



Mr. Chris Koos, Chair  
Long Range Water Plan Steering Committee  
Town of Normal  
100 E. Phoenix  
Normal, IL 61761

April 2, 2020

Dear Mayor Koos:

Enclosed are the hydrographs of water levels for the observation wells and river stages measured by the Illinois State Water Survey (ISWS) as part of the monitoring project conducted for the Long Range Water Plan Steering Committee through December 2019. The ISWS has monitored and maintained the observation well network since 1993. The network provides data which can be used to document changes in groundwater levels over time and was installed as part of a large aquifer assessment and modeling project that is described in Cooperative Groundwater Report 19 <https://www.ideals.illinois.edu/bitstream/handle/2142/35254/ISWSCOOP-19.pdf?sequence=2&isAllowed=y>.

The ISWS is moving toward displaying all water levels in an online interactive hydrograph. All wells equipped with telemetry in the region are now posted online at:

- McTaz: <http://aqueduct.isws.illinois.edu/isws-hydrographs.html?network=mt>
- Logan County: <http://aqueduct.isws.illinois.edu/isws-hydrographs.html?network=nl>

All hydrographs will be updated over the next year to include all historic transducer and hand measurements, as well as associated attribute data of the well (location, depth, aquifer).

A total of 51 measuring points have been reported during the history of this project. Of those, 45 are active measuring points, while 6 points (SWS-6, MTH-3, MTH-4, MTH-5, MTH-14 and MTH-25) were retired due to damage and/or being abandoned. A total of 42 measurements are groundwater levels in observation wells. The wells fit into three categories, with either SWS, MTH or B designation. The SWS wells were installed in 1992 as part of a regional assessment of the Sankaty-Mahomet Aquifer by the Illinois State Water Survey (ISWS). The project was funded by the Department of Energy and Natural Resources and the Illinois Department of Transportation's Division of Water Resources. Except for MTH-26 and MTH-27, the MTH wells were installed in 1993 as part of the comprehensive aquifer assessment funded by the Long Range Water Plan Steering Committee. MTH-26 was installed in 1994 as an aquifer test observation well and MTH-27 was installed in 1997 to verify the mapped geology in a particularly complicated region of the aquifer. Figure 1 shows the locations of the wells with MTH and SWS designations. The wells with B designation are shown in Figure 2 and are located northwest of Bloomington near Evergreen Lake. These wells were added in 2013 at the request of the City of Bloomington, who provided automated stations for 9 total wells in the network during 2013. In addition, the Northern Logan County Water Authority has provided automated stations for 4 locations (included one nested well) in the network since 2014. In addition to the wells, three of the measurements are of river stage along the Mackinaw River. The river measurements are denoted by RVR.

