

# ANNUAL SUMMARY OF GROUNDWATER CONDITIONS IN THE SOUTHEAST BOISE GROUNDWATER MANAGEMENT AREA CALENDAR YEAR 2021

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This report describes the groundwater conditions in and around the Southeast Boise Groundwater Management Area (GWMA) based on the groundwater level observation network established in the spring of 2000 under the guidance of the Southeast Boise Groundwater Advisory Committee (Advisory Committee). The network is a cooperative effort among Micron Technology, Inc., Suez Water Idaho Inc., and the Idaho Department of Water Resources (IDWR). The cooperators submit water level data to IDWR and/or provide support and access to wells for monitoring. The data is maintained in the IDWR groundwater database. The J.R. Simplot Co., City of Boise, Sunroc Corp., Idaho Transportation Department, Idaho Department of Lands, Boise Gun Club, and other landowners provide access to wells within the monitoring network.

## Status of Monitoring Network

The network currently consists of 35 active monitoring sites (**Table A1**), with one site (03N 02E 14ABC) containing a set of five nested wells for a total of 39 active wells (**Figure B1**). Although the core monitoring network has remained relatively stable over time, one change occurred in 2021: IDWR deployed a transducer to a new addition to the network, the Surprise Valley Well (03N 03E 33CDB1).

IDWR manually measured water levels in 31 of the 39 wells during each of the final three quarters in 2021 and measured the Surprise Valley Well in the final quarter of 2021. Twenty-six wells are equipped with In-Situ™ pressure transducers and are programmed to collect water level and water temperature observations at a minimum of two times per day (**Figure B1**), with most storing hourly readings. IDWR downloaded the transducer data at all 26 wells during manual measurement visits. Suez Water Idaho Inc. measured the remaining seven wells bi-monthly.

## Groundwater Level Trends

Groundwater level hydrographs showing the complete period of record for active wells in the monitoring network are shown in **Appendix C**. Groundwater level hydrographs displaying data only for the period from January 1, 1990, to December 31, 2021, for all active monitoring wells are shown in **Appendix D**. All available data has been included in this report. Several wells are subject to significant seasonal trends and/or pumping effects, which can make it difficult to draw meaningful conclusions from the hydrographs. Similarly, nearby pumping and/or management changes may impact apparent water level trends. Periodic data collection in wells lacking continuous measurements from pressure transducers can make it difficult to conclude trends due to the uncertainty regarding the seasonal peaks and troughs of the hydrographs relative to the instantaneous manual measurements. The magnitude of the observed water level changes can also be such that determining trends independent of factors such as systematic and random errors can be challenging. All qualitative and quantitative analyses should recognize the limitations of the data as well as the associated uncertainties. Qualitative trends have

been completed for each well in the network, and Mann-Kendall trend analyses have been completed for each well with at least four years of fall measurements.

Qualitative trends were determined by subtracting the minimum depth to water for a given calendar year from the minimum depth to water for calendar year 2021, and by subtracting the maximum depth to water for a given calendar year from the maximum depth to water for calendar year 2021 (**Table A2**). If the calculated difference for the minimum depth to water and the maximum depth to water values are both negative, the water level trend is said to be increasing (measured water levels are becoming shallower). If the calculated difference for the minimum depth to water and the maximum depth to water values are both positive, the water level trend is said to be decreasing (measured water levels are becoming deeper). If the calculated difference for the minimum depth to water and the maximum depth to water values have different arithmetic signs, the water level trend is said to be undetermined.

Qualitative trends for 5-, 10-, and 15-year intervals were developed for the active monitoring network (**Table A2**). In the last five years (2016 to 2021), there have been apparent decreasing water level trends in 11 of the 39 active wells. In that same time period, there have been apparent increasing water level trends in 13 of the 39 active wells. Water level trends for the remaining 15 wells were said to be undetermined due to water level ambiguity, and/or insufficient data.

The Southeast Boise Monitoring Network fall water level measurements were used to test for groundwater level trends using the Mann-Kendall computer program described by Helsel et al., 2006 (**Table A3**). The Mann-Kendall test describes trend over time while providing a measure of the trend's statistical significance (Helsel & Hirsch, 2002). High quality hand measurements from the fall time period, with no pumping or recovering groundwater conditions, were used in the trend analysis, and wells with at least four years of measurements were selected for the analysis. Results were considered statistically significant if the p-value was  $< 0.05$ . Mann-Kendall trend results show a statistically significant decreasing water level trend in six of the 36 qualifying wells, and a statistically significant increasing water level trend in 17 wells. It should be noted that in some of the wells with increasing trends, the oldest measurements were excluded from the analysis as those measurements did not sit within the fall timeframe or did not qualify for another reason, e.g. the well was pumping/recovering during the measurement. An example of such a well is 02N 02E 02BBC2, where the oldest measurement, in 1989, was not recorded within in the fall timeframe. In 13 of the 36 qualifying wells, the results were not statistically significant.

## **Recommendations**

In May 2021 the Advisory Committee requested that IDWR continue to pursue additional groundwater monitoring wells for the monitoring network, develop improved elevation data for the wells that currently utilize data based on topographic map data, utilize a statistical trend test methodology, produce hydrographs in the annual report using consistent scales whenever possible, and recommended that transducers be upgraded as appropriate and within a reasonable time frame to improve data collection. This annual report has detailed the progress made in the previous year towards furthering those Advisory Committee requests and recommendations. IDWR will continue to look for opportunities to pursue Advisory Committee requests and recommendations.

## **Bibliography**

Helsel, D. R., & Hirsch, R. M. (2002). Statistical Methods in Water Resources. United States Geological Survey.

Helsel, D. R., Mueller, D. K., & Slack, J. R. (2006). Computer program for the Kendall family of trend tests.

## Appendix A

### **Tables**

**Table A1.** Summary of the groundwater monitoring network for the Southeast Boise GWMA.

Map ID	Well Number	Well Name	Period of Water Level Record	Status of Well	Comments
1	01N 01E 34AAA1	City of Boise Farm	2018 - 2022	Active	Transducer installed January 2018
2	01N 03E 04BBD1	Prigge	1994 - 2022	Active	Transducer installed October 2014, vented transducer installed April 2019
3	01N 04E 28CAC1	Ken Agenbroad	1979 - 2022	Active	
4	02N 01E 36BBB1	Harris South Cole	1969 - 2022	Active	Transducer installed May 2018
5	02N 02E 02BBC2	JR Flat	1989 – 2022	Active	
6	02N 02E 04CBB1	IDL House	1973 - 2022	Active	Transducer installed March 2017
7	02N 02E 07CBC1	Hollilynn	1993 - 2022	Active	Transducer installed May 2018
8	02N 02E 17ABD1	Ten Mile	1996 – 2022	Active	
9	02N 02E 21CBB1	SunRoc	2018 - 2022	Active	Transducer installed April 2018
10	02N 02E 22BBB1	Pioneer	1998 - 2022	Active	
11	02N 02E 34CCD1	Boise Gun Club	1976 - 2022	Active	Transducer installed November 2016
12	02N 03E 06DCA1	Micron Test #1	1986 - 2022	Active	Transducer installed October 2019
13	02N 03E 07BAC1	Micron Test #2	1983 - 2022	Active	Transducer installed October 2019
14	02N 03E 07CDA1	Pettibone	1997 - 2022	Active	Transducer installed October 2019
15	02N 03E 07DBB1	Micron Shallow Obs	1998 - 2022	Active	Transducer installed October 2019
16	02N 03E 07DBB2	Micron Deep Obs	1998 - 2022	Active	Transducer installed October 2019
17	02N 03E 09BAA2	Christensen	1993 - 2022	Active	Transducer installed October 2019
18	02N 03E 19DBB1	Micron South	2017 - 2022	Active	Vented transducer installed April 2019

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Map ID	Well Number	Well Name	Period of Water Level Record	Status of Well	Comments
19	02N 03E 28CAA1	Blacks Creek Rest Area Westbound	2007 - 2022	Active	Transducer installed May 2018
20	02N 03E 34ACC1	Blacks Creek Exit ITD	2012 - 2022	Active	Transducer installed October 2014, vented transducer installed April 2019
21	03N 02E 11DDD1	TV Lenzi	1977 - 2022	Active	Transducer installed June 2016
22	03N 02E 14ABC	TVHP 4-1 through 4-5	2002 - 2022	Active	Transducers installed August 2016
23	03N 02E 25ACBC1	Helen Lowder Park	1992 - 2022	Active	
24	03N 02E 25CAA1	Centennial	1976 - 2022	Active	
25	03N 02E 26DBA1	Bergeson	1990 - 2022	Active	
26	03N 02E 35BAB1	Market	1991 - 2022	Active	
27	03N 02E 36ABC1	Terteling	1972 - 2022	Active	
28	03N 03E 30BCBD1	Hurok	1969 - 2022	Active	
29	03N 03E 30DDAA1	E Boise Ave	1987 - 2019	Active	Transducer installed March 2017, Lost access to site in Summer of 2019
30	03N 03E 31ADD1	Simplot Golden Development	1993 - 2022	Active	
31	03N 03E 32BBA1	Whitney Fire	1975 - 2022	Active	
32	03N 03E 32CDD1	Micron Columbia	1990 - 2022	Active	Transducer installed October 2019, Removed January 2020 due to malfunction. Reinstalled October 2020.
33	03N 03E 33DAA1	Hammer Flats	1969 - 2022	Active	
34	02N 02E 03DDC1	Boise Airport	2019 - 2022	Active	Drilled June 2019, Transducer installed July 2019
35	03N 03E 33CDB1	Surprise Valley	2021-2022	Active	Site added December 2021, Transducer installed January 2022

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<b>Map ID</b>	<b>Well Number</b>	<b>Well Name</b>	<b>Period of Water Level Record</b>	<b>Status of Well</b>	<b>Comments</b>
N/A	02N 02E 04CAA1	SEB IDL Field	2000 - 2009	Inactive	Discontinued in 2010
N/A	02N 03E 09BCA2	Vern Guyer	1993 - 2007	Inactive	Discontinued in 2007
N/A	03N 02E 25CBCA1	Motive Power 41A	1997 - 2015	Inactive	Discontinued in 2015
N/A	03N 03E 31BDD1 - DESTROYED	Oregon Trail - Destroyed	1977 - 2012	Inactive	Discontinued in 2013
N/A	03N 02E 36CDA1	Cromon	1991-2018	Inactive	Homeowner requested an end to monitoring activity. Discontinued in 2020

**Table A2.** Qualitative trend results for the 39 active monitoring wells.

Well Number	Well Name	5 Year Trend (2021-2016)	10 Year Trend (2021-2011)	15 Year Trend (2021-2006)
01N 01E 34AAA1	City of Boise Farm	N/A	N/A	N/A
01N 03E 04BBD1	Prigge	Increasing	N/A	N/A
01N 04E 28CAC1	Ken Agenbroad	Increasing	Undetermined	N/A
02N 01E 36BBB1	Harris South Cole	Decreasing	Decreasing	Decreasing
02N 02E 02BBC2	JR Flat	Undetermined	Undetermined	Increasing
02N 02E 04CBB1	IDL House	Decreasing	Decreasing	N/A
02N 02E 07CBC1	Hollilynn	Decreasing	Decreasing	Decreasing
02N 02E 21CBB1	SunRoc	N/A	N/A	N/A
02N 02E 22BBB1	Pioneer	Undetermined	Increasing	Increasing
02N 02E 34CCD1	Boise Gun Club	Decreasing	Decreasing	Decreasing
02N 03E 06DCA1	Micron Test #1	Increasing	Increasing	Increasing
02N 03E 07CDA1	Pettibone	Decreasing	Increasing	Increasing
02N 03E 07DBB1	Micron Shallow Obs	Decreasing	Decreasing	Increasing
02N 03E 07DBB2	Micron Deep Obs	Decreasing	Undetermined	Increasing
02N 03E 09BAA2	Christensen	Increasing	Increasing	Increasing
02N 03E 28CAA1	Blacks Creek Rest Area Westbound	N/A	Decreasing	N/A
02N 03E 34ACC1	Blacks Creek Exit ITD	Increasing	N/A	N/A
03N 02E 11DDD1	TV Lenzi	Undetermined	Undetermined	Undetermined
03N 02E 14ABC1	TVHP 4-1	Decreasing	Decreasing	Decreasing
03N 02E 14ABC2	TVHP 4-2	Decreasing	Decreasing	Decreasing
03N 02E 14ABC3	TVHP 4-3	Decreasing	Decreasing	Decreasing
03N 02E 14ABC4	TVHP 4-4	Undetermined	Undetermined	Undetermined
03N 02E 14ABC5	TVHP 4-5	Undetermined	Undetermined	Undetermined
03N 02E 25CAA1	Centennial	Increasing	Increasing	Increasing
03N 02E 26DBA1	Bergeson	Increasing	Increasing	Increasing
03N 02E 35BAB1	Market	Increasing	Increasing	Increasing
03N 02E 36ABC1	Terteling	Increasing	Increasing	Increasing
03N 03E 30BCBD1	Hurok	Undetermined	Decreasing	Undetermined
03N 03E 30DDAA1	E Boise Ave	N/A	N/A	N/A
03N 03E 32BBA1	Whitney Fire	Increasing	Increasing	Increasing
03N 03E 31ADD1	Simplot Golden Development	Increasing	Increasing	Increasing
03N 03E 32CDD1	Micron Columbia	Undetermined	Increasing	Increasing
03N 03E 33DAA1	Hammer Flats	Increasing	Decreasing	Decreasing
02N 03E 07BAC1	Micron Test #2	Increasing	Increasing	Increasing
02N 02E 17ABD1	Ten Mile	Decreasing	Decreasing	Decreasing
02N 03E 19DBB1	Micron South	N/A	N/A	N/A
03N 02E 25ACBC1	Helen Lowder Park	Undetermined	Decreasing	Undetermined
02N 02E 03DDC1	Boise Airport Well	N/A	N/A	N/A
03N 03E 33CDB1	Surprise Valley	N/A	N/A	N/A



**Table A3.** Mann-Kendall trend results for fall depth to water measurements in 36 active monitoring wells. Wells with sufficient data, at least 4 years of fall measurements, were included in the analysis. Shaded results represent a statistically significant slope trend,  $p < 0.05$ . A negative slope value indicates a rising water trend.

