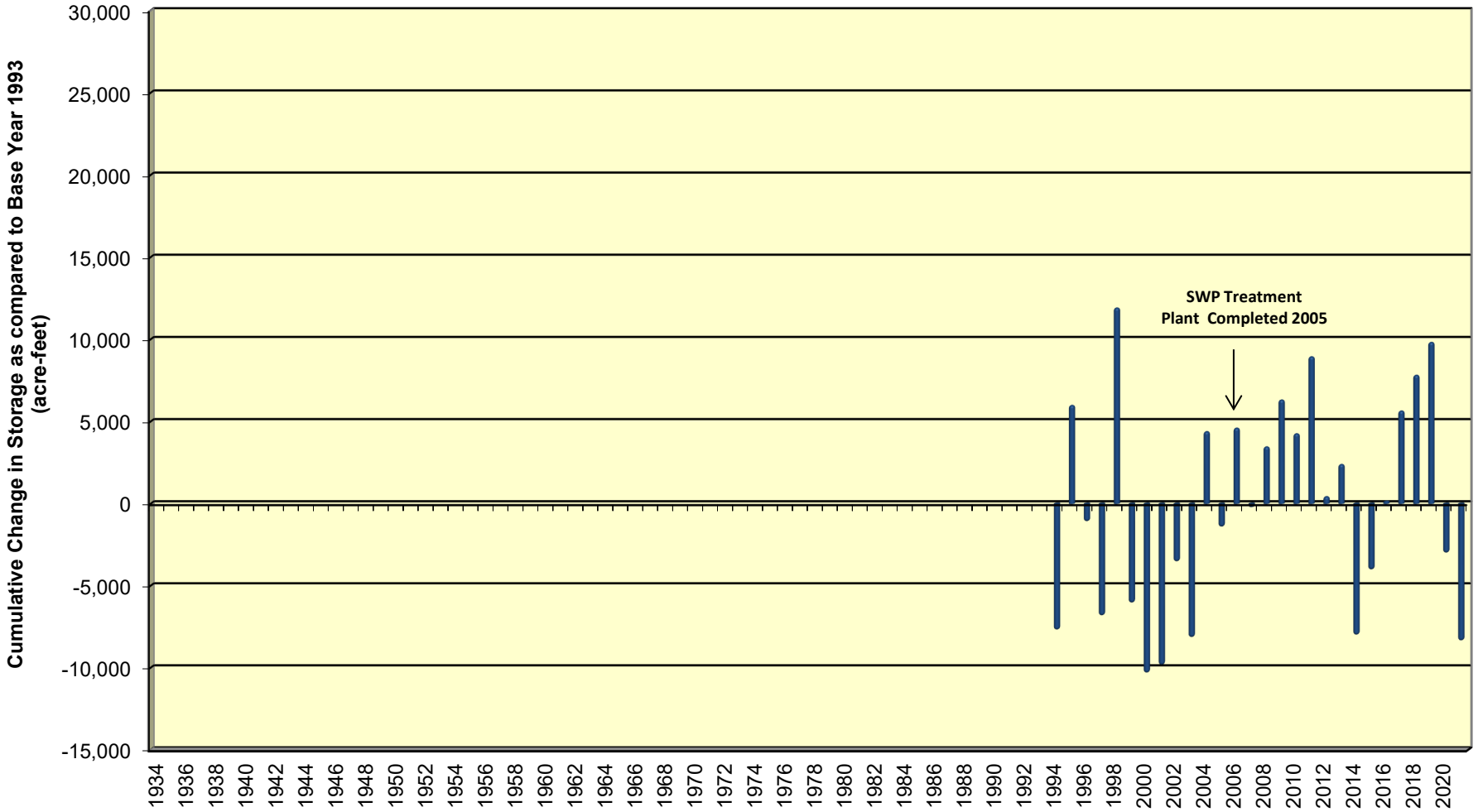
0 0.5 1 2 3 4 Miles

Source: Geoscience Support Services, Inc. (Sub-Basin Boundaries)

Total Storage for the Yucaipa Basin



Annual Change in Storage for the Yucaipa Basin

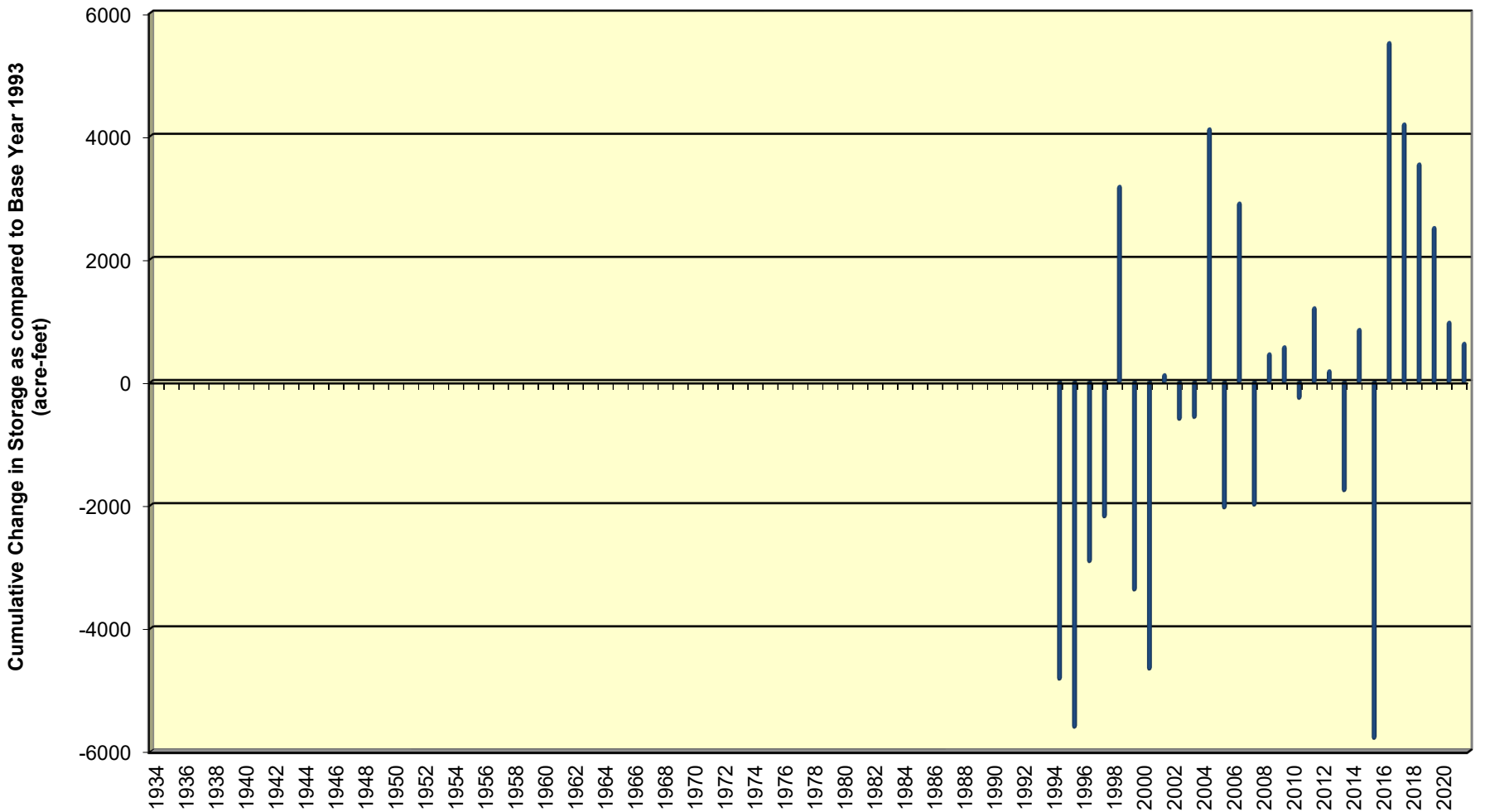


San Bernardino Valley Municipal Water District

Change In Storage for the Yucaipa Basin 1993 - Present

(1) Year	(2) Basin Index (ft.)	(3) Annual Change in Groundwater Storage (acre-feet)	(4) Total Groundwater Storage (acre-feet)
1993	0	0	2,247,503
1994	-3	-7,695	2,239,808
1995	10	5,985	2,245,793
1996	0	-1,088	2,244,705
1997	-7	-6,827	2,237,878
1998	13	11,912	2,249,790
1999	-7	-6,049	2,243,741
2000	-10	-10,319	2,233,422
2001	-14	-9,841	2,223,581
2002	-2	-3,536	2,220,045
2003	-10	-8,151	2,211,894
2004	2	4,389	2,216,283
2005	2	-1,418	2,214,865
2006	4	4,602	2,219,467
2007	1	-238	2,219,229
2008	3	3,462	2,222,691
2009	7	6,314	2,229,005
2010	6	4,260	2,233,265
2011	11	8,942	2,242,207
2012	4	434	2,242,641
2013	3	2,392	2,245,033
2014	-11	-8,006	2,237,027
2015	-1	-4,027	2,233,000
2016	-3	157	2,233,157
2017	4	5,644	2,238,801
2018	10	7,819	2,246,620
2019	6	9,818	2,256,438
2020	-5	-3,005	2,253,433
2021	-12	-8,355	2,245,078