# I ILLINOIS

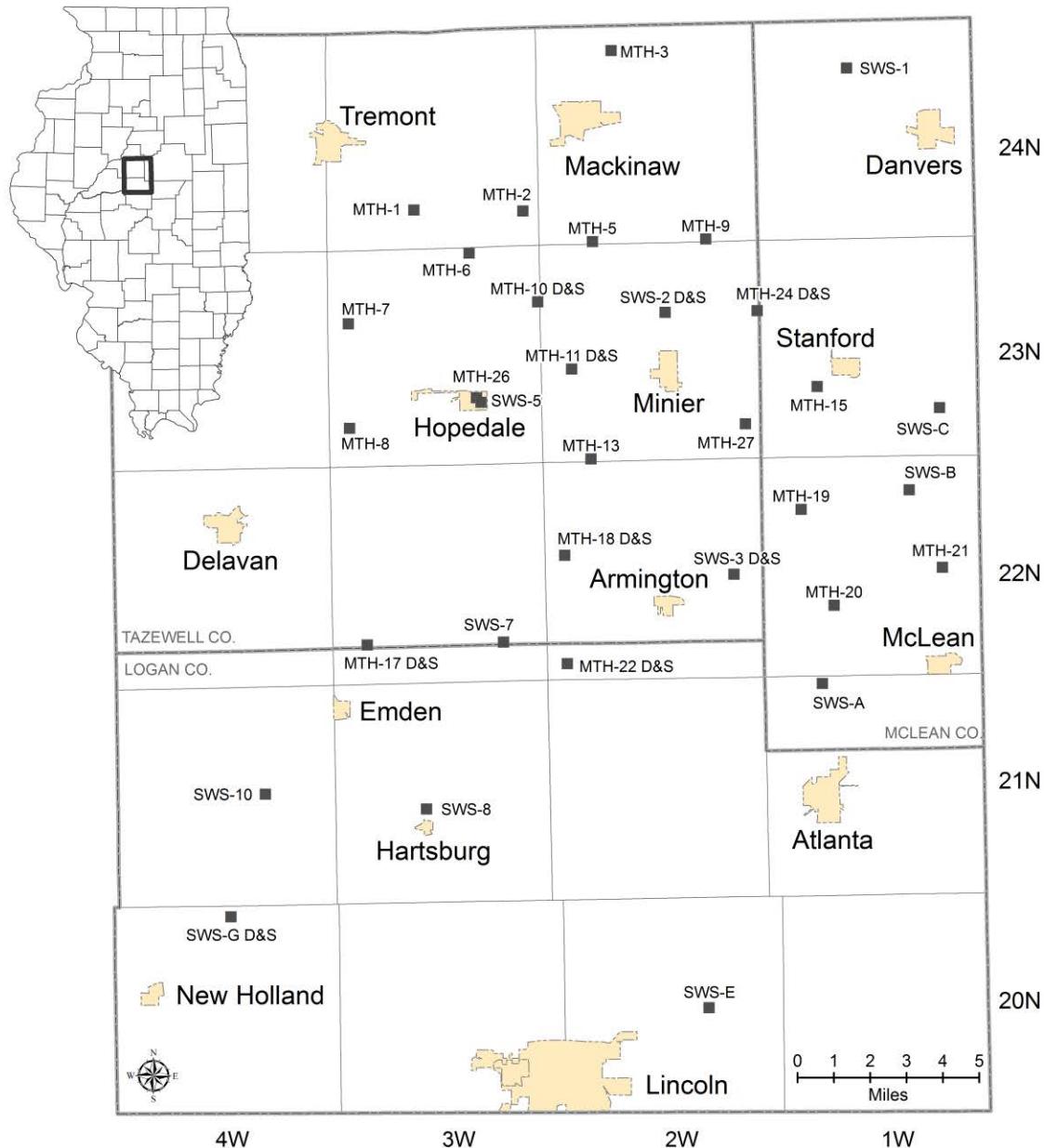
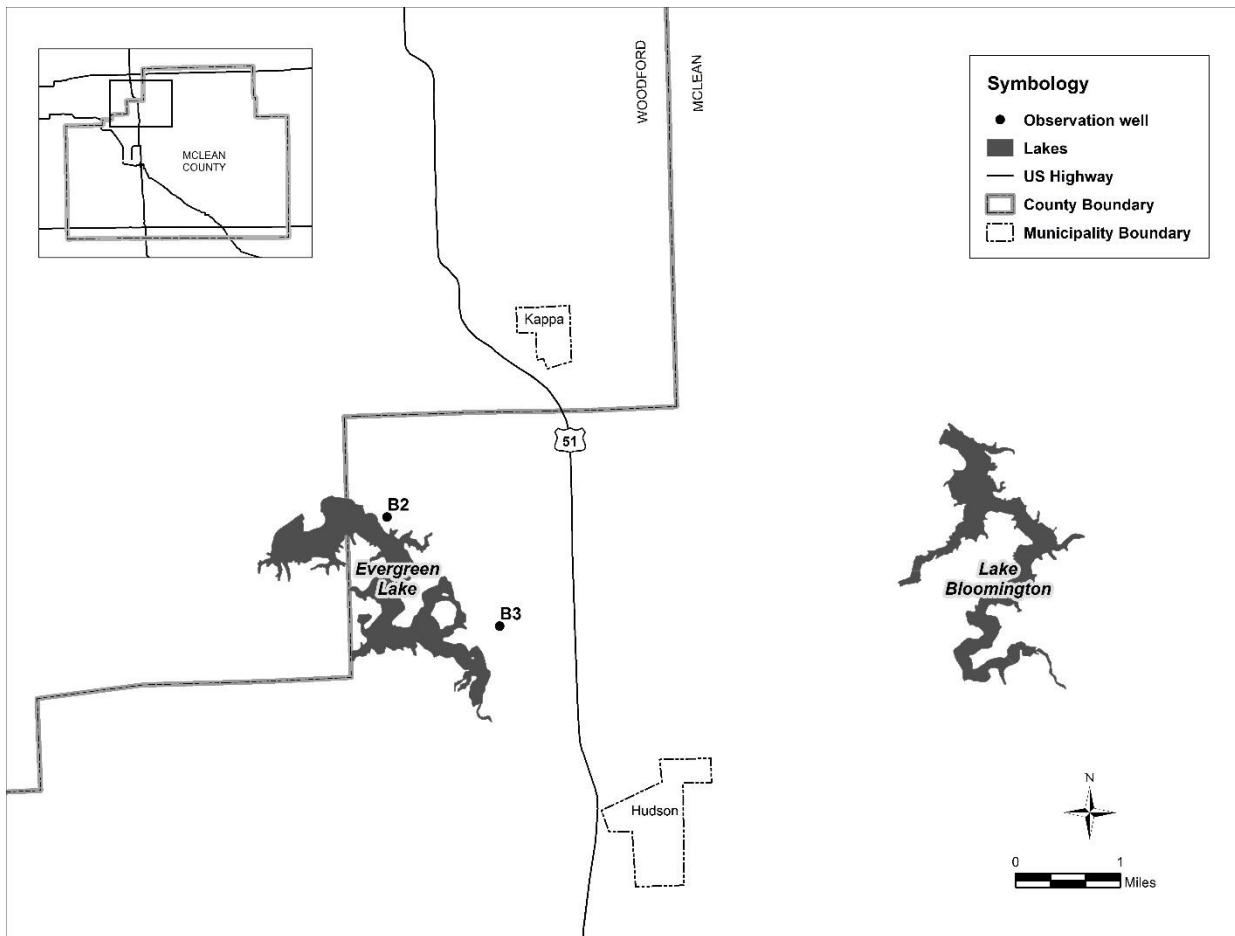