Well Number	Well Name	slope (ft/yr)	p-value
01N 01E 34AAA1	City of Boise Farm	0.28	1.000
01N 03E 04BBD1	Prigge	<b>-0.23</b>	0.002
01N 04E 28CAC1	Ken Agenbroad	0.14	0.112
02N 01E 36BBB1	Harris South Cole	<b>0.39</b>	0.000
02N 02E 02BBC2	JR Flat	<b>-0.92</b>	0.009
02N 02E 04CBB1	IDL House	<b>0.72</b>	0.000
02N 02E 07CBC1	Hollilynn	<b>0.79</b>	0.000
02N 02E 17ABD1	Ten Mile	<b>0.89</b>	0.024
02N 02E 22BBB1	Pioneer	0.39	0.199
02N 02E 34CCD1	Boise Gun Club	<b>0.37</b>	0.000
02N 03E 06DCA1	Micron Test #1	-0.19	0.341
02N 03E 07BAC1	Micron Test #2	<b>-0.87</b>	0.000
02N 03E 07CDA1	Pettibone	<b>-1.51</b>	0.004
02N 03E 07DBB1	Micron Shallow Obs	<b>-1.72</b>	0.008
02N 03E 07DBB2	Micron Deep Obs	<b>-0.99</b>	0.047
02N 03E 09BAA2	Christensen	<b>-0.24</b>	0.021
02N 03E 19DBB1	Micron South	-0.31	0.734
02N 03E 28CAA1	Blacks Creek Rest Area WB	-0.39	0.221
02N 03E 34ACC1	Blacks Creek Exit ITD	-0.06	0.202
03N 02E 11DDD1	TV Lenzi	<b>-0.08</b>	0.000
03N 02E 14ABC1	TVHP 4-1	0.00	1.000
03N 02E 14ABC2	TVHP 4-2	<b>-0.11</b>	0.002
03N 02E 14ABC3	TVHP 4-3	<b>-0.10</b>	0.010
03N 02E 14ABC4	TVHP 4-4	-0.18	0.767
03N 02E 14ABC5	TVHP 4-5	-0.20	0.767
03N 02E 25ACBC1	Helen Lowder Park	-0.11	0.112
03N 02E 25CAA1	Centennial	-0.89	0.071
03N 02E 26DBA1	Bergeson	<b>-2.08</b>	0.000
03N 02E 35BAB1	Market	<b>-1.09</b>	0.001
03N 02E 36ABC1	Terteling	<b>-1.44</b>	0.005
03N 03E 30BCBD1	Hurok	0.00	0.882
03N 03E 30DDAA1	E Boise Ave	<b>-1.07</b>	0.000
03N 03E 31ADD1	Simplot Golden Development	<b>-0.79</b>	0.000
03N 03E 32BBA1	Whitney Fire	<b>-3.28</b>	0.000
03N 03E 32CDD1	Micron Columbia	<b>-0.27</b>	0.065
03N 03E 33DAA1	Hammer Flats	<b>0.41</b>	0.000

## Appendix B

### **Figures**

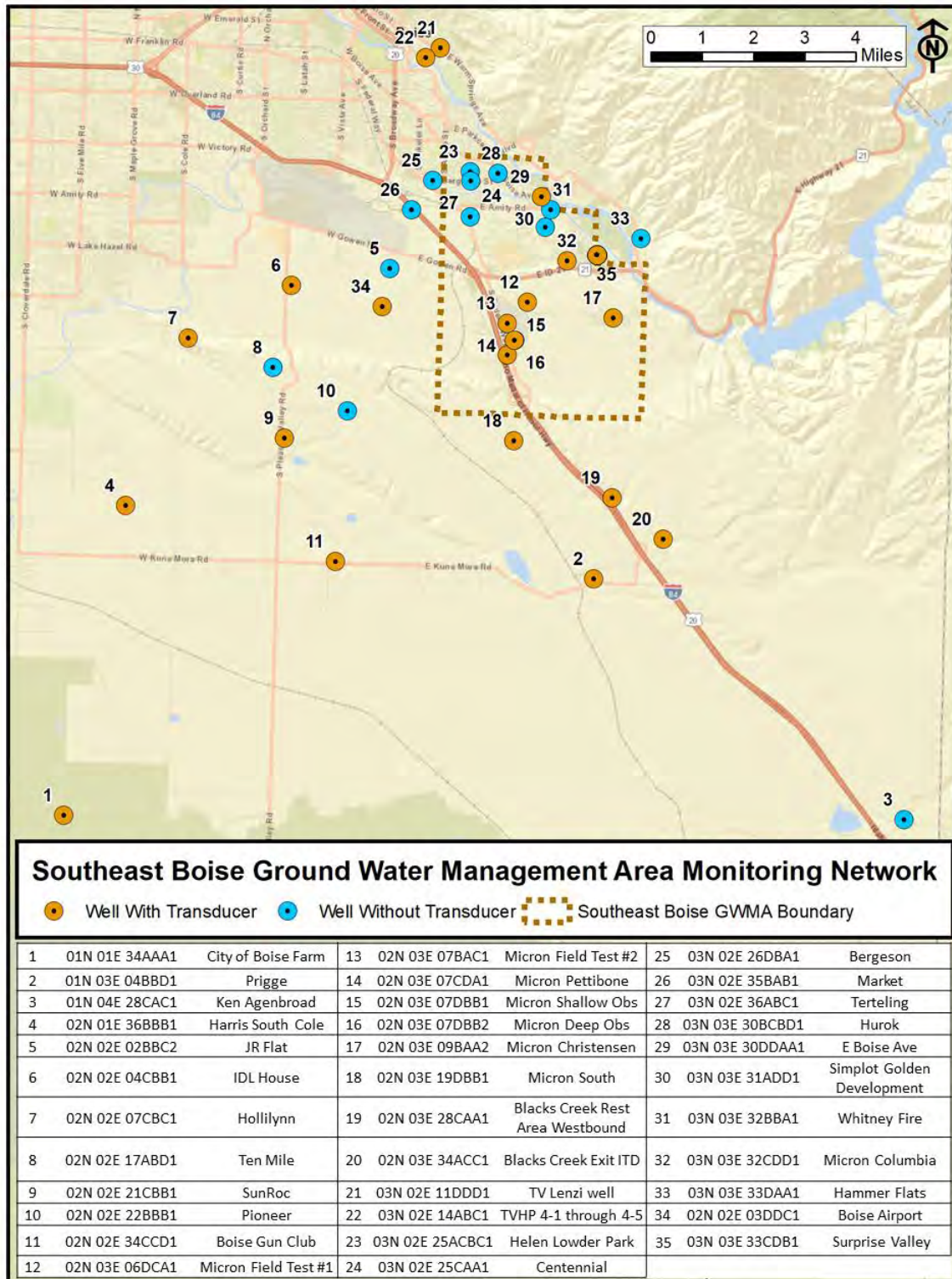
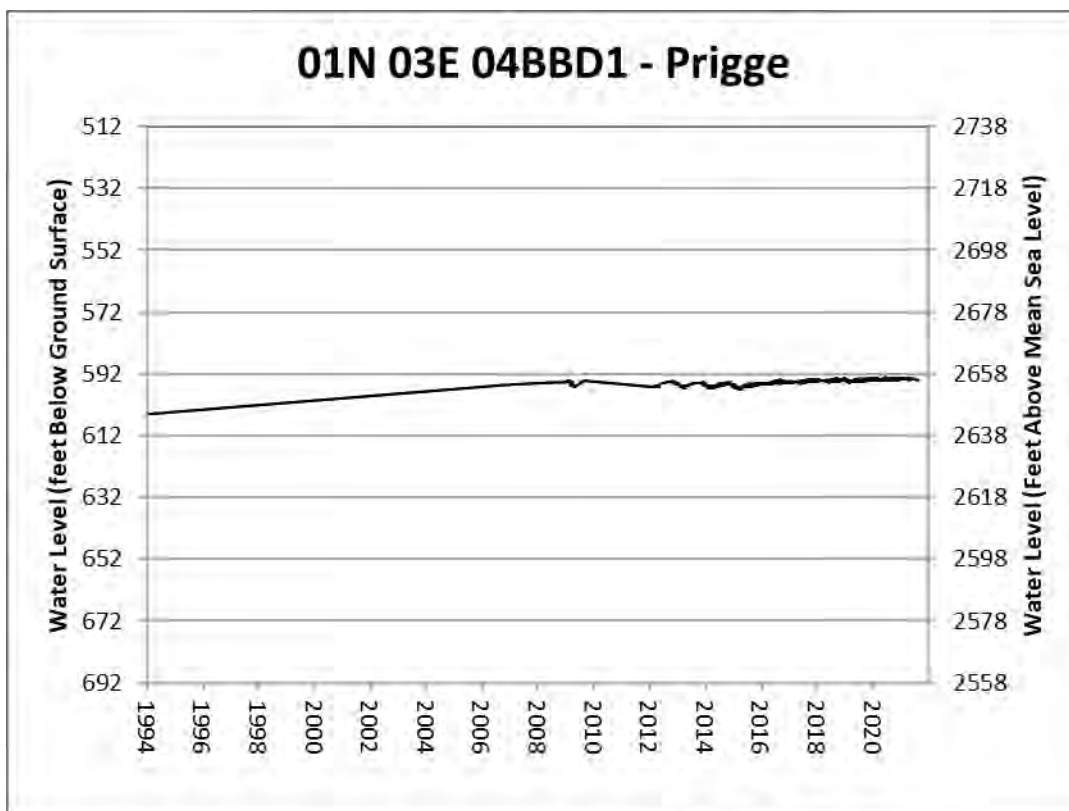
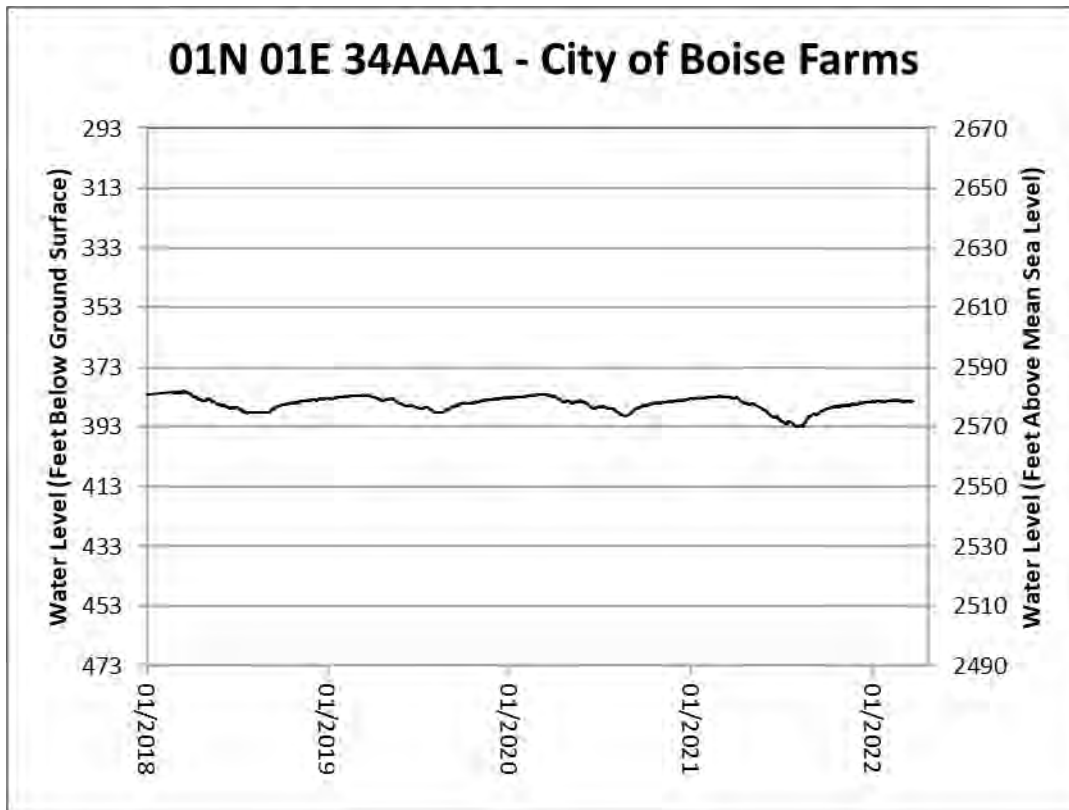
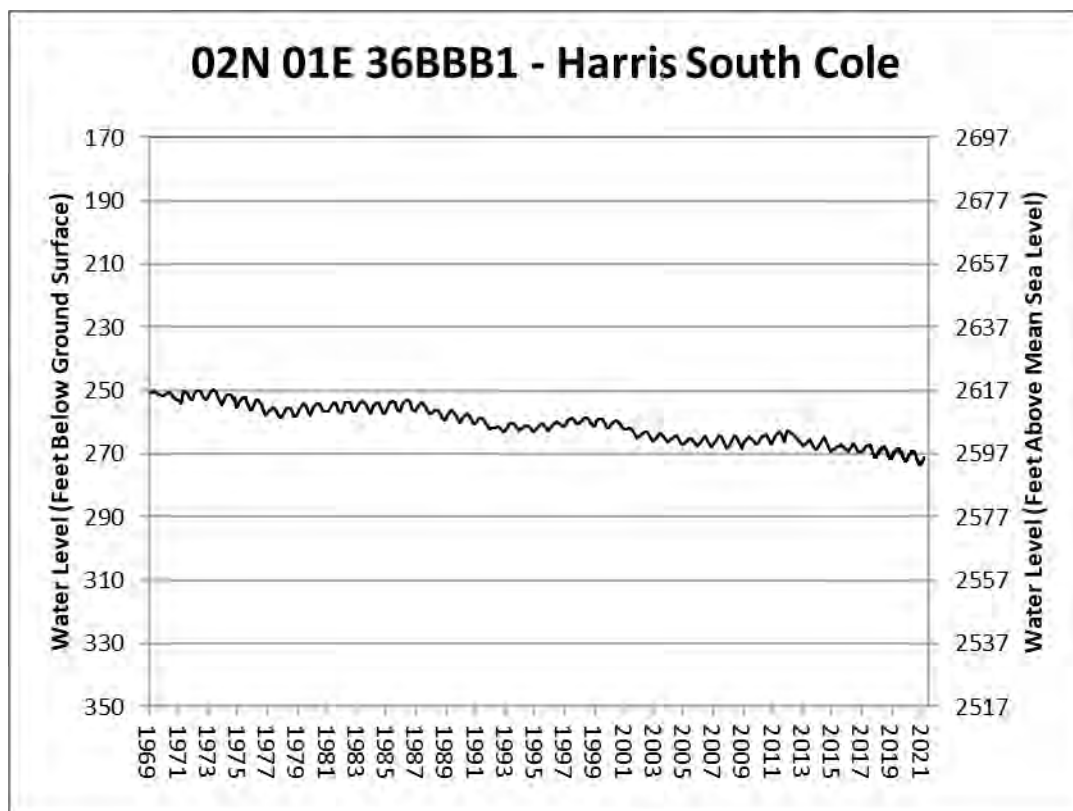
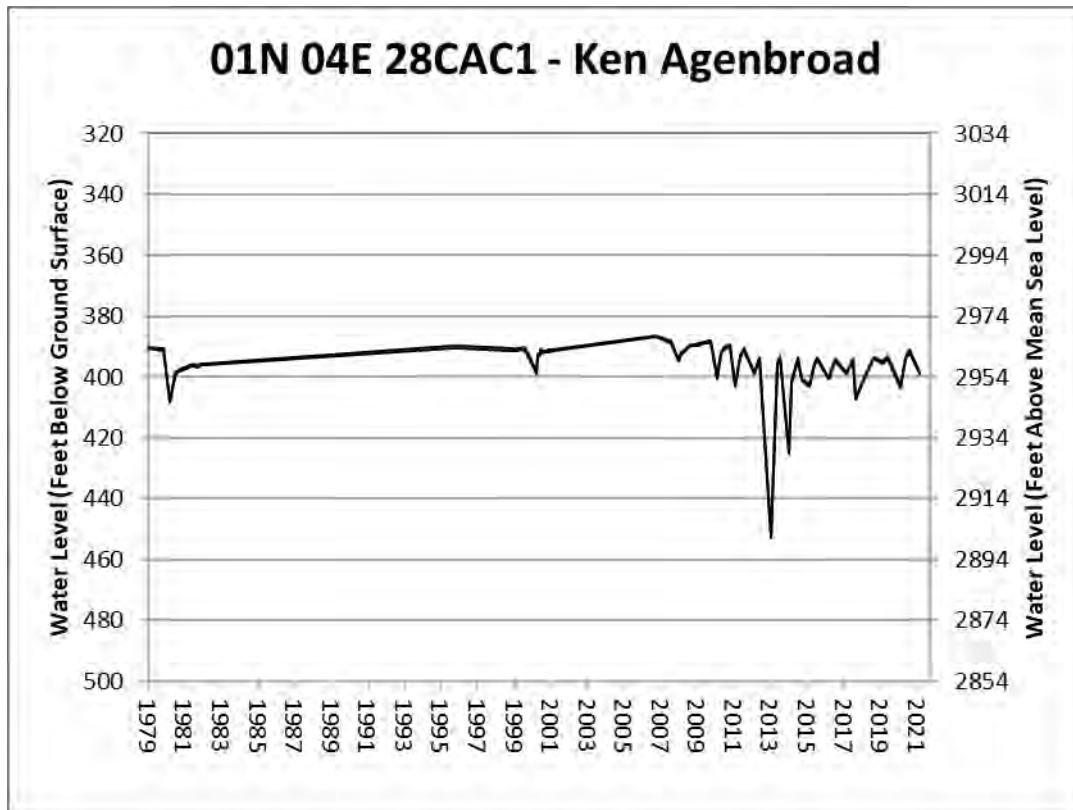