Annual Change in Storage for the Calimesa Sub-Basin

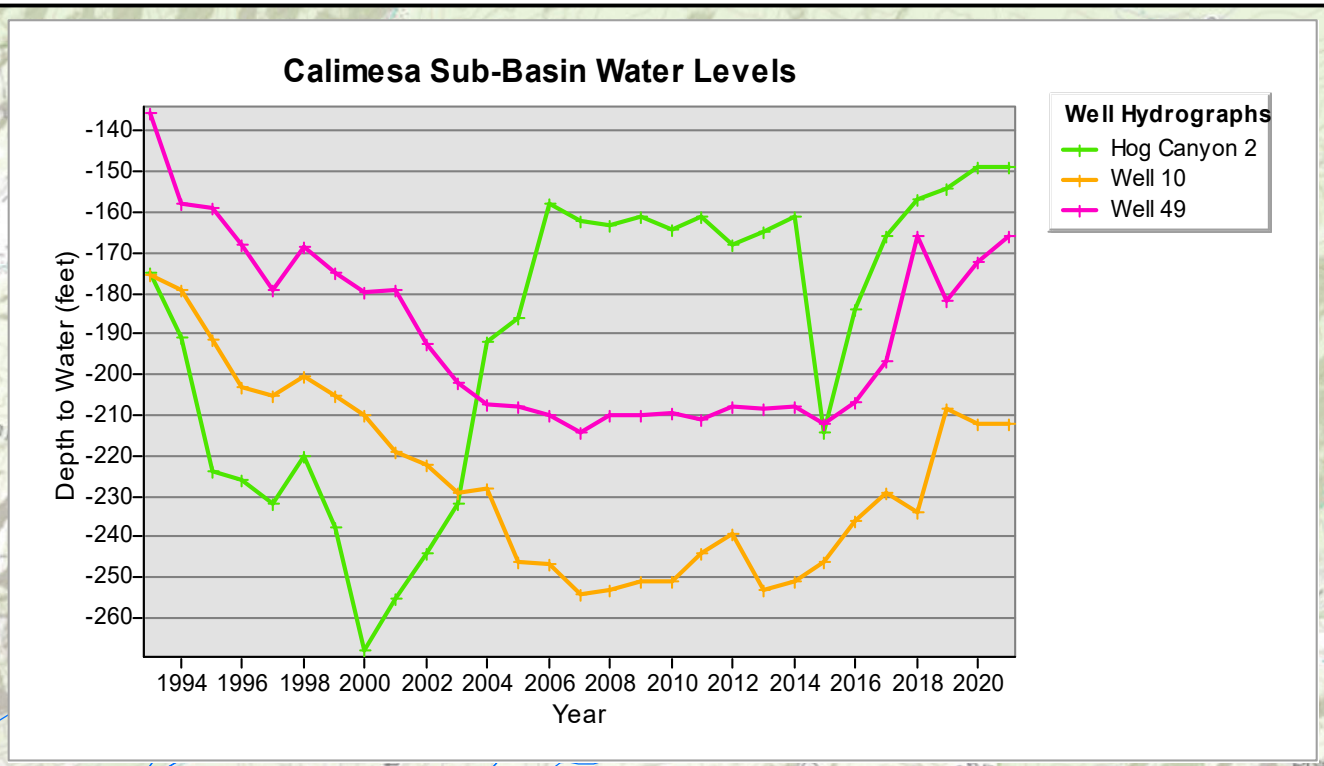


San Bernardino Valley Municipal Water District

Change In Storage for the Calimesa Sub-Basin 1993 - Present

(1) Year	(2) Basin Index (ft.)	(3) Annual Change in Groundwater Storage (acre-feet)	(4) Cummulative Change in Groundwater Storage (acre-feet)
1993	0		
1994	-14	-4,853	-4,853
1995	-15	-5,633	-10,486
1996	-8	-2,943	-13,429
1997	-6	-2,216	-15,645
1998	9	3,197	-12,448
1999	-10	-3,404	-15,852
2000	-13	-4,688	-20,540
2001	1	136	-20,404
2002	-2	-632	-21,036
2003	-1	-601	-21,637
2004	12	4,130	-17,507
2005	-4	-2,070	-19,577
2006	9	2,925	-16,652
2007	-5	-2,026	-18,678
2008	1	475	-18,203
2009	1	590	-17,613
2010	-1	-291	-17,904
2011	3	1,223	-16,681
2012	0	199	-16,482
2013	-4	-1,791	-18,273
2014	2	872	-17,401
2015	-17	-5,814	-23,215
2016	15	5,531	-17,684
2017	12	4,209	-13,475
2018	12	3,559	-9,916
2019	4	2,527	-7,389
2020	4	989	-6,400
2021	2	647	-5,753

Calimesa Sub-Basin & Wells



Well 49

HOG CANYON 2

Well 10

Yucaipa

Calimesa

CRAFTON HILLS

RIVERSIDE

Wildwood Canyon State Park

Wildwood Canyon

Wildwood Canyon Rd

Newport Ave

Mentone Blvd

Nice Ave

Crafton Ave

Sand Canyon

Crafton Hills College

Chapman Heights Rd

Yucaipa Valley Golf Club

Yucaipa Blvd

Avenue D

Avenue F

Avenue G

Avenue H

Colorado St

16th St

6th St

5th St

3rd St

Bryant St

Douglas St

California St

Mesa Grande Dr

W County Line Rd

W Avenue L

Myrtlewood Dr

Calimesa Blvd

Garden Air Golf Course

Harnqt 'Aki' Preserve

Pisgah Peak Spur

3296 ft

0 0.5 1 2 Miles

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan,

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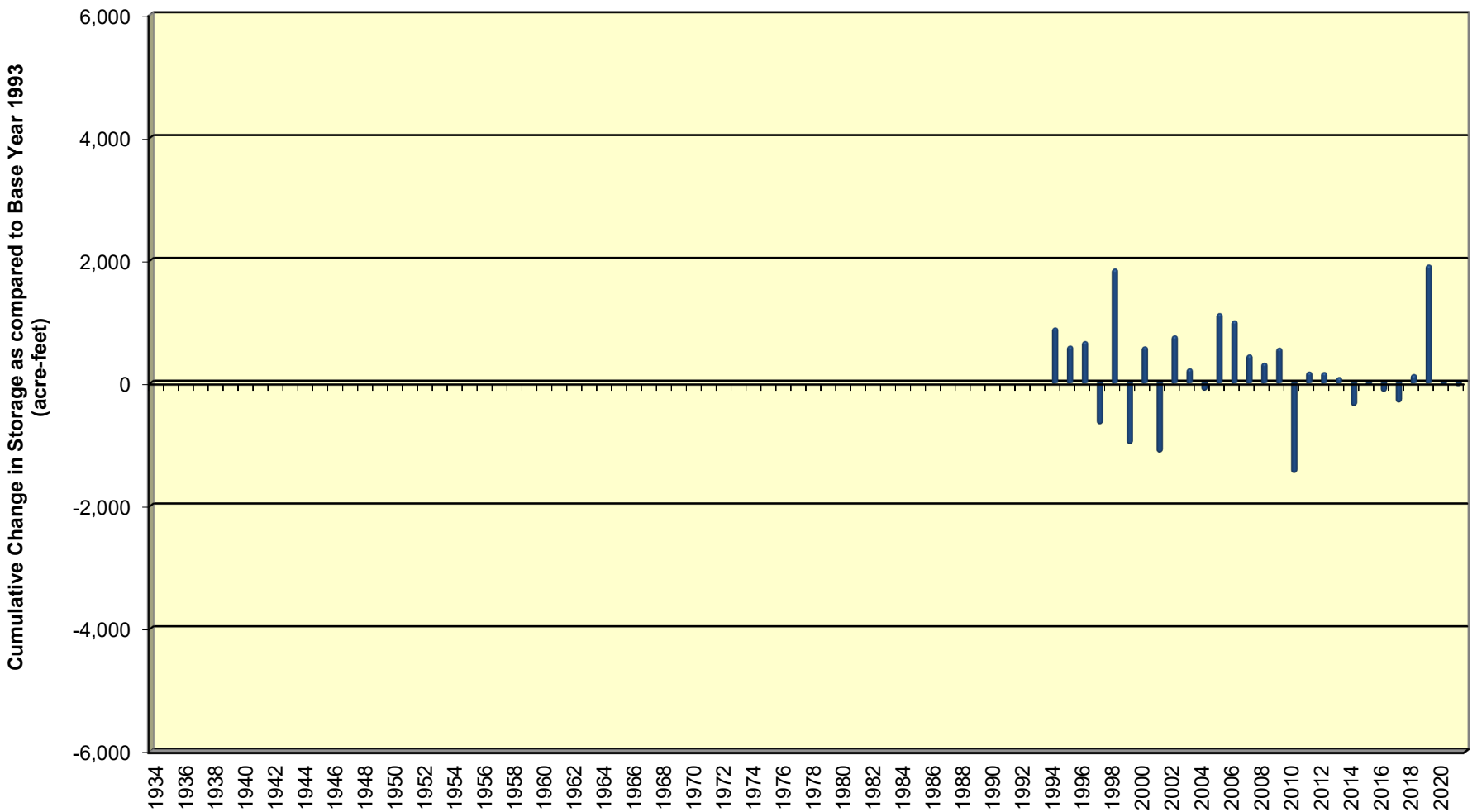
Annual Change in Storage for the Crafton Sub-Basin