Figure 1. Location of Observation Wells

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**Figure 2. Location of Observation Wells near Evergreen Lake**

In accordance with our agreement, measurements were taken four times during 2019: February 27, May 30, August 23, and November 20. In addition, the areas surrounding the wells were mowed twice during the summer to keep the sites presentable. The monitoring wells were developed with an air compressor to ensure the screen is open to the aquifer during 2011. Well development was considered at SWS-1 in 2018, but after discussion with a local driller, it was concluded that the depth of the well and depth to water within the well prevents the ISWS from being able to develop it properly with the equipment available. SWS-1 has not been repaired to date.

Tables 1 and 2 contain the updated precipitation data for 2019, along with all the historical precipitation data since the wells were installed. Table 1 shows the amount of precipitation above or below the average received monthly and Table 2 shows the total monthly amount of precipitation. 2019 precipitation was above average with 6.09 inches (the sixth wettest overall), the 30 year average is 39.60. During 2019, 8 of the 12 months received below average precipitation with January thru June, September and October being above average. The precipitation data are compared against the new 30 year (1981-2010) average. Overall, total precipitation is 11.14 inches below the 30yr average over the 27 year period, with 14 years above average and 13 below. On average, precipitation over this 27 year period is 0.41 inches per year less than the 30yr average.