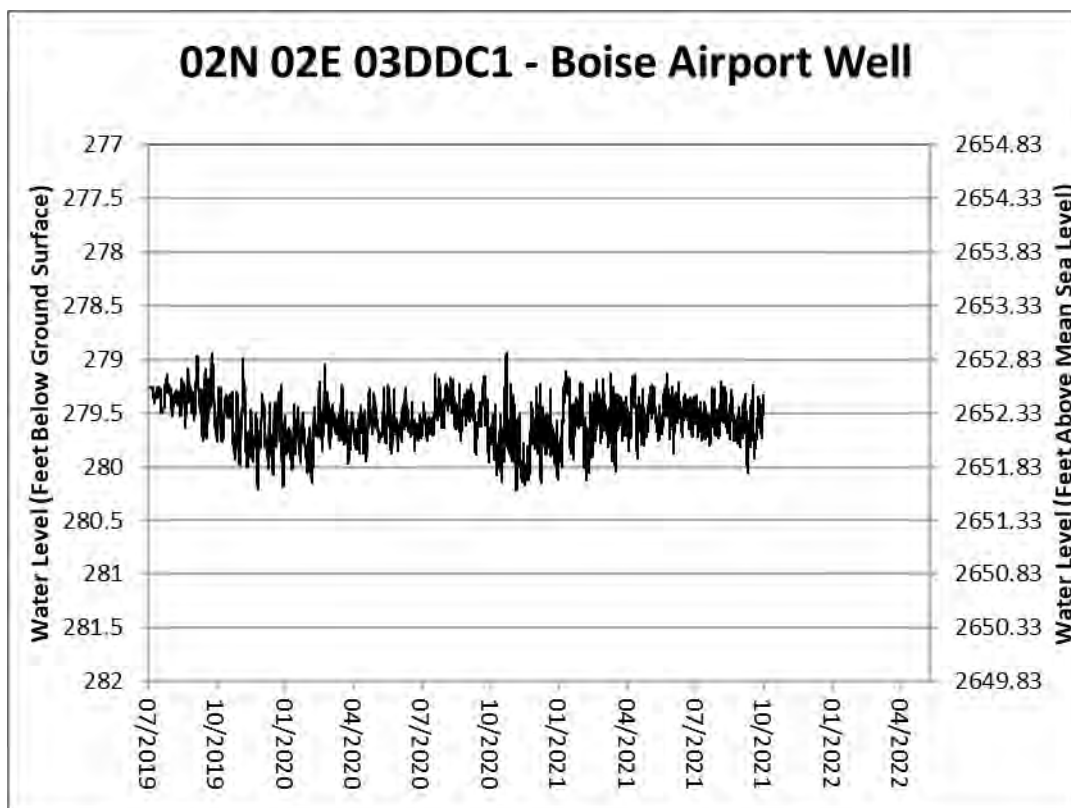
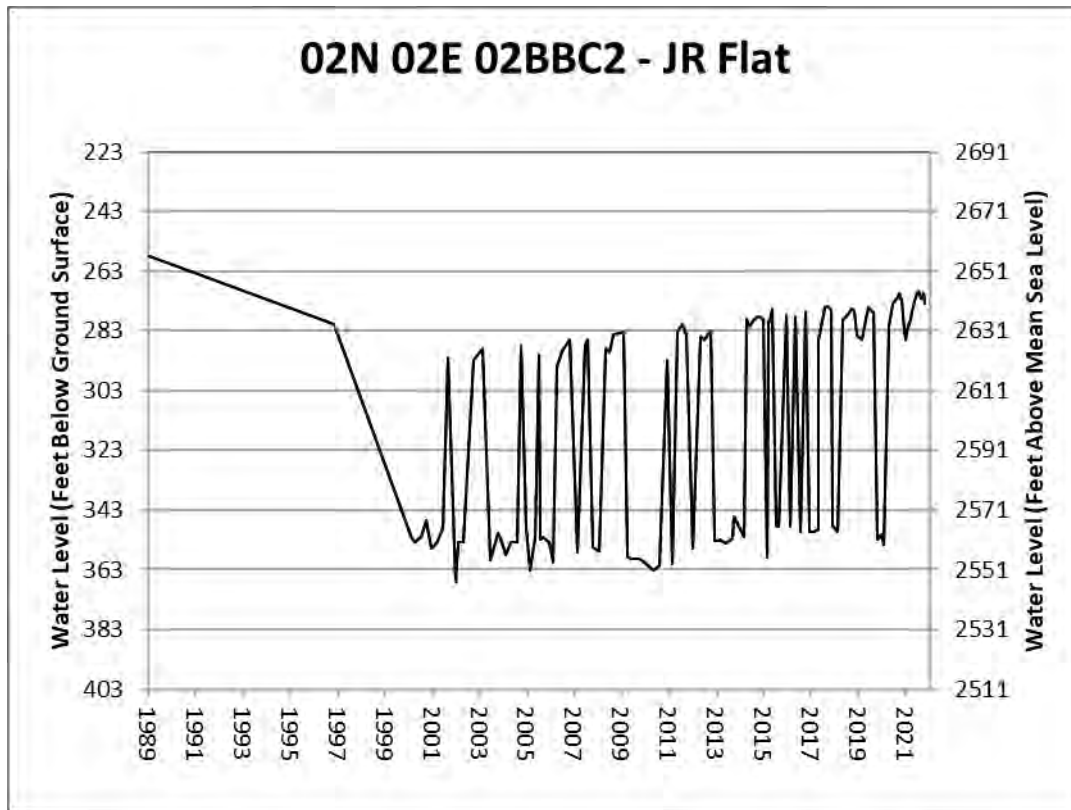
Figure B1. Current Southeast Boise GWMA monitoring network.

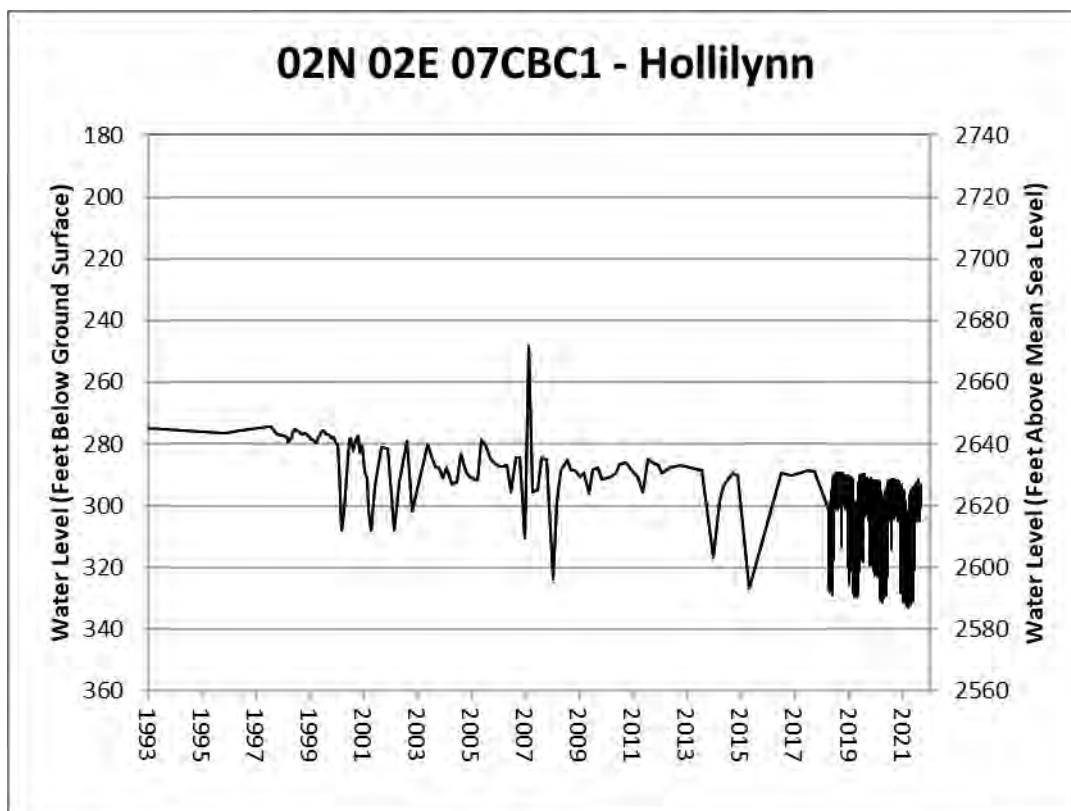
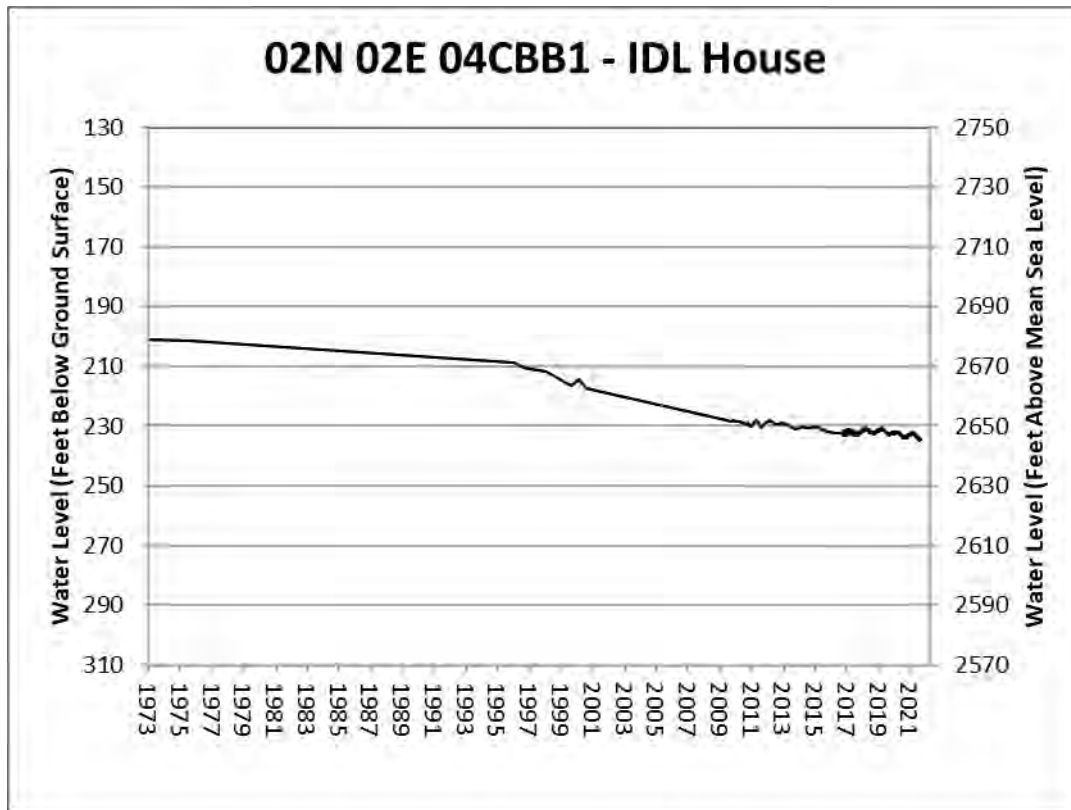
## Appendix C