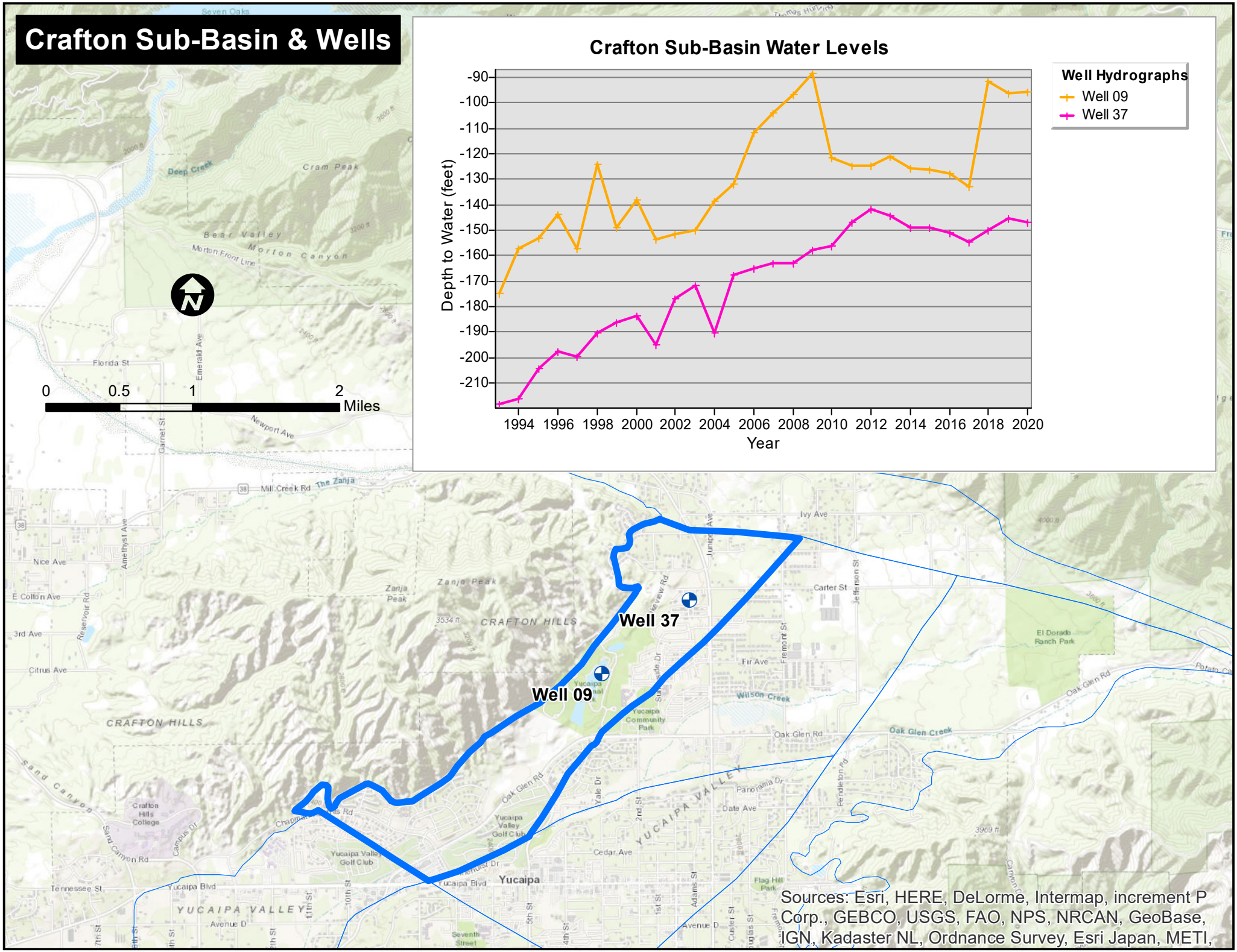


San Bernardino Valley Municipal Water District

Change In Storage for the Crafton Sub-Basin 1993 - Present

(1) Year	(2) Basin Index (ft.)	(3) Annual Change in Groundwater Storage (acre-feet)	(4) Cummulative Change in Groundwater Storage (acre-feet)
1993	0		
1994	10	898	898
1995	8	602	1,500
1996	8	676	2,176
1997	-8	-678	1,498
1998	21	1,857	3,355
1999	-10	-1,000	2,355
2000	7	590	2,945
2001	-14	-1,139	1,806
2002	10	770	2,576
2003	3	234	2,810
2004	-4	-132	2,678
2005	15	1,132	3,810
2006	11	1,014	4,824
2007	5	459	5,283
2008	4	326	5,609
2009	7	568	6,177
2010	-16	-1,471	4,706
2011	3	180	4,886
2012	2	173	5,059
2013	1	91	5,150
2014	-5	-379	4,771
2015	0	-18	4,753
2016	-2	-150	4,603
2017	-4	-324	4,279
2018	1	139	4,418
2019	23	1,923	6,341
2020	0	-23	6,318
2021	-1	-59	6,259

Crafton Sub-Basin & Wells



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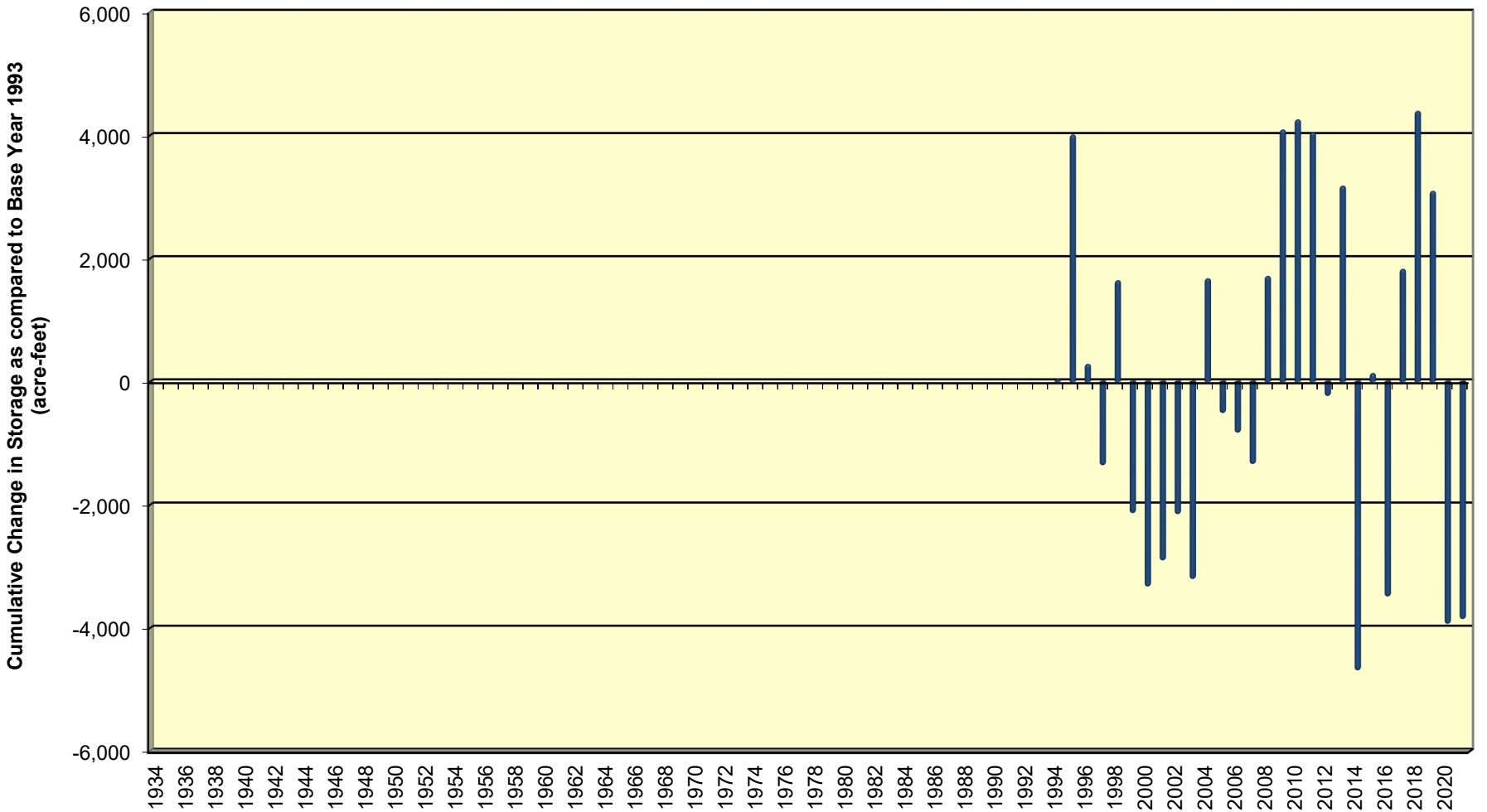
Annual Change in Storage for the Gateway Sub-Basin