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Despite the above average precipitation in 2019, July of 2019 was 3.84 inches below average and had the lowest July precipitation since this study began in 1993. This is the largest deviation in the negative direction from the 30yr average of any month over the period of this study. It also should be noted that July had below average precipitation in 19 of the 27 years of this study, largely because of two long stretches of below average July precipitation (1994-2001; 2009-2014). More analysis is required to determine if this is representative of an actual trend, particularly given that 2015-2017 had above average July precipitation.

**Table 1. Monthly Precipitation Summaries for Lincoln, IL  
Inches Above or Below the 30yr Average.**

30 Yr Ave (1981-2010)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
	1.93	1.82	2.60	3.61	4.16	4.32	5.06	3.92	3.21	3.08	3.25	2.64	39.60
1993 +/-	2.68	0.00	0.48	1.67	-2.80	3.12	2.08	0.50	3.40	0.43	0.05	-1.43	10.18
1994 +/-	-0.74	-0.90	-1.25	2.84	-1.19	-0.02	-2.14	-0.81	-0.96	-1.21	1.39	-0.38	-5.37
1995 +/-	1.68	-1.26	0.59	0.25	8.54	-0.94	-3.13	-0.06	-2.27	1.10	-1.86	-1.72	0.92
1996 +/-	-0.72	-1.25	-0.87	-1.12	1.76	-1.54	-0.20	-1.30	-1.42	-1.20	-0.32	-1.99	-10.17
1997 +/-	-0.20	1.22	0.64	-2.23	-1.06	-0.82	-3.79	1.35	1.46	-1.41	-0.41	-1.03	-6.28
1998 +/-	0.53	0.63	1.75	4.94	0.17	4.07	-2.00	1.73	-1.88	1.46	-1.36	-0.93	9.11
1999 +/-	-0.37	0.44	-1.44	2.05	0.30	0.91	-1.58	2.33	-1.12	-1.25	-2.95	-0.01	-2.69
2000 +/-	-1.14	-0.51	-0.35	0.21	-1.19	1.46	-1.01	-0.20	-0.24	-1.05	0.62	-1.24	-4.64
2001 +/-	0.45	1.57	-1.18	-1.38	-1.24	-1.30	-2.25	0.32	-1.10	2.73	-1.23	-0.90	-5.49
2002 +/-	0.56	0.41	-0.74	1.38	1.03	-1.93	2.73	4.66	-1.69	-0.85	-2.57	-1.02	1.97
2003 +/-	-1.38	-0.78	-0.54	-0.10	-0.84	-1.64	4.88	-1.04	1.29	-1.53	0.39	-0.83	-2.12
2004 +/-	-0.77	-1.44	1.64	-1.79	3.05	0.38	-1.76	0.42	-2.74	3.01	1.80	-1.07	0.73
2005 +/-	4.25	-0.15	-1.44	-2.18	-2.68	-3.14	-3.30	-0.46	-0.22	-0.80	0.73	-1.09	-10.48
2006 +/-	1.14	-1.43	0.31	1.24	-2.33	-1.92	3.21	-0.63	-0.44	-0.16	0.69	0.34	0.02
2007 +/-	0.36	0.48	0.13	-1.27	-1.55	-0.59	-1.40	-3.03	-0.28	0.34	-1.44	0.82	-7.43
2008 +/-	3.80	2.71	-0.45	-1.15	0.44	2.63	5.94	-3.15	7.09	-0.88	-2.14	1.79	16.63
2009 +/-	-1.36	0.81	1.78	2.03	0.27	0.64	-0.18	-0.65	-1.21	6.78	0.60	1.03	10.54
2010 +/-	-0.58	0.11	0.06	-0.90	0.45	6.47	-1.47	-0.01	2.17	-1.51	-0.71	-0.55	3.53
2011 +/-	-0.90	0.44	-1.20	1.73	-0.30	1.43	-2.04	-3.37	-0.90	-1.68	0.01	0.79	-5.99
2012 +/-	-0.76	-0.52	-1.40	-0.29	-2.18	-3.75	-3.69	-2.45	1.21	-1.16	-1.99	0.53	-16.59
2013 +/-	0.76	0.24	0.13	2.00	3.80	-1.07	-2.20	-2.05	-2.28	0.43	-2.04	-1.13	-3.41
2014 +/-	-0.14	0.92	-0.71	-0.62	-2.38	2.10	-0.28	2.21	4.41	1.33	-1.02	-1.19	4.63
2015 +/-	-0.54	-0.45	-1.07	-1.37	3.68	5.35	0.87	-2.84	1.47	-1.44	1.17	4.17	9.00
2016 +/-	-0.94	-0.57	1.23	-1.02	-0.91	-1.96	3.63	2.52	1.22	-1.44	-0.34	-1.28	0.14
2017 +/-	-1.17	-0.93	1.42	2.41	-0.69	-3.34	0.76	-1.73	-2.50	1.60	-0.76	-2.18	-6.11
2018 +/-	-1.20	2.97	1.67	-1.10	-1.17	-0.20	-1.20	-0.98	-0.92	3.19	-0.76	1.84	2.14
2019 +/-	1.28	0.66	2.78	1.77	2.68	0.85	-3.84	-0.44	1.12	1.66	-1.28	-1.15	6.09