# Hydrographs for Active Monitoring Wells

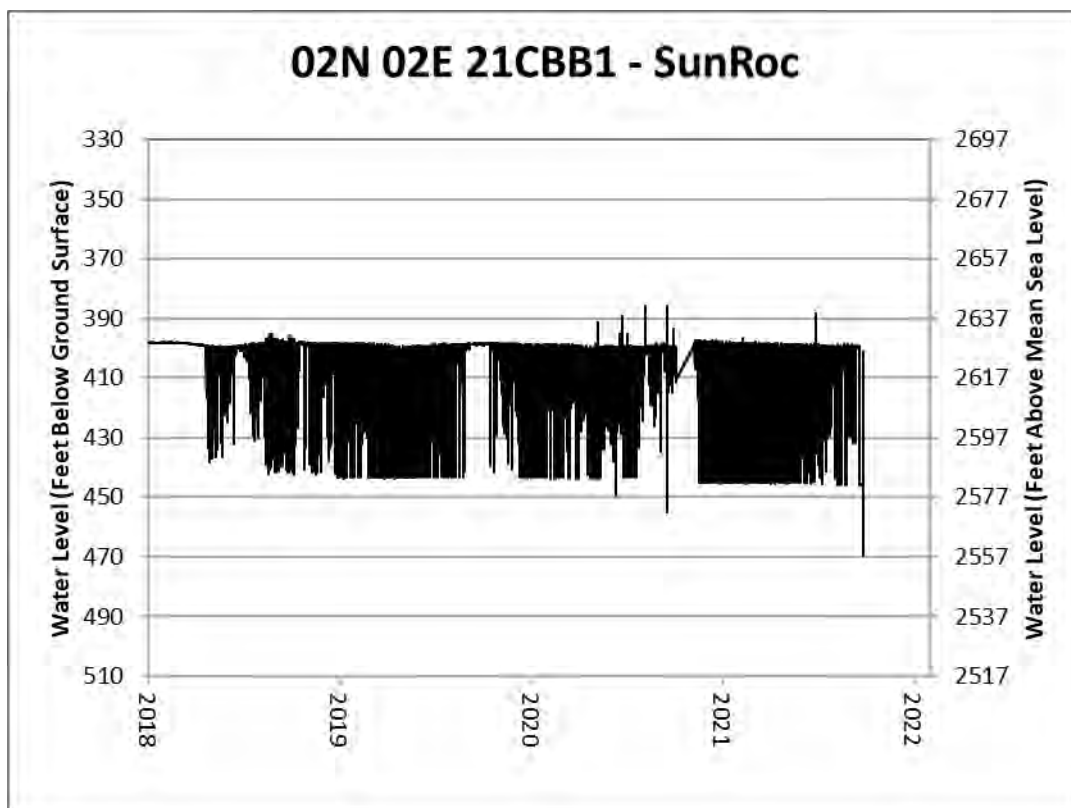
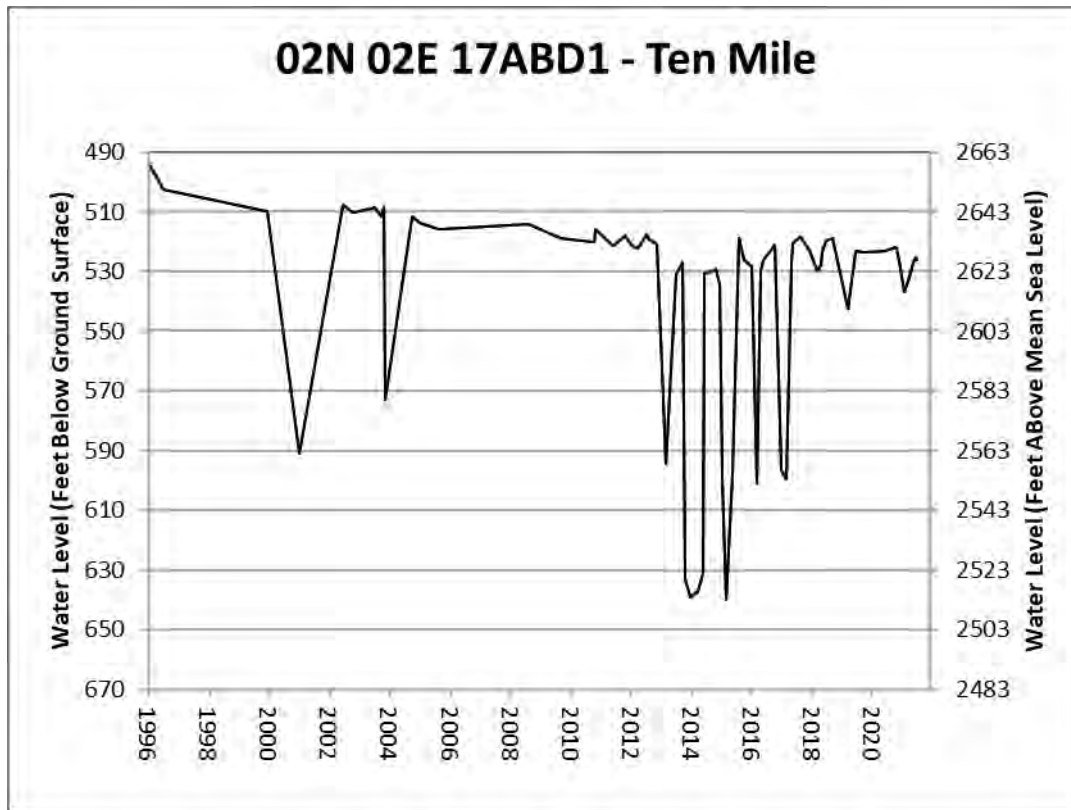


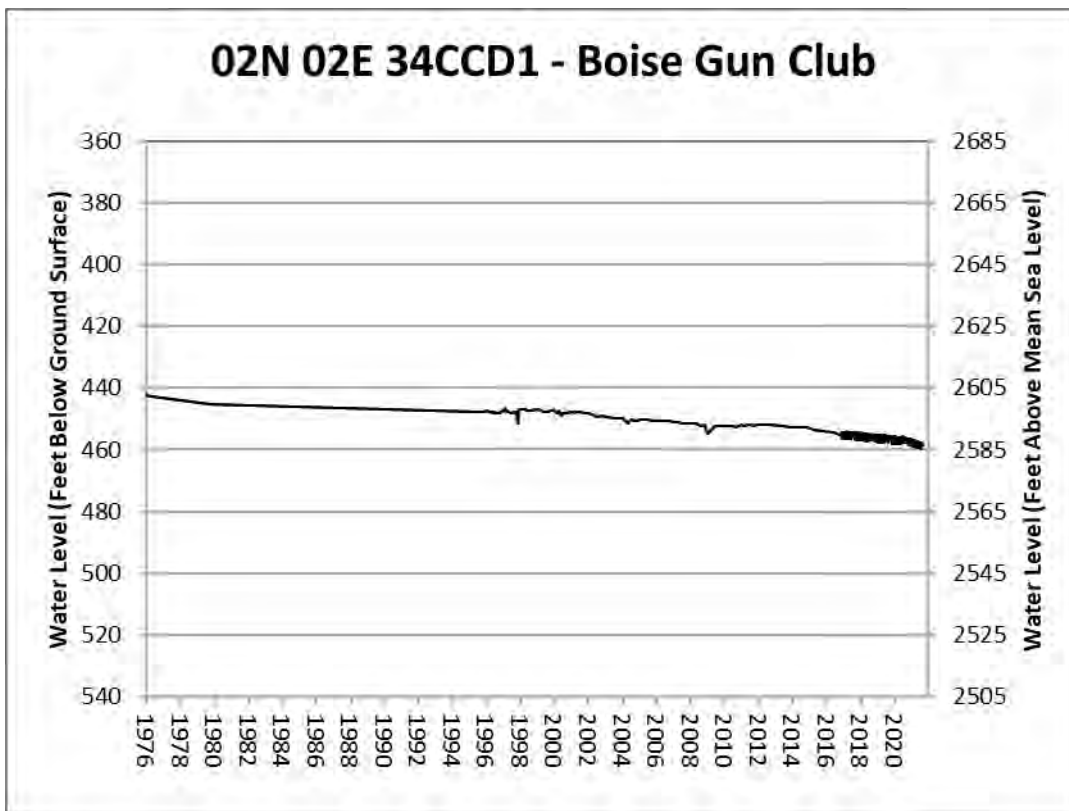
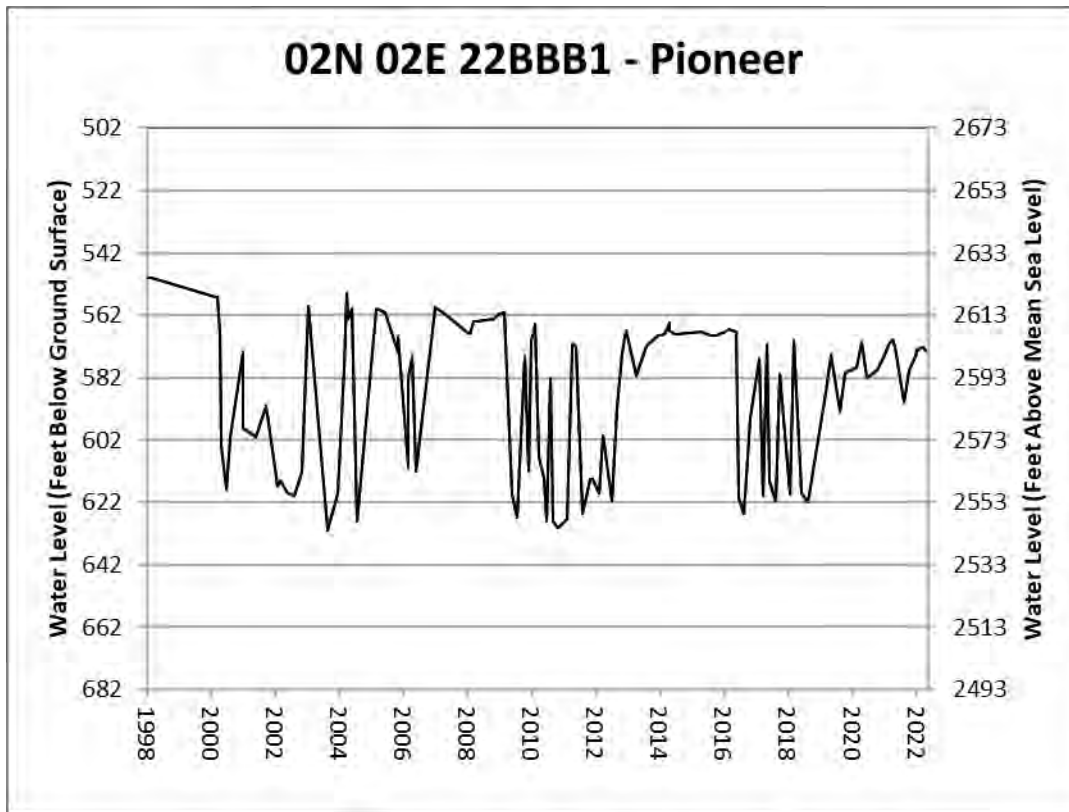


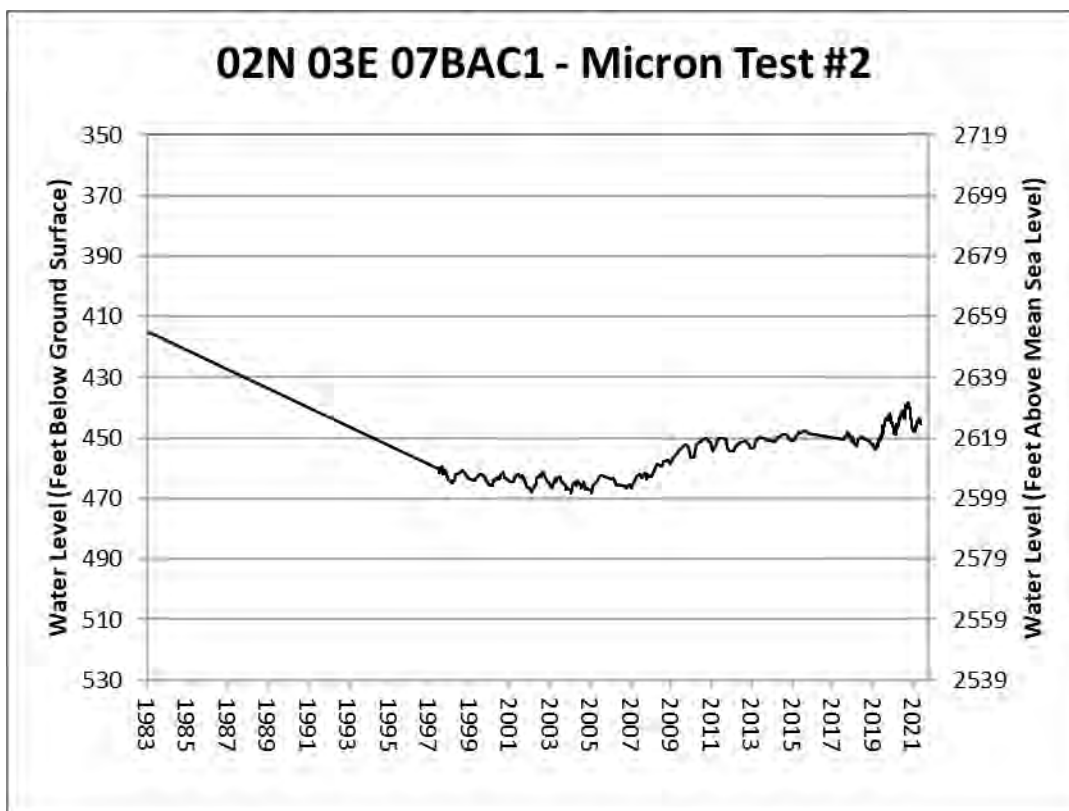
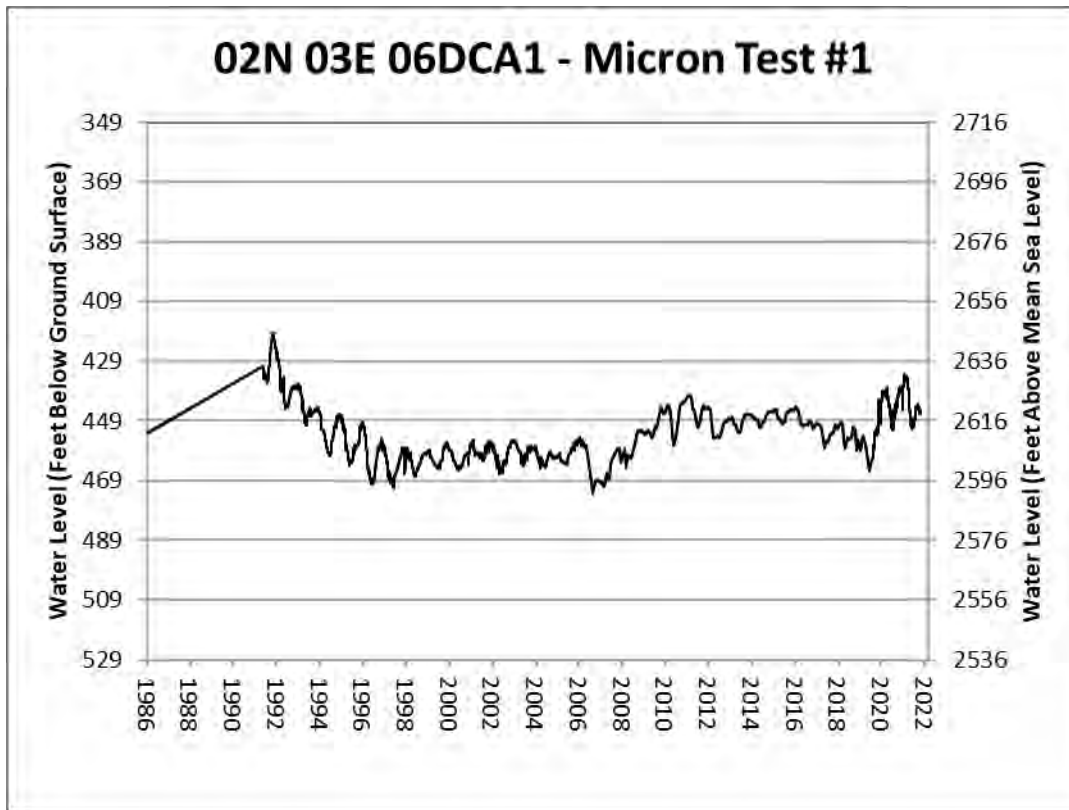