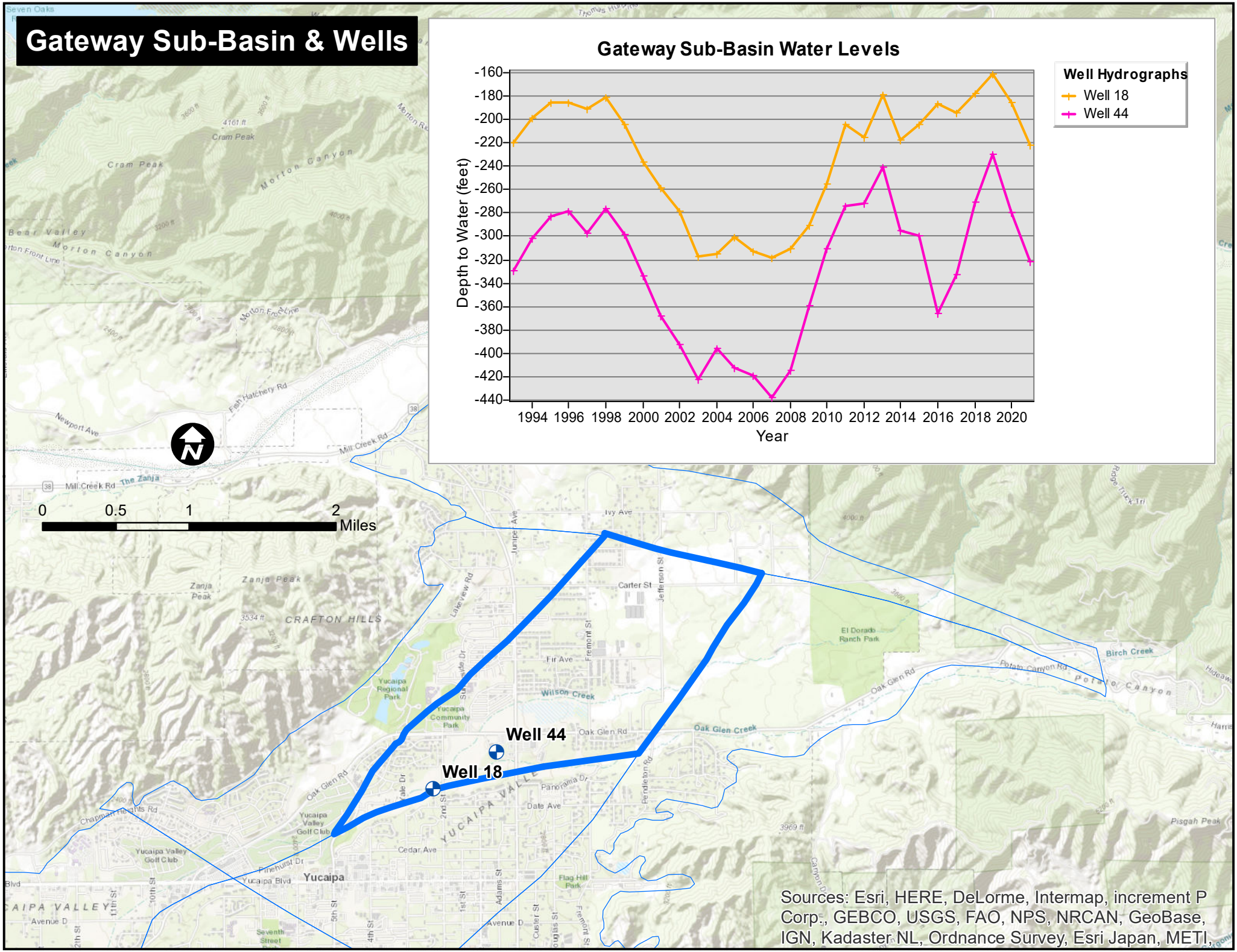


San Bernardino Valley Municipal Water District

Change In Storage for the Gateway Sub-Basin 1993 - Present

(1) Year	(2) Basin Index (ft.)	(3) Annual Change in Groundwater Storage (acre-feet)	(4) Cummulative Change in Groundwater Storage (acre-feet)
1993	0		
1994	24	36	36
1995	16	4,009	4,045
1996	2	284	4,329
1997	-12	-1,361	2,968
1998	16	1,642	4,610
1999	-22	-2,139	2,471
2000	-34	-3,331	-860
2001	-28	-2,906	-3,766
2002	-22	-2,156	-5,922
2003	-35	-3,209	-9,131
2004	14	1,673	-7,458
2005	-1	-514	-7,972
2006	-9	-833	-8,805
2007	-12	-1,342	-10,147
2008	16	1,712	-8,435
2009	37	4,089	-4,346
2010	42	4,254	-92
2011	44	4,041	3,949
2012	-4	-237	3,712
2013	34	3,179	6,891
2014	-47	-4,692	2,199
2015	4	136	2,335
2016	-25	-3,492	-1,157
2017	13	1,827	670
2018	39	4,393	5,063
2019	29	3,093	8,156
2020	-37	-3,936	4,220
2021	-39	-3,859	361

Gateway Sub-Basin & Wells



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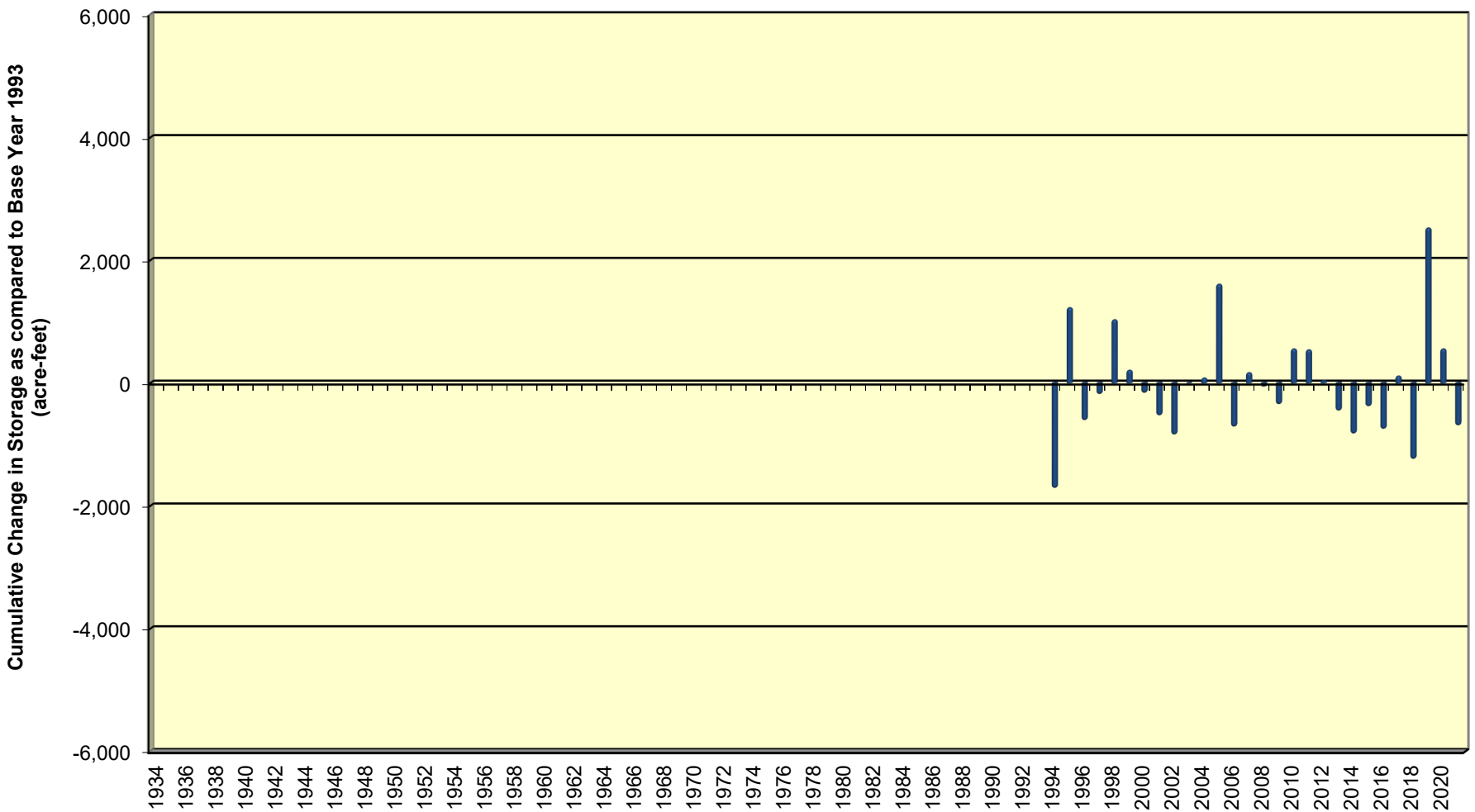
Annual Change in Storage for the Oak Glen Sub-Basin