**Notes:** 1993-2019 data compared against 1981-2010 30yr Average for the Lincoln, IL Station



**Table 2. Monthly Precipitation Summaries for Lincoln, IL**  
**Total Inches of Precipitation for the Year**

30 Yr Ave (1981-2010)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1993 Total	4.61	1.82	3.08	5.28	1.36	7.44	7.14	4.42	6.61	3.51	3.30	1.21	49.78
1994 Total	1.19	0.92	1.35	6.45	2.97	4.30	2.92	3.11	2.25	1.87	4.64	2.26	34.23
1995 Total	3.61	0.56	3.19	3.86	12.70	3.38	1.93	3.86	0.94	4.18	1.39	0.92	40.52
1996 Total	1.21	0.57	1.73	2.49	5.92	2.78	4.86	2.62	1.79	1.88	2.93	0.65	29.43
1997 Total	1.73	3.04	3.24	1.38	3.10	3.50	1.27	5.27	4.67	1.67	2.84	1.61	33.32
1998 Total	2.46	2.45	4.35	8.55	4.33	8.39	3.06	5.65	1.33	4.54	1.89	1.71	48.71
1999 Total	1.56	2.26	1.16	5.66	4.46	5.23	3.48	6.25	2.09	1.83	0.30	2.63	36.91
2000 Total	0.79	1.31	2.25	3.82	2.97	5.78	4.05	3.72	2.97	2.03	3.87	1.40	34.96
2001 Total	2.38	3.39	1.42	2.23	2.92	3.02	2.81	4.24	2.11	5.81	2.02	1.74	34.11
2002 Total	2.49	2.23	1.86	4.99	5.19	2.39	7.79	8.58	1.52	2.23	0.68	1.62	41.57
2003 Total	0.55	1.04	2.06	3.51	3.32	2.68	9.94	2.88	4.50	1.55	3.64	1.81	37.48
2004 Total	1.16	0.38	4.24	1.82	7.21	4.70	3.30	4.34	0.47	6.09	5.05	1.57	40.33
2005 Total	6.18	1.67	1.16	1.43	1.48	1.18	1.76	3.46	2.99	2.28	3.98	1.55	29.12
2006 Total	3.07	0.39	2.91	4.85	1.83	2.40	8.27	3.29	2.77	2.92	3.94	2.98	39.62
2007 Total	2.29	2.30	2.73	2.34	2.61	3.73	3.66	0.89	2.93	3.42	1.81	3.46	32.17
2008 Total	5.73	4.53	2.15	2.46	4.60	6.95	11.00	0.77	10.30	2.20	1.11	4.43	56.23
2009 Total	0.57	2.63	4.38	5.64	4.43	4.96	4.88	3.27	2.00	9.86	3.85	3.67	50.14
2010 Total	1.35	1.93	2.66	2.71	4.61	10.79	3.59	3.91	5.38	1.57	2.54	2.09	43.13
2011 Total	1.03	2.26	1.40	5.34	3.86	5.75	3.02	0.55	2.31	1.40	3.26	3.43	33.61
2012 Total	1.17	1.30	1.20	3.32	1.98	0.57	1.37	1.47	4.42	1.92	1.26	3.17	23.01
2013 Total	2.69	2.06	2.73	5.61	7.96	3.25	2.86	1.87	0.93	3.51	1.21	1.51	36.19
2014 Total	1.79	2.74	1.89	2.99	1.78	6.42	4.78	6.13	7.62	4.41	2.23	1.45	44.23
2015 Total	1.39	1.37	1.53	2.24	7.84	9.67	5.93	1.08	4.68	1.64	4.42	6.81	48.60
2016 Total	0.99	1.25	3.83	2.59	3.25	2.36	8.69	6.44	4.43	1.64	2.91	1.36	39.74
2017 Total	1.76	0.89	4.02	6.02	3.47	0.98	5.82	2.19	0.71	4.68	2.49	0.46	33.49
2018 Total	0.73	4.79	4.27	2.51	2.99	4.12	3.86	2.94	2.29	6.27	2.49	4.48	41.74
2019 Total	3.21	2.48	5.38	5.38	6.84	5.17	1.22	3.48	4.33	4.74	1.97	1.49	45.69