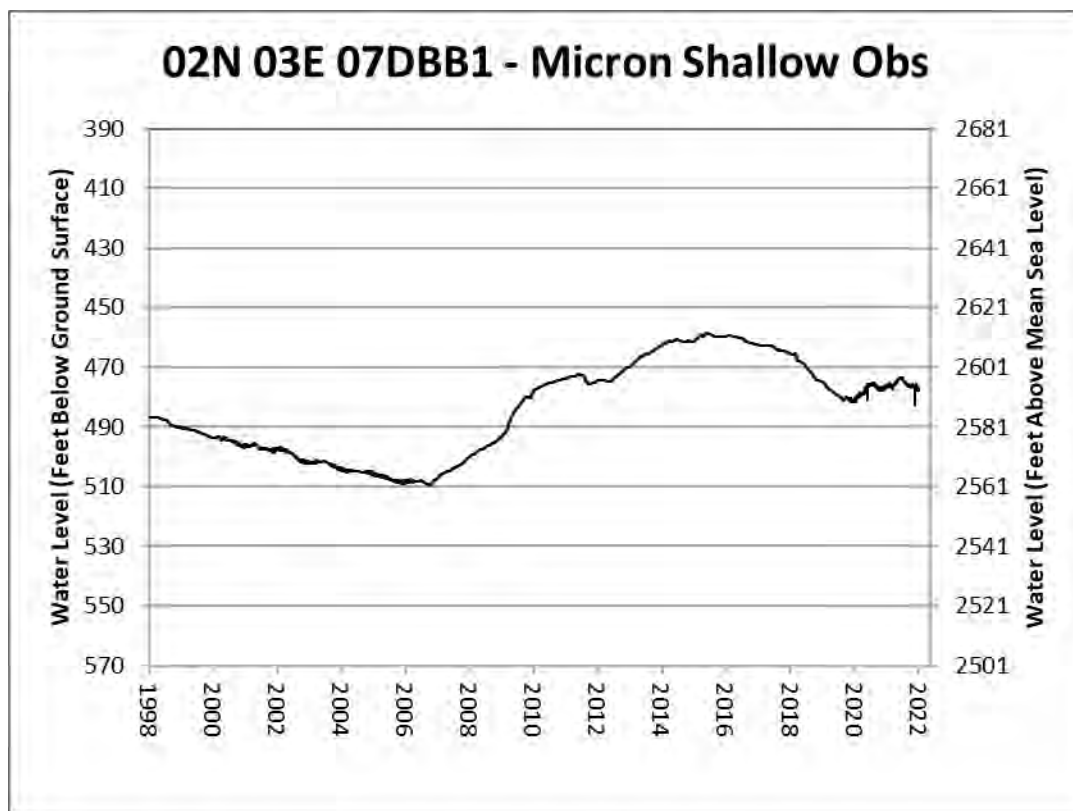
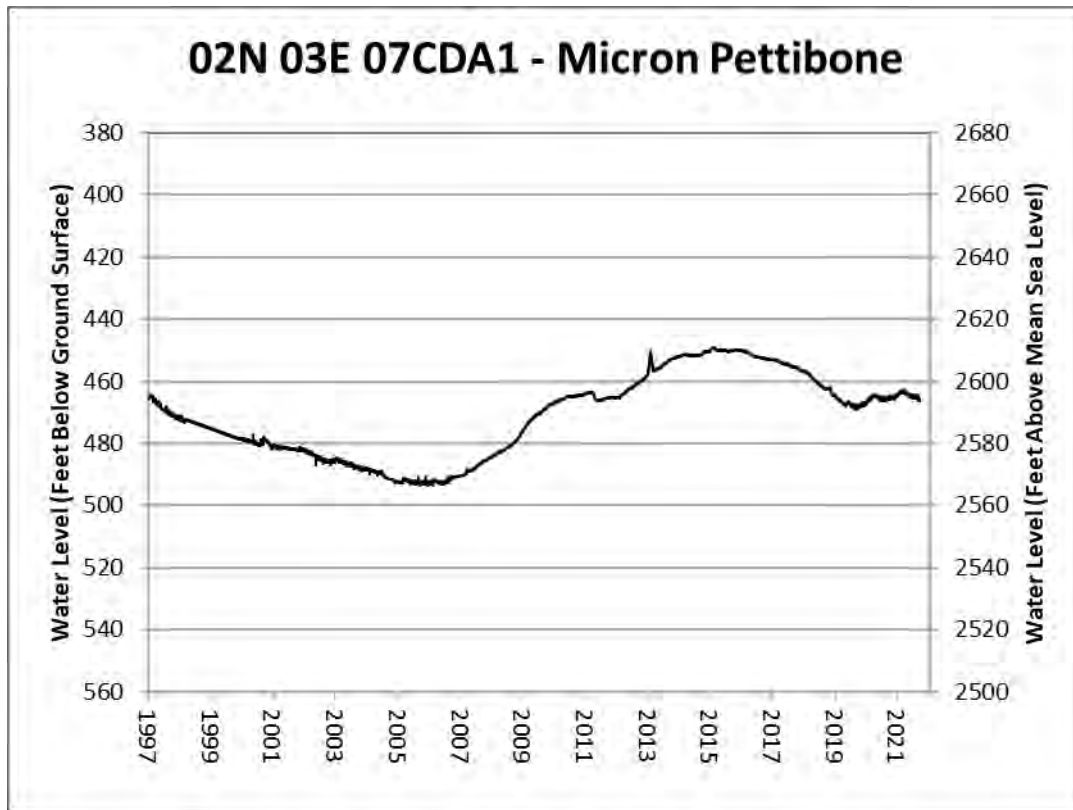


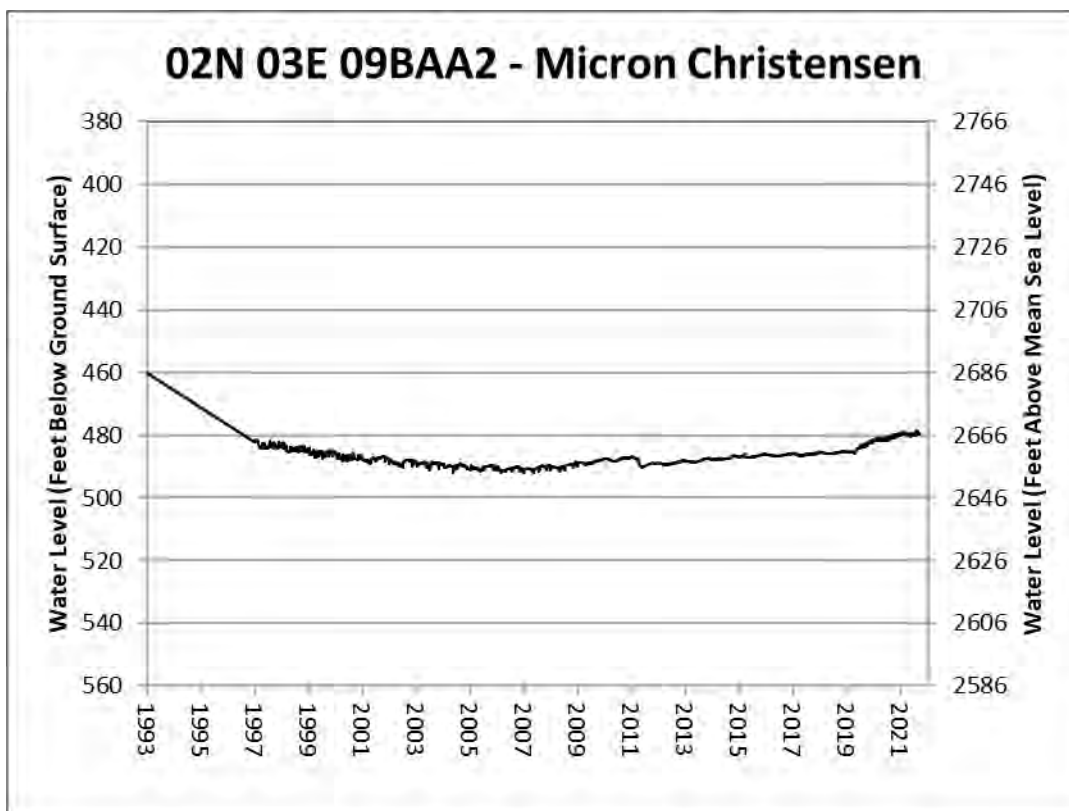


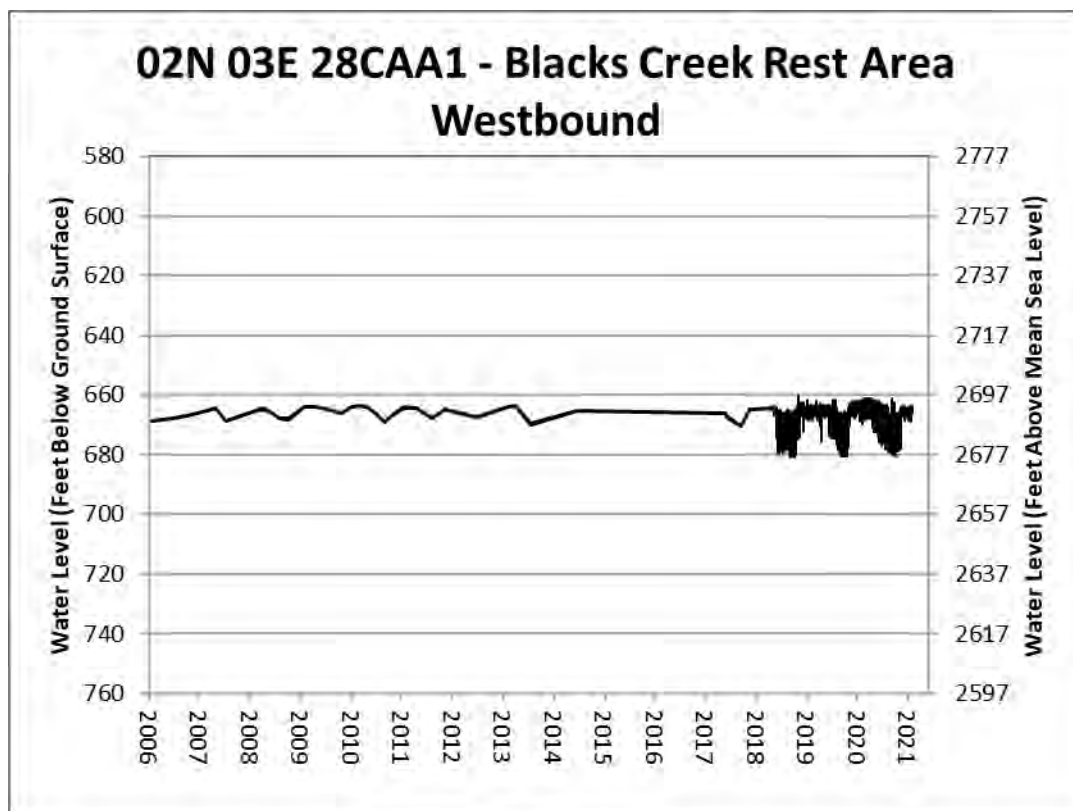
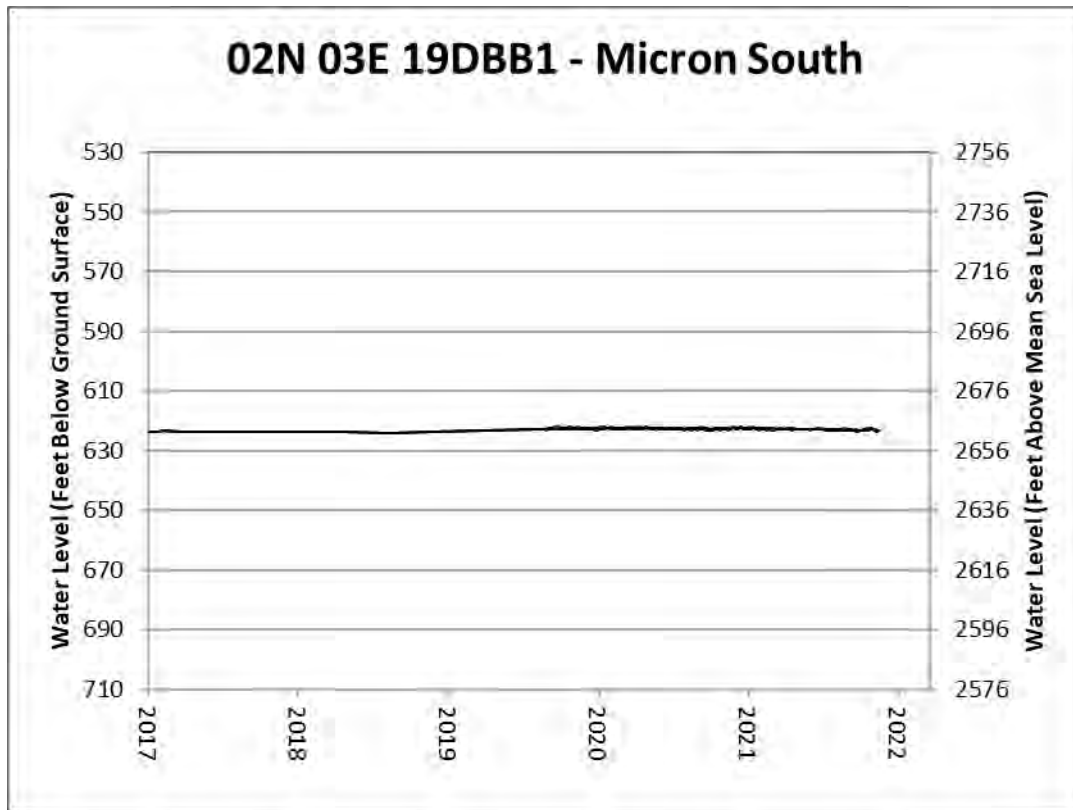