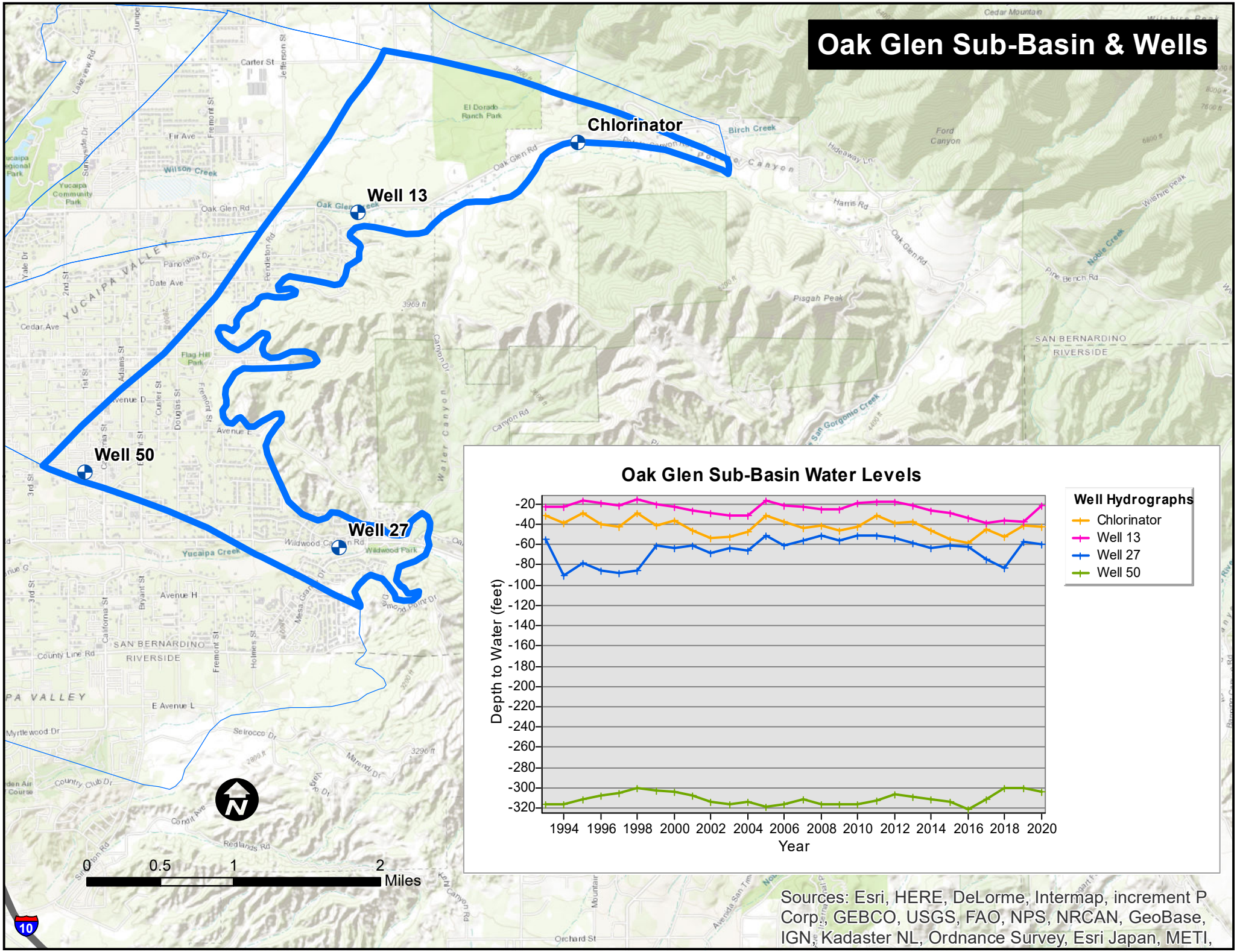


San Bernardino Valley Municipal Water District

Change In Storage for the Oak Glen Sub-Basin 1993 - Present

(1) Year	(2) Basin Index (ft.)	(3) Annual Change in Groundwater Storage (acre-feet)	(4) Cummulative Change in Groundwater Storage (acre-feet)
1993	0		
1994	-11	-1,713	-1,713
1995	8	1,230	-483
1996	-4	-609	-1,092
1997	-1	-184	-1,276
1998	7	1,033	-243
1999	2	211	-32
2000	-1	-165	-197
2001	-4	-531	-728
2002	-6	-843	-1,571
2003	0	0	-1,571
2004	1	83	-1,488
2005	10	1,612	124
2006	-5	-715	-591
2007	1	171	-420
2008	0	-65	-485
2009	-3	-349	-834
2010	3	558	-276
2011	4	544	268
2012	-1	42	310
2013	-2	-454	-144
2014	-5	-827	-971
2015	-3	-383	-1,354
2016	-5	-751	-2,105
2017	2	116	-1,989
2018	-1	-1,240	-3,229
2019	9	2,528	-701
2020	2	558	-143
2021	-3	-694	-837

Oak Glen Sub-Basin & Wells



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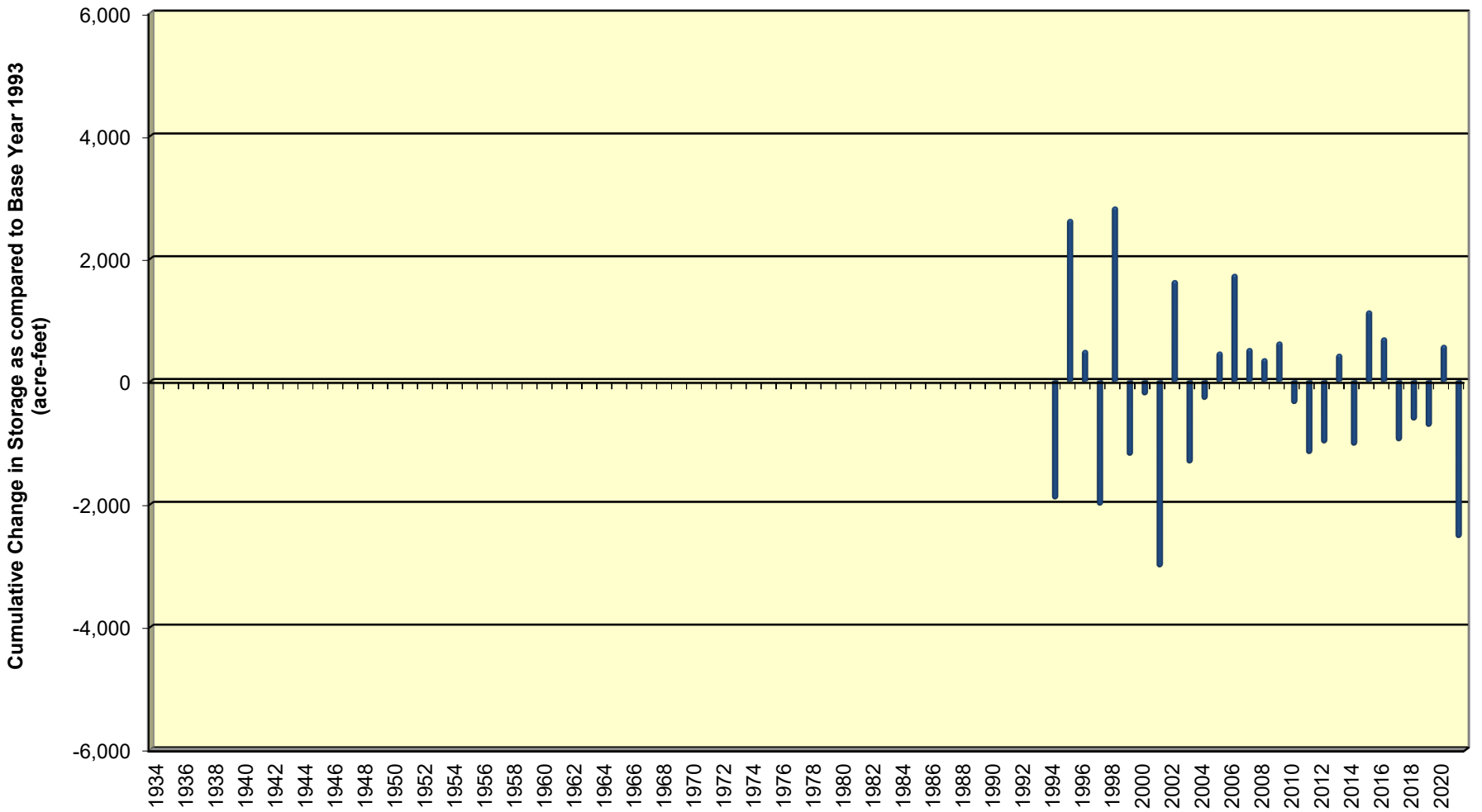
Annual Change in Storage for the Western Heights Sub-Basin

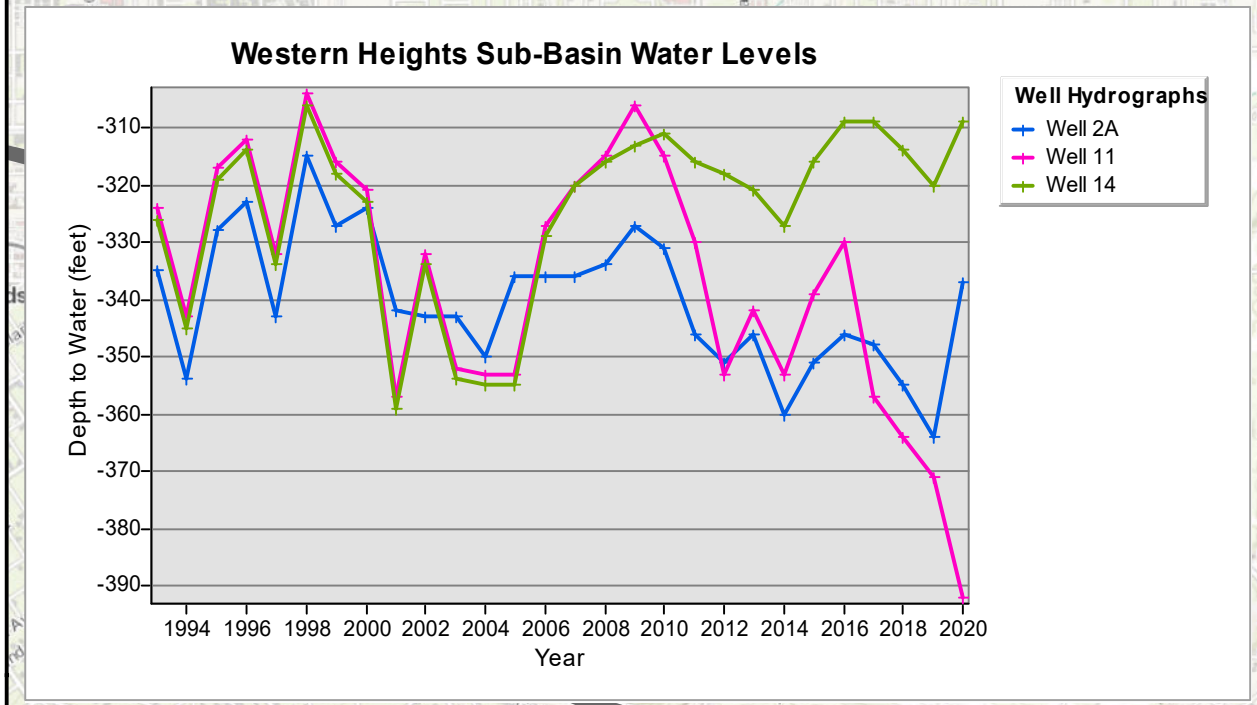


San Bernardino Valley Municipal Water District

Change In Storage for the Western Heights Sub-Basin 1993 - Present

(1) Year	(2) Basin Index (ft.)	(3) Annual Change in Groundwater Storage (acre-feet)	(4) Cummulative Change in Groundwater Storage (acre-feet)
1993	0		
1994	-19	-1,929	-1,929
1995	26	2,640	711
1996	5	507	1,218
1997	-20	-2,030	-812
1998	28	2,842	2,030
1999	-12	-1,218	812
2000	-2	-233	579
2001	-30	-3,035	-2,456
2002	16	1,644	-812
2003	-13	-1,343	-2,155
2004	-3	-307	-2,462
2005	5	480	-1,982
2006	17	1,746	-236
2007	5	537	301
2008	4	371	672
2009	6	644	1,316
2010	-4	-375	941
2011	-12	-1,189	-248
2012	-10	-1,016	-1,264
2013	4	444	-820
2014	-10	-1,054	-1,874
2015	11	1,149	-725
2016	7	711	-14
2017	-10	-981	-995
2018	-6	-644	-1,639
2019	-7	-746	-2,385
2020	6	589	-1,796
2021	-25	-2,557	-4,353

Western Heights Sub-Basin & Wells



Well 2A
Well 11
Well 14

CRAFTON HILLS
YUCAIPA VALLEY
Yucaipa Creek
Oak Glen Creek
Live Oak Canyon Rd
Mentone Blvd
Tennessee St
Yucaipa Blvd
Avenue D
Avenue E
Kentucky St
Colorado St
Redlands Country Club
Oakmont Park
Crafton Hills College
Yucaipa Valley Golf Club
Caroline Park
Herngt 'Aki Preserve
Zanja Peak
3534 ft
2283 ft

0 0.5 1 2 Miles

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS,

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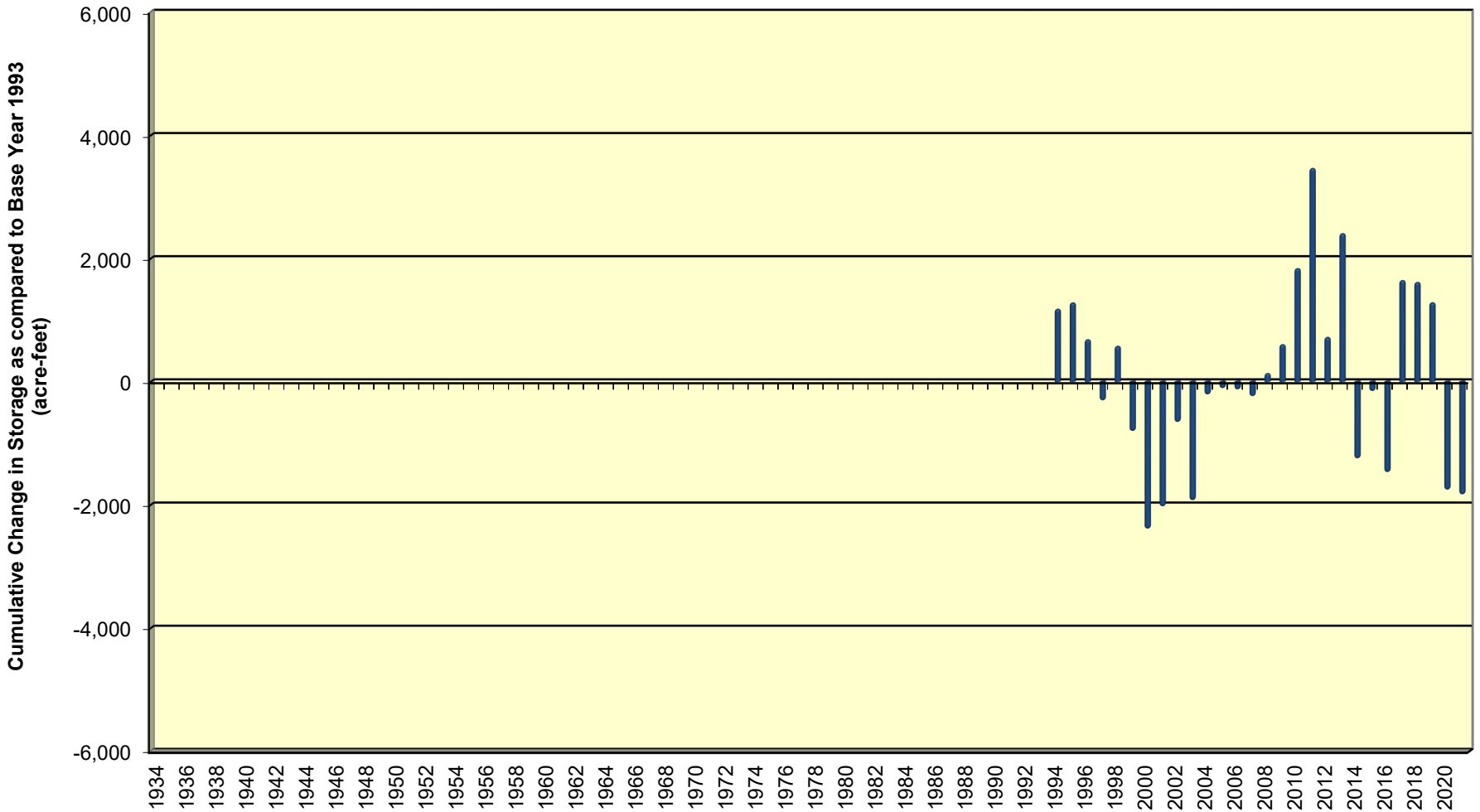
Annual Change in Storage for the Wilson Creek Sub-Basin