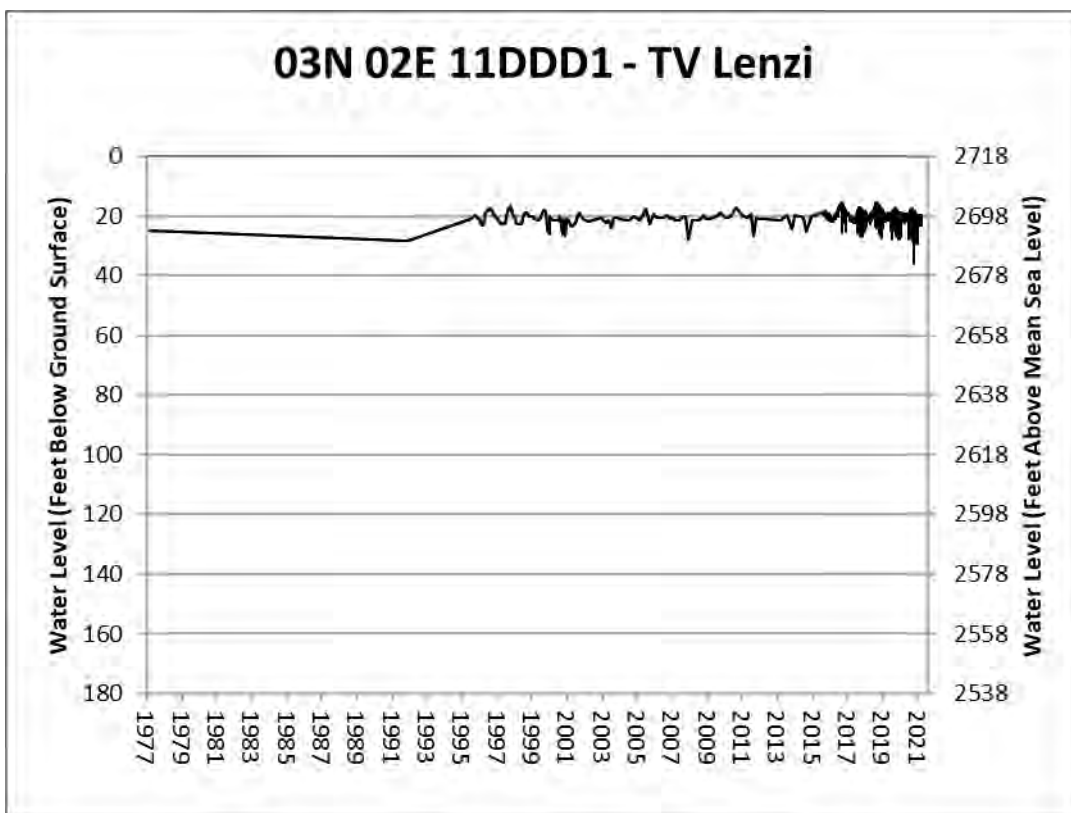
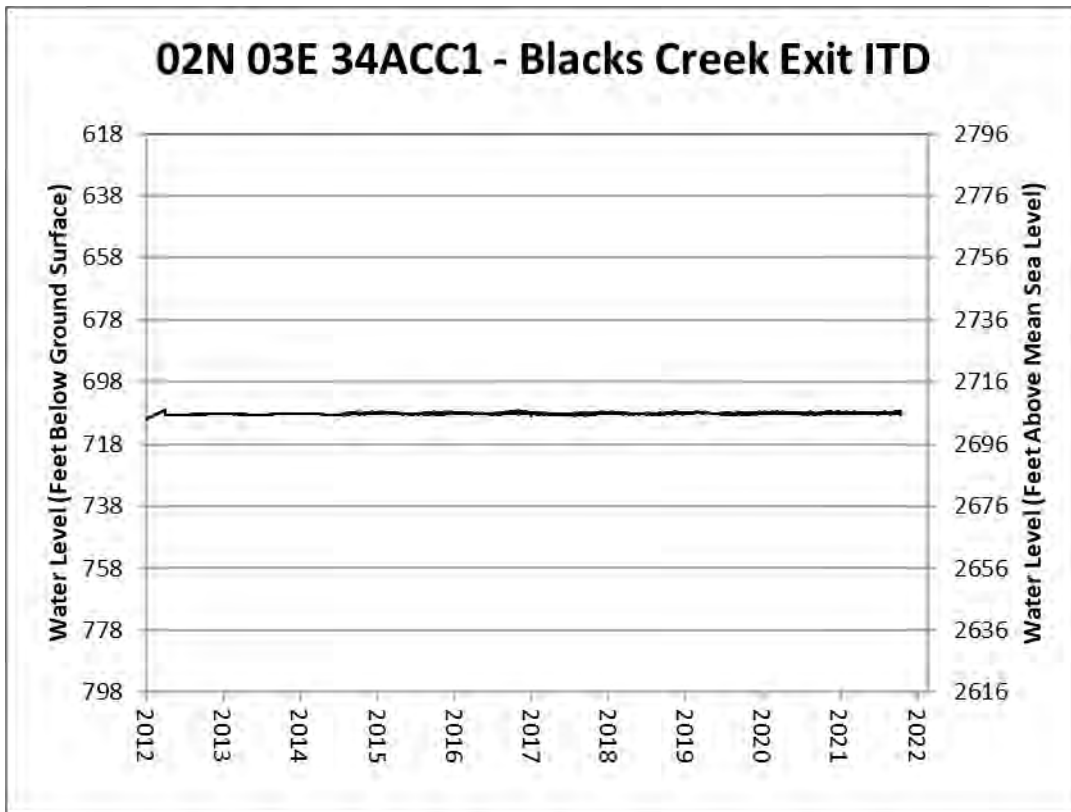


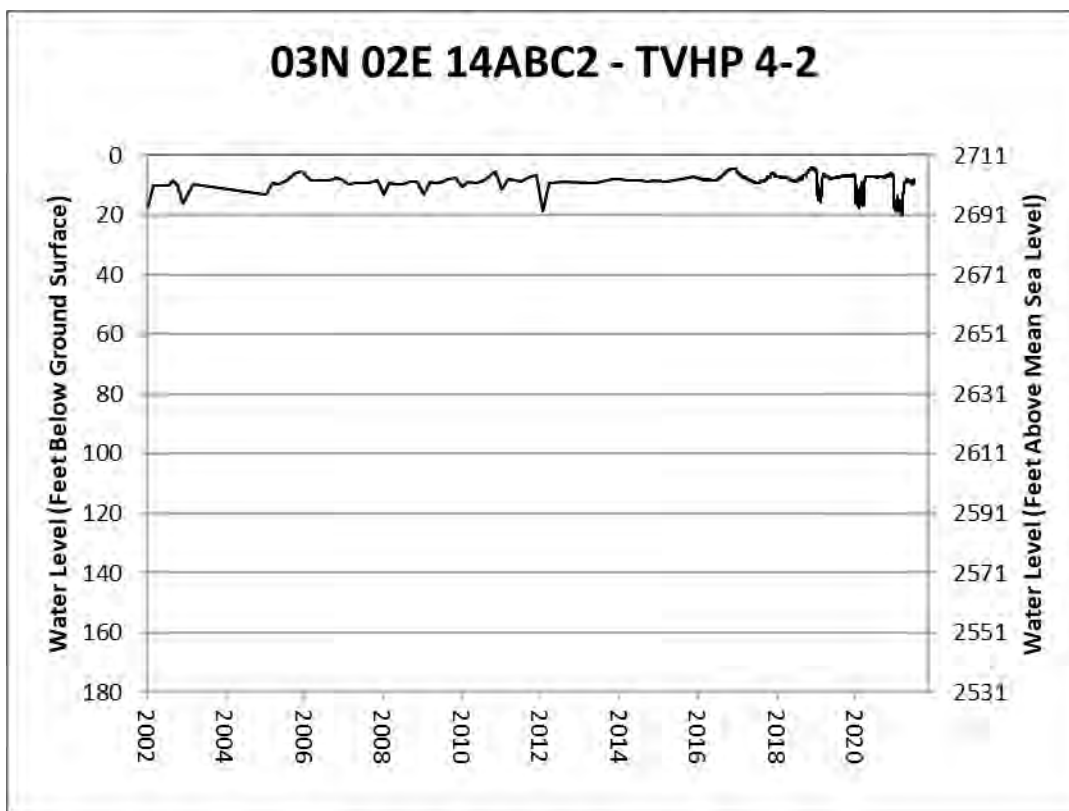
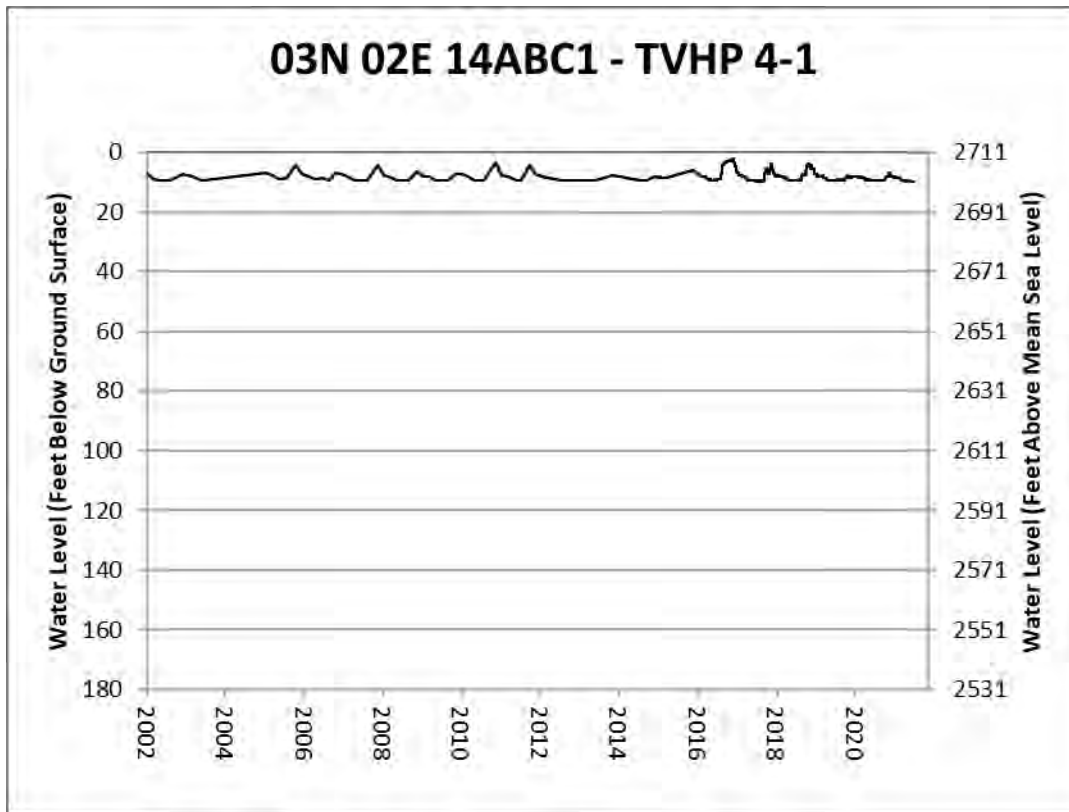




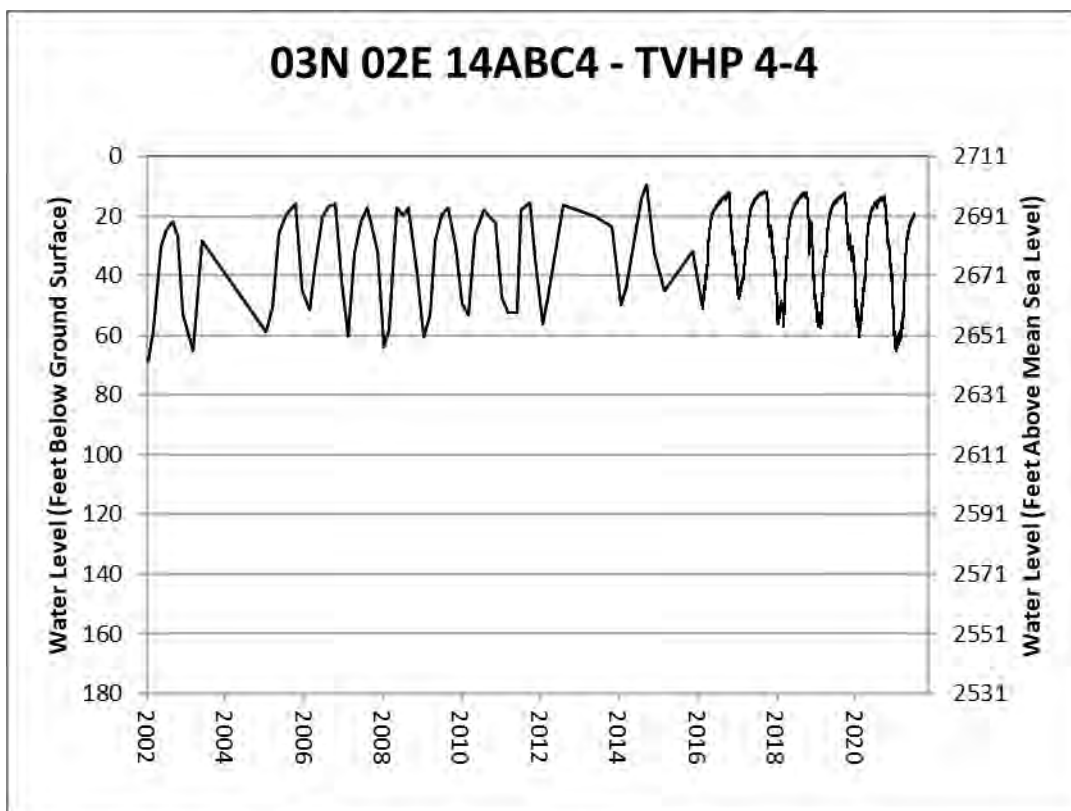
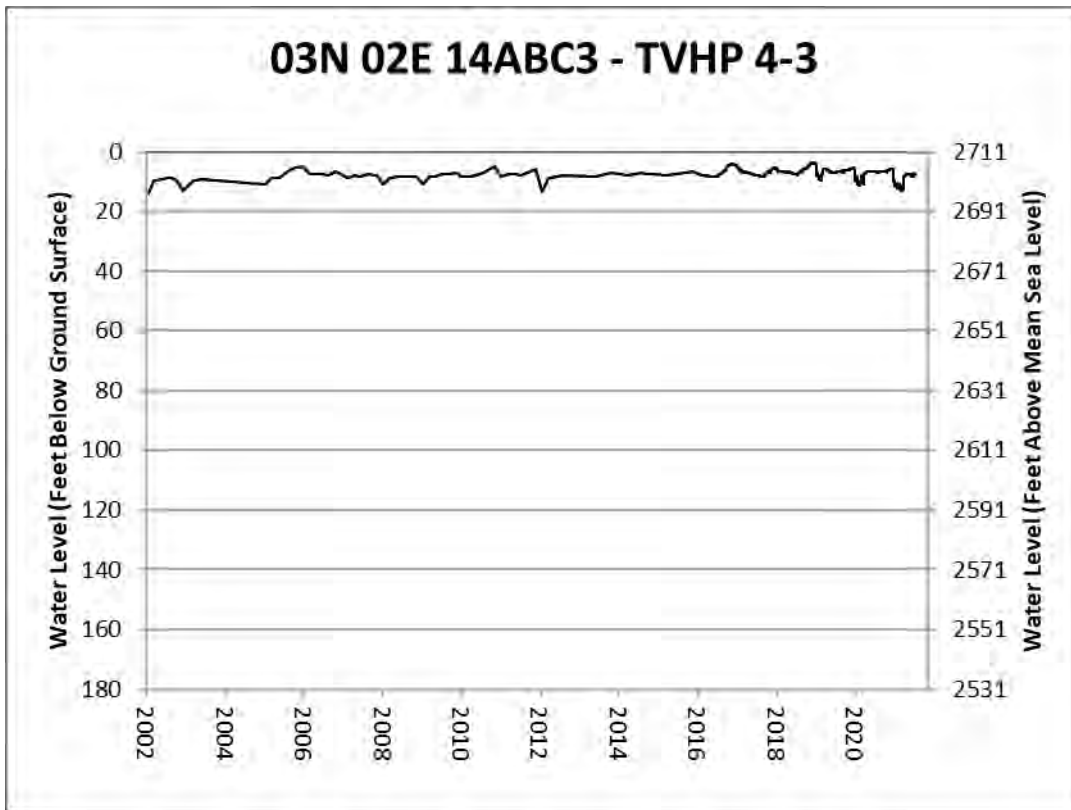