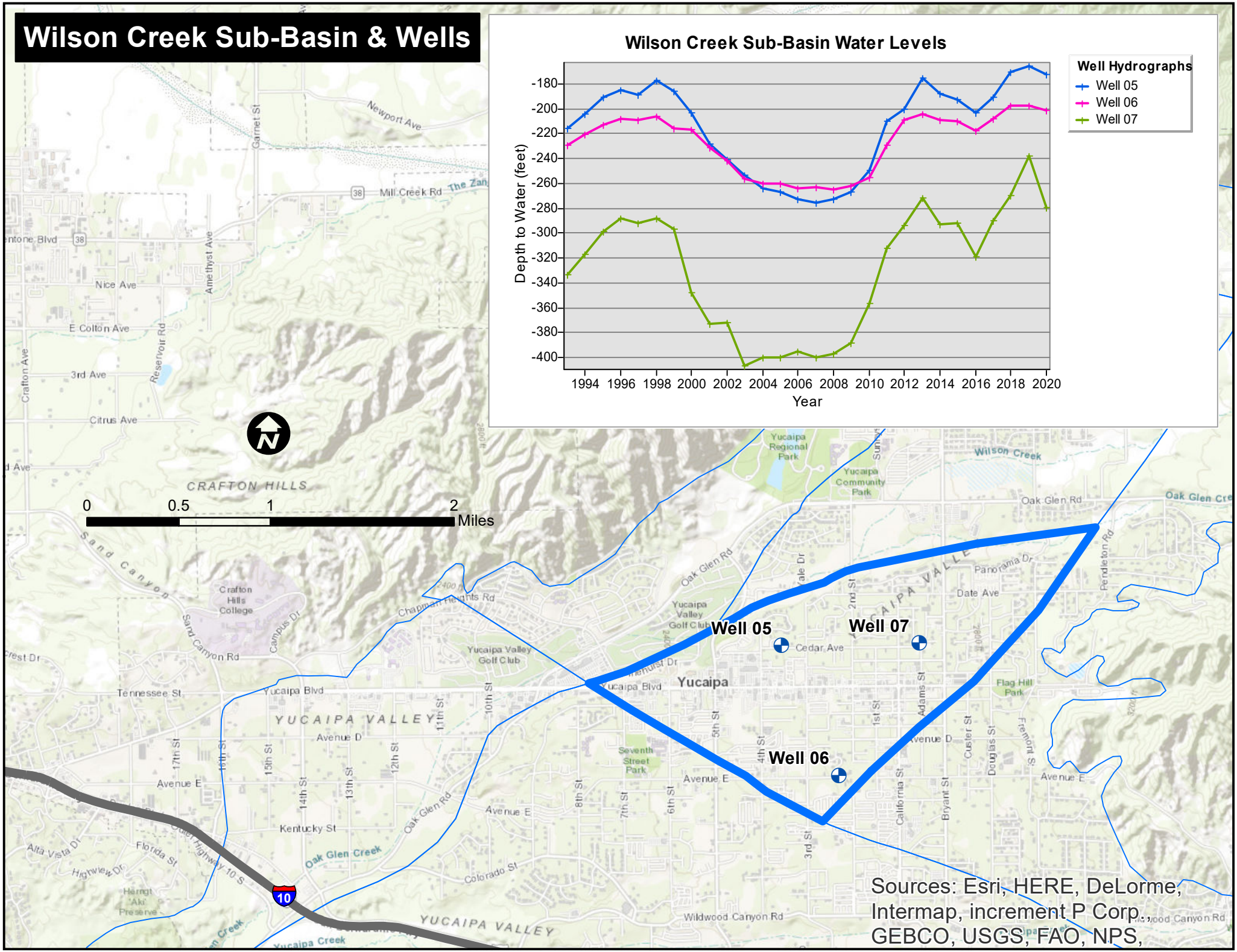


San Bernardino Valley Municipal Water District

Change In Storage for the Wilson Creek Sub-Basin 1993 - Present

(1) Year	(2) Basin Index (ft.)	(3) Annual Change in Groundwater Storage (acre-feet)	(4) Cummulative Change in Groundwater Storage (acre-feet)
1993	0		
1994	12	1,179	1,179
1995	13	1,282	2,461
1996	7	684	3,145
1997	-3	-307	2,838
1998	6	578	3,416
1999	-9	-804	2,612
2000	-23	-2,390	222
2001	-21	-2,027	-1,805
2002	-8	-658	-2,463
2003	-20	-1,928	-4,391
2004	-3	-211	-4,602
2005	-1	-109	-4,711
2006	-2	-129	-4,840
2007	-2	-239	-5,079
2008	1	135	-4,944
2009	6	603	-4,341
2010	19	1,839	-2,502
2011	37	3,465	963
2012	16	722	1,685
2013	17	2,406	4,091
2014	-13	-1,249	2,842
2015	-2	-156	2,686
2016	-15	-1,472	1,214
2017	17	1,645	2,859
2018	17	1,615	4,474
2019	12	1,285	5,759
2020	-17	-1,757	4,002
2021	-18	-1,833	2,169

Wilson Creek Sub-Basin & Wells



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Well 31

USGS Vineyard

Rialto 4

Well 10

Well 11

Well 17

Well 16

Rialto Ave

Legend

- Well Location
- Rialto-Colton Basin (Source: DWR)

Document Path: Y:\1422ChangeInStorage\CIS\RialtoColton.mxd

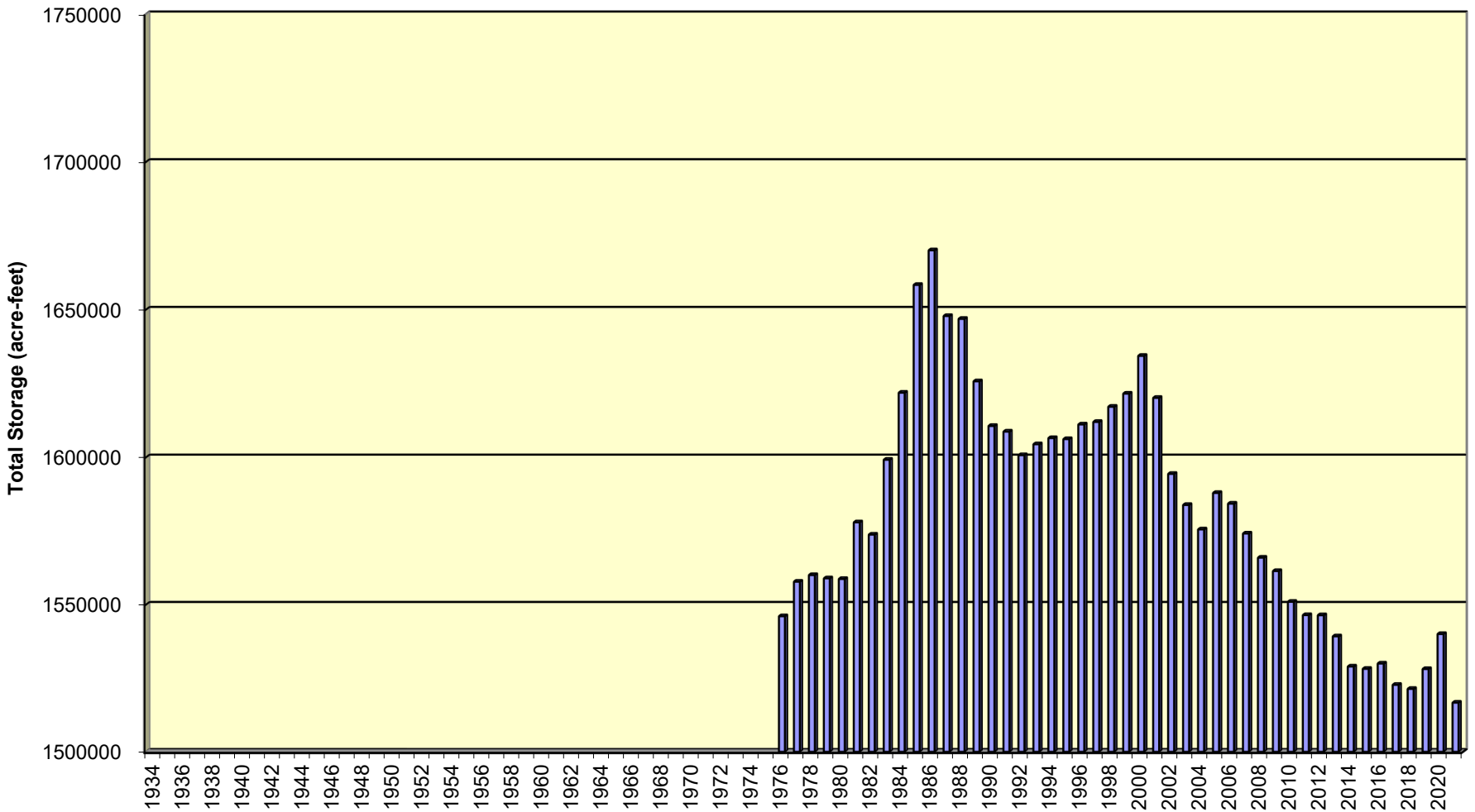
RIALTO-COLTON BASIN AND WELL LOCATIONS

SAN BERNARDINO Valley MUNICIPAL WATER DISTRICT

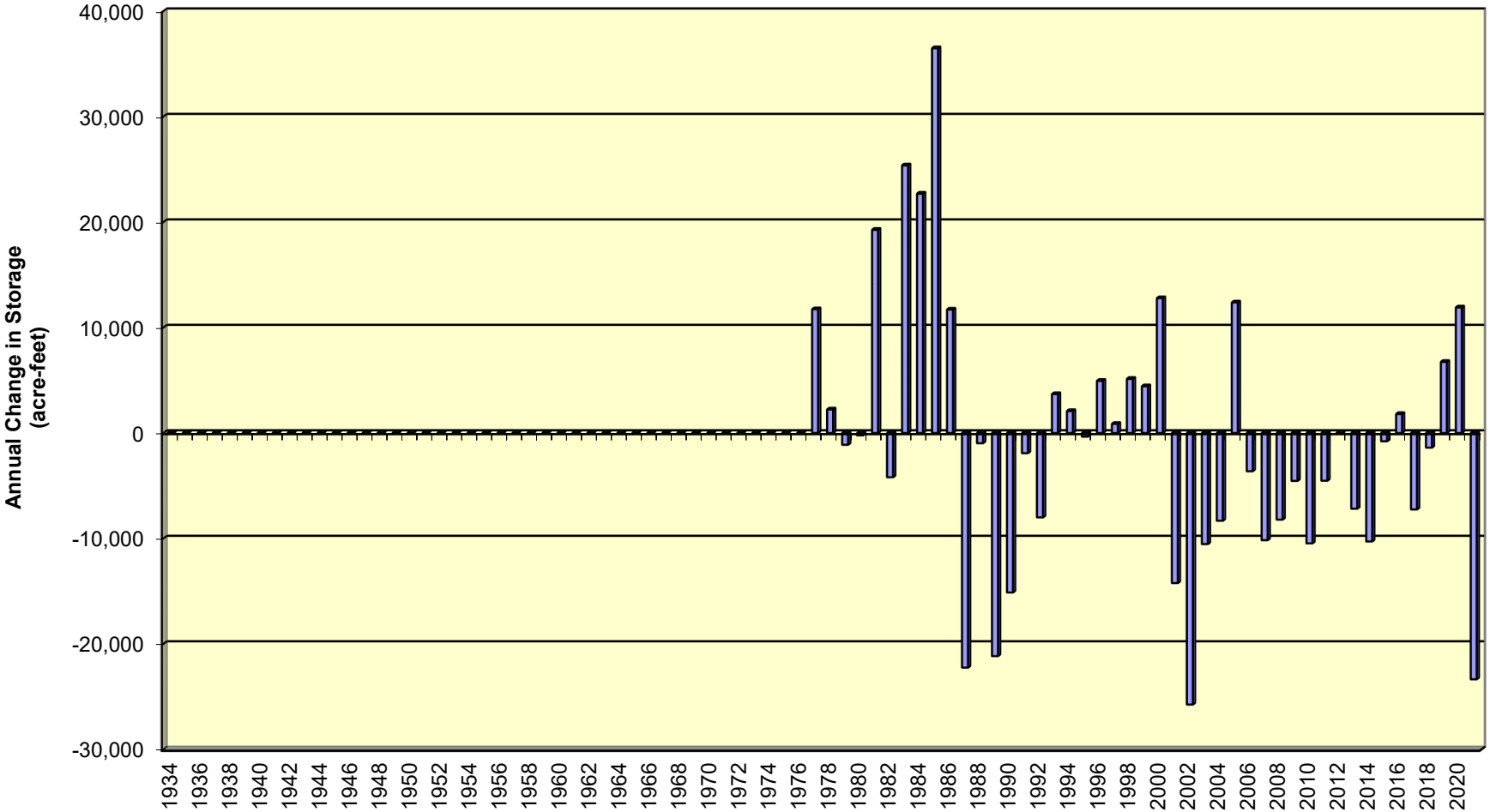
0 0.5 1 2 3 4 Miles

N

Total Storage for the Rialto-Colton Basin



Annual Change in Storage for the Rialto-Colton Basin

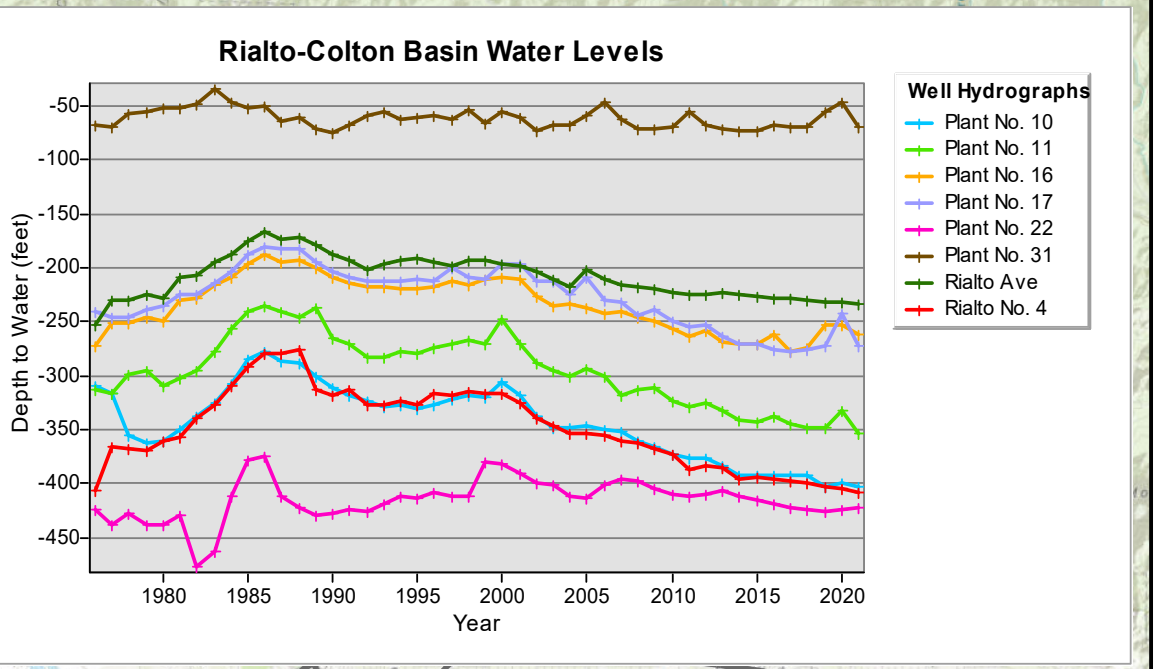


San Bernardino Valley Municipal Water District

Change In Storage for the Rialto-Colton Basin 1976 - Present

(1) Year	(2) Basin Index (ft.)	(3) Annual Change in Groundwater Storage (acre-feet)	(4) Total Groundwater Storage (acre-feet)
1976			1,546,082
1977	7	11,742	1,557,824
1978	0	2,239	1,560,063
1979	0	-1,111	1,558,952
1980	0	-218	1,558,734
1981	10	19,268	1,578,002
1982	0	-4,188	1,573,814
1983	13	25,380	1,599,194
1984	15	22,698	1,621,892
1985	16	36,486	1,658,378
1986	6	11,707	1,670,085
1987	-10	-22,232	1,647,853
1988	0	-962	1,646,891
1989	-11	-21,142	1,625,749
1990	-9	-15,111	1,610,638
1991	-2	-1,905	1,608,733
1992	-5	-7,992	1,600,741
1993	1	3,695	1,604,436
1994	1	2,087	1,606,523
1995	-1	-339	1,606,184
1996	3	4,948	1,611,132
1997	1	868	1,612,000
1998	2	5,137	1,617,137
1999	2	4,439	1,621,576
2000	8	12,786	1,634,362
2001	-8	-14,217	1,620,145
2002	-14	-25,730	1,594,415
2003	-5	-10,524	1,583,891
2004	-5	-8,315	1,575,576
2005	6	12,383	1,587,959
2006	-3	-3,618	1,584,341
2007	-5	-10,157	1,574,184
2008	-4	-8,206	1,565,978
2009	-2	-4,537	1,561,441
2010	-6	-10,454	1,550,987
2011	-3	-4,521	1,546,466
2012	1	-48	1,546,418
2013	-4	-7,173	1,539,245
2014	-6	-10,274	1,528,971
2015	-1	-774	1,528,197
2016	1	1,803	1,530,000
2017	-4	-7,245	1,522,755
2018	-1	-1,382	1,521,373
2019	3	6,748	1,528,121
2020	7	11,908	1,540,029
2021	-12	-23,338	1,516,691

Rialto-Colton Basin & Wells



Plant No. 31

Plant No. 22/Vineyard

Plant No. 10

Rialto No. 4

Plant No. 11

Rialto Ave

Plant No.16

Plant No.17

0 0.5 1 2 Miles

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

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