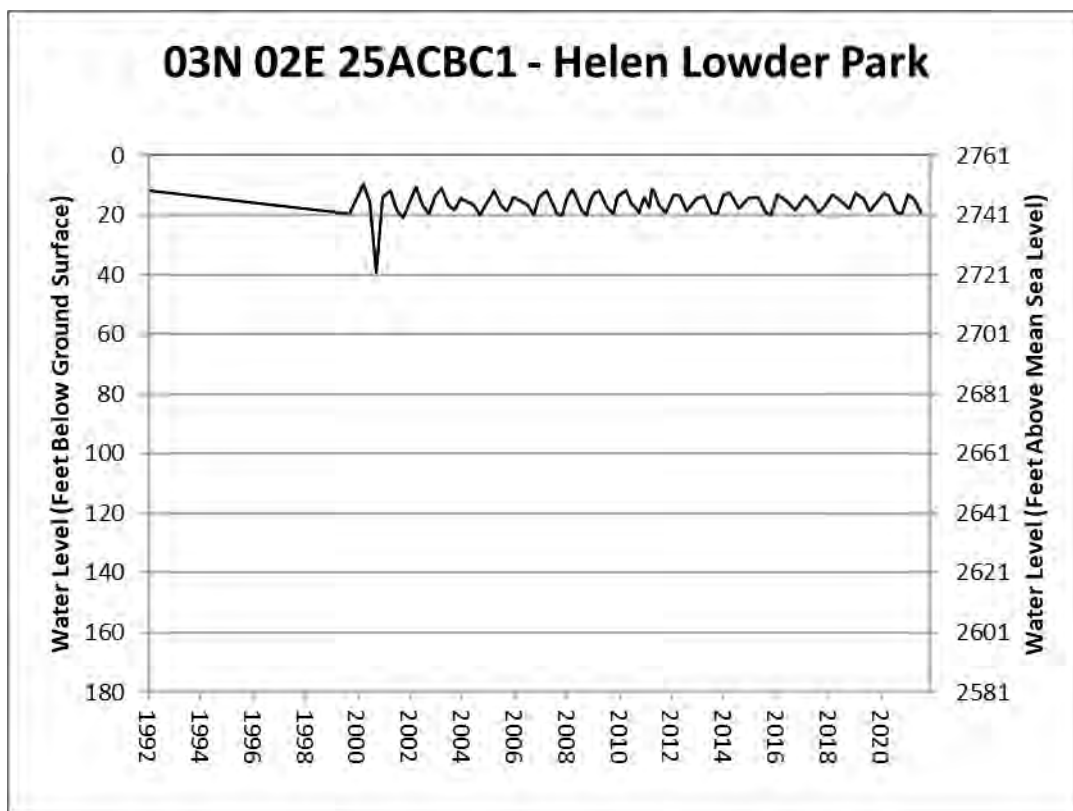
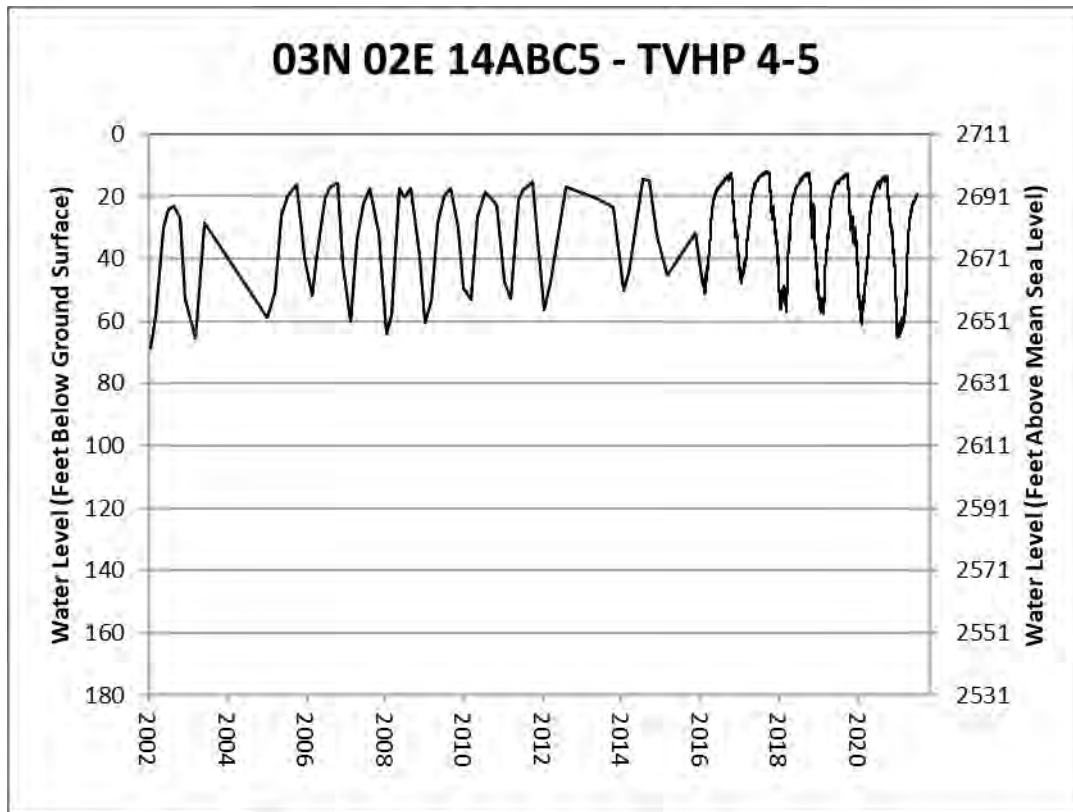


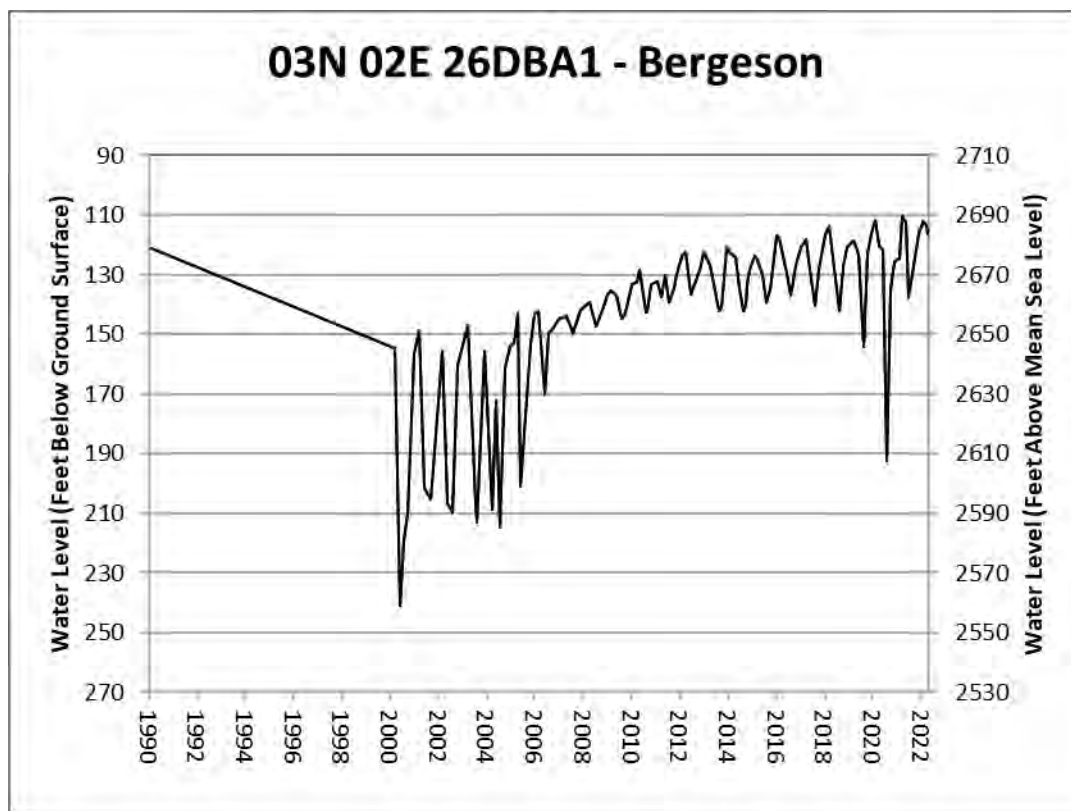
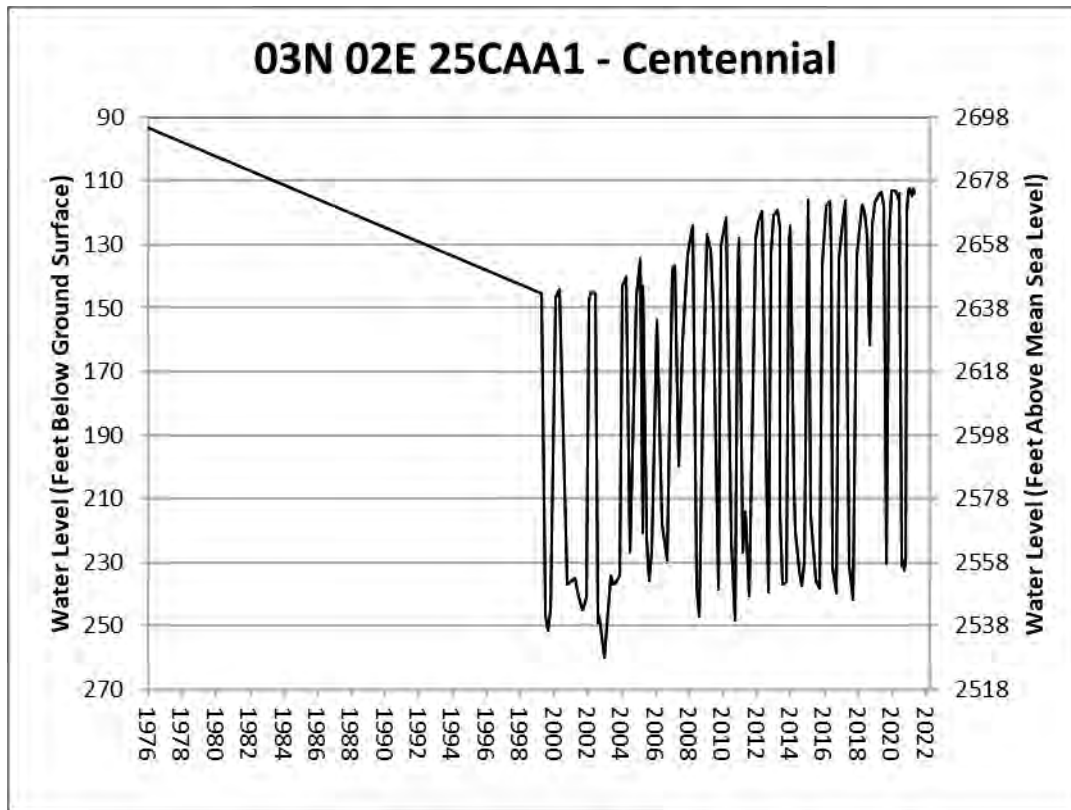


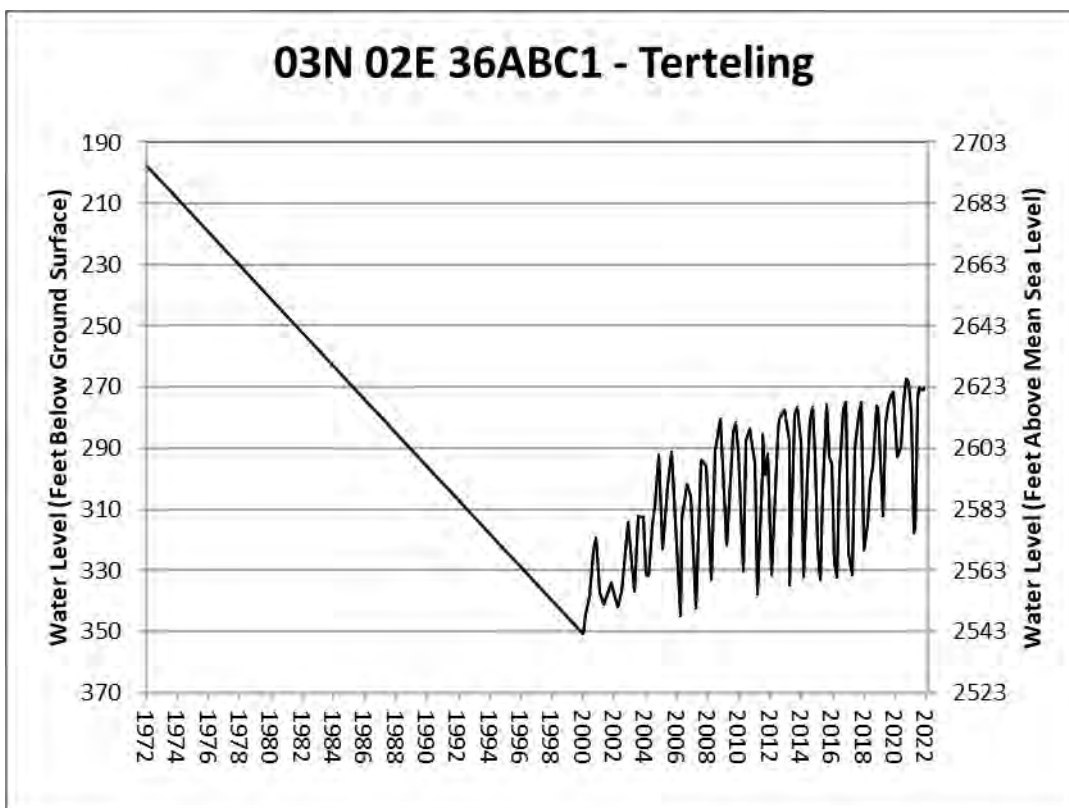
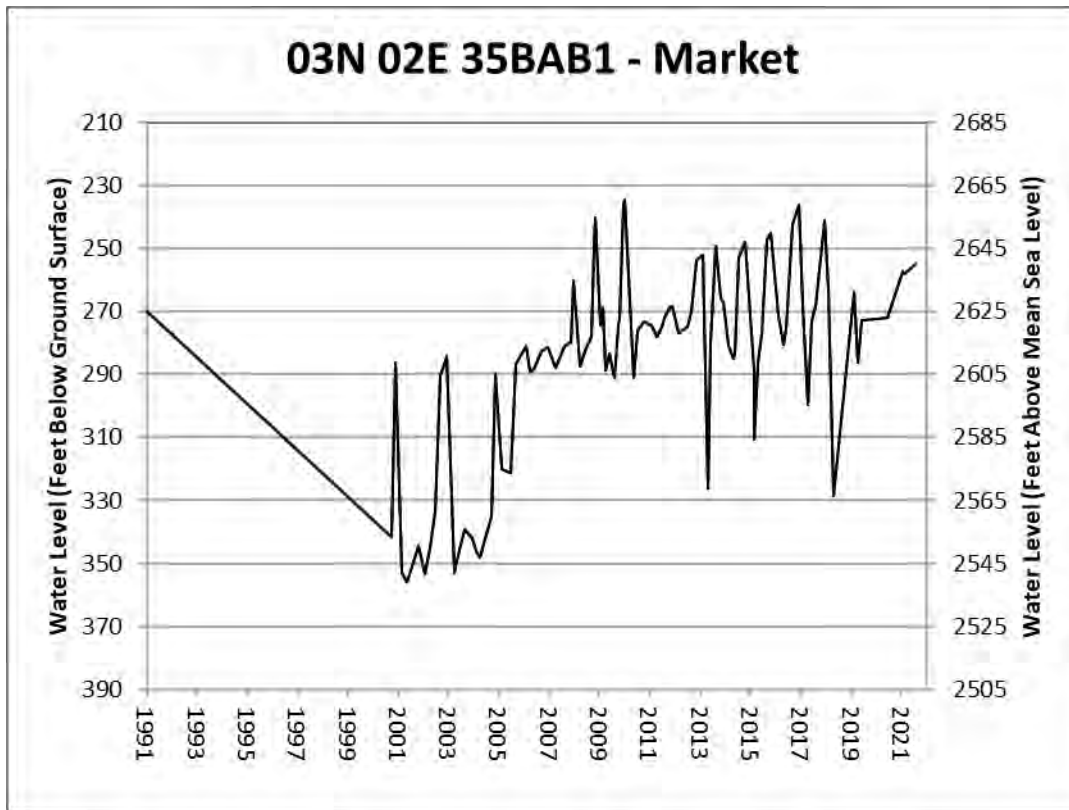


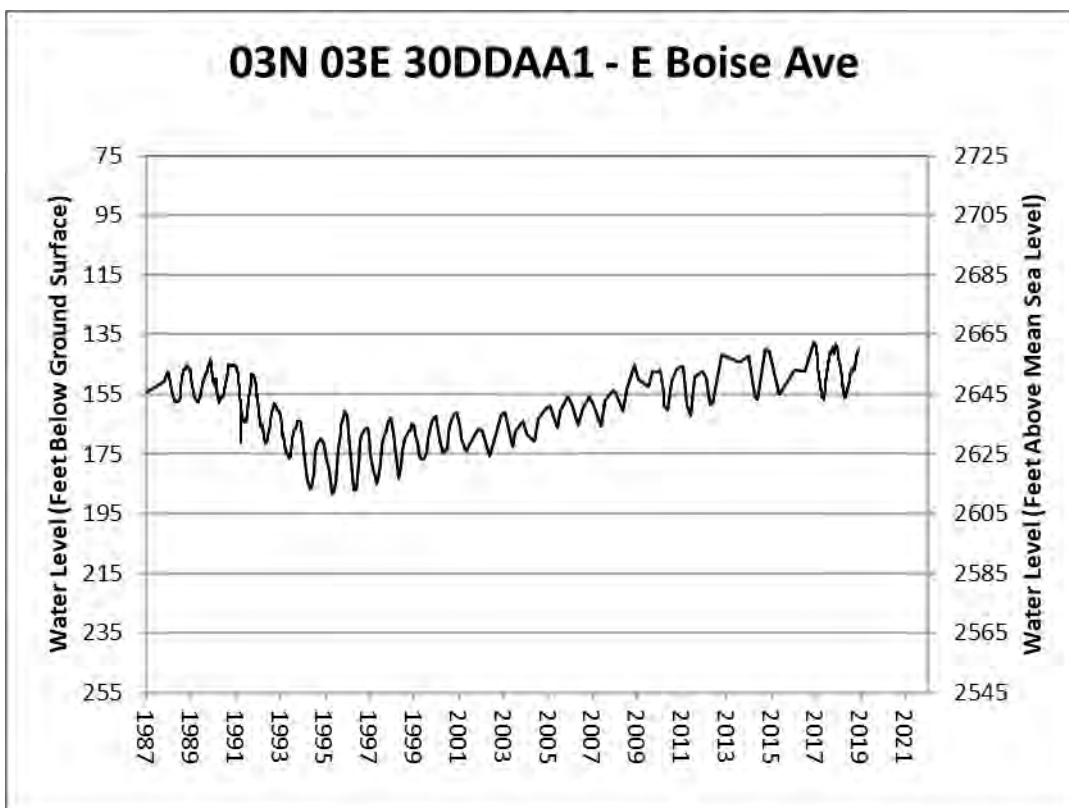
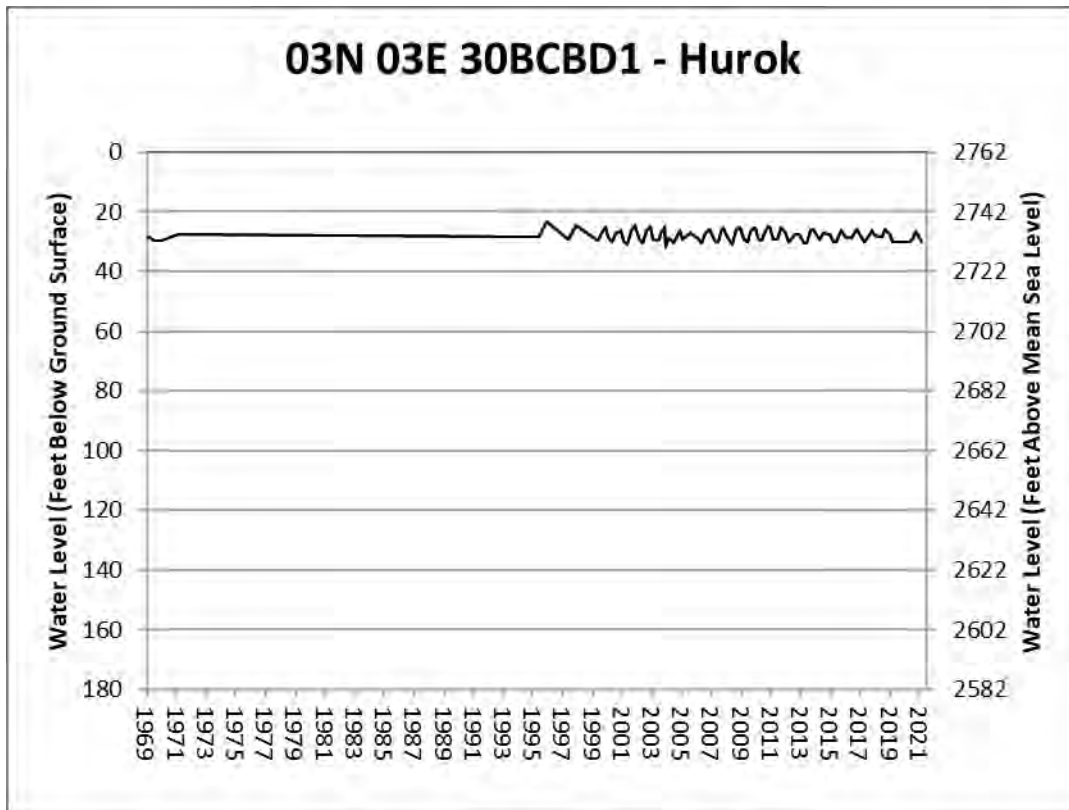


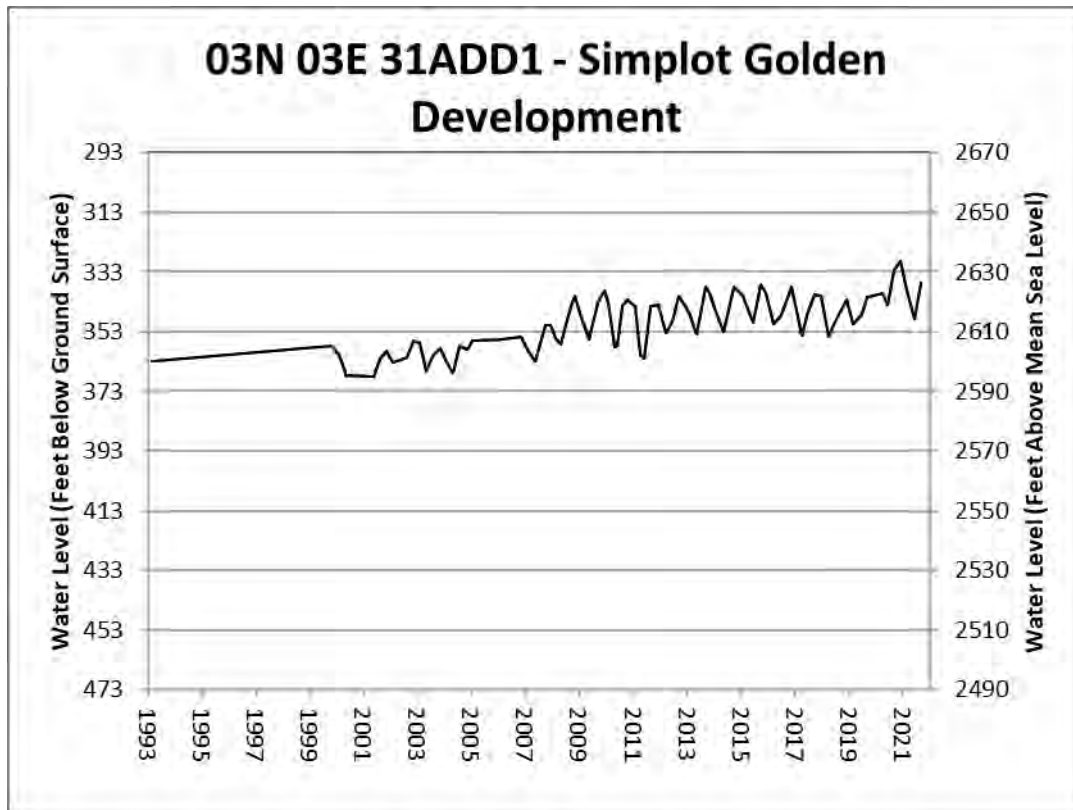


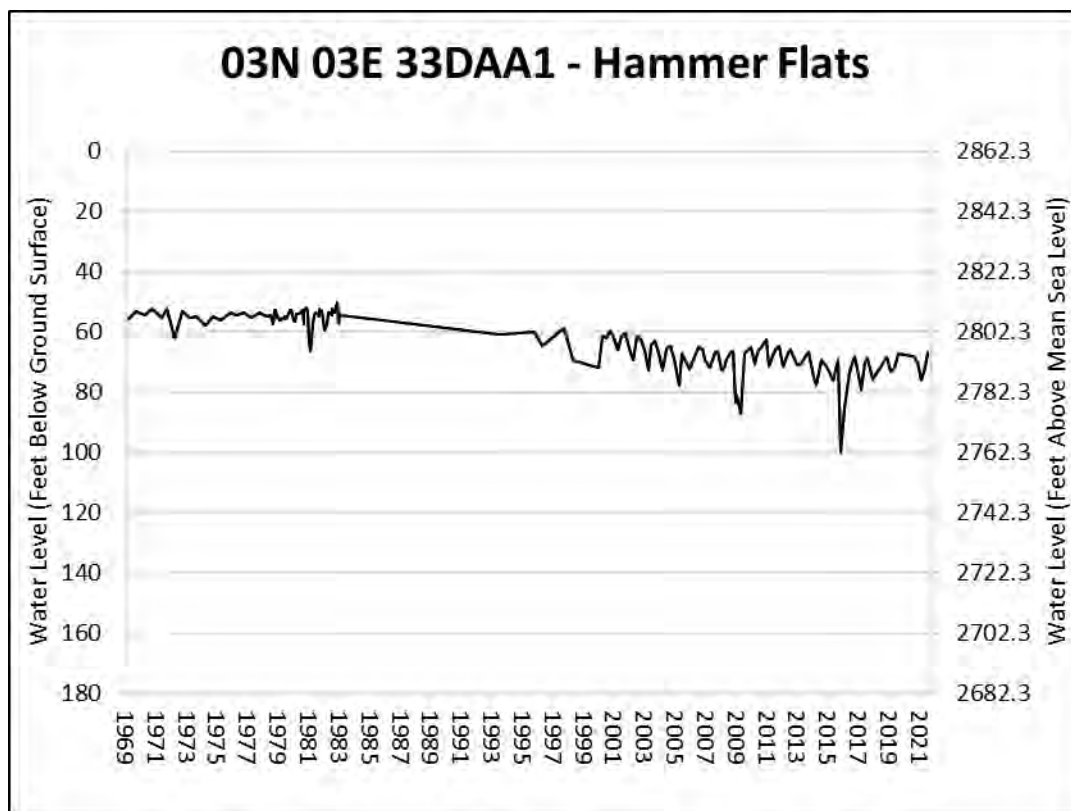
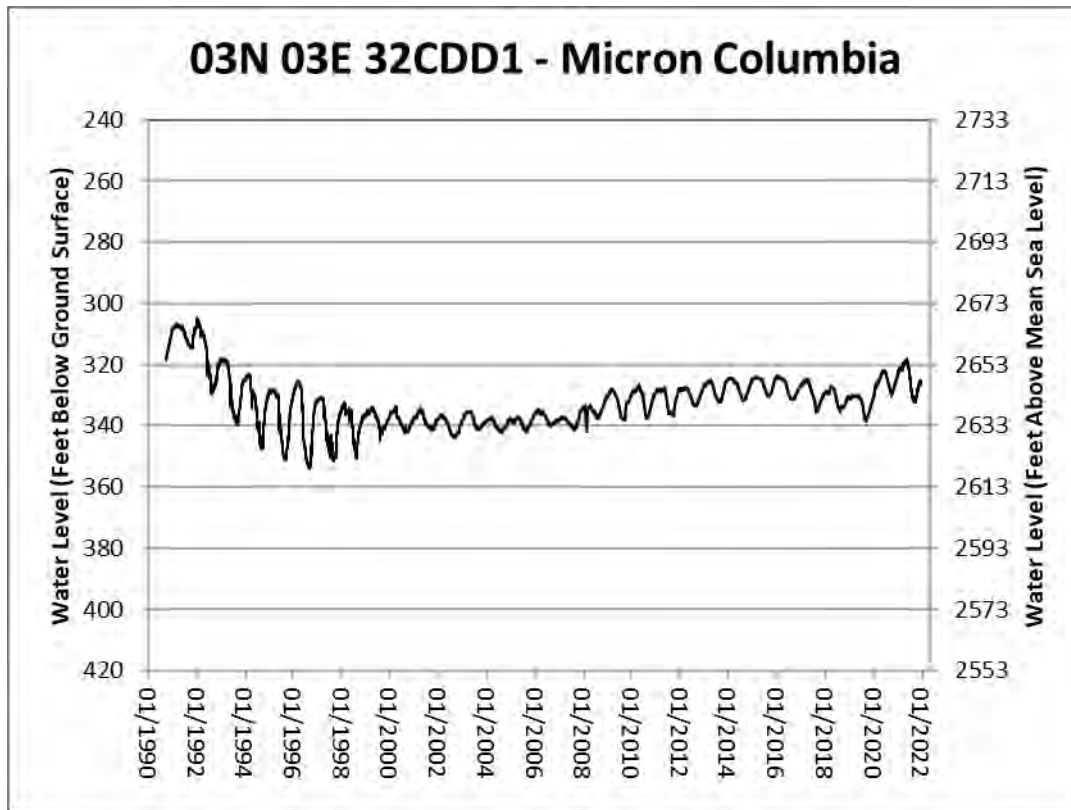












## Appendix D

# **Hydrographs for Active Monitoring Wells from 1990 through 2021**