**Notes:** 1993-2019 data compared against 1981-2010 30yr Average for the Lincoln, IL Station

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The three Mackinaw River hydrographs are numbered to correspond to the MTH wells that are closest to them. So for instance, RVR-3, which is at Mackinaw, IL, is close to MTH-3. Comparing water level elevations to river stage, the water level in MTH-3 is 50 feet lower than the river. But at the other 2 locations, MTH-6 and MTH-7, the differences with river stage are only 7 feet and 2 feet, respectively, suggesting that the Mackinaw River is not connected to the aquifer near Mackinaw, but near MTH-6 and MTH-7, it likely is. The hydrographs for these two wells also show some of the most variation between individual measurements, suggesting the influence of the river.

The City of Bloomington funded the development of eight locations (9 wells) with data loggers and telemetry for collecting continuous water level measurements. The wells, SWS-3A, SWS-3B, SWS-A, SWS-B, MTH-15, MTH-20, and MTH-21, are located in the eastern portion of the study area. Wells B-2 and B-3 are near Lake Evergreen, north of Bloomington/Normal. These stations became operational in the summer and fall of 2013. During 2014, ISWS teamed with Northern Logan County Water Authority to equip two wells with data loggers and telemetry systems. The wells, SWS-E and SWS-10, are located in Logan County. These new stations became operational in the summer of 2015. The stations are programmed to collect water level data every hour at the top of the hour. In 2018, Northern Logan County Water Authority funded the expansion of the network to SWS-8 and MTH-22D&S. The hydrographs for all data associated with these wells are at the end of this report, and the most recently reported data is available online.

Multiple wells show the influence of irrigation, in particular SWS-3A, SWS-10, SWS-A, SWS-B, MTH-15, MTH-20, and MTH-21. Irrigation is most prominent in these wells in 2017, 2018, and 2019. In all cases, the lowest 2019 groundwater elevations did not reach the lowest elevations observed in 2018, despite the low precipitation in July of 2019 (although some, like MTH-15, approached 2018 levels). This is due to two factors. First, the period that preceded July was very wet, resulting in elevated groundwater elevations just before irrigation season as compared to 2018. Second, precipitation in August was higher than in 2017 and 2018. Consequently, the peak of irrigation occurred over a much narrower period in 2019 than in the two previous years, particularly evident at MTH-15.

These data continue to be very valuable for evaluating drawdown due to irrigation, and to provide a clearer picture of the annual changes in water levels in the aquifer. The hydrograph for SWS-A is a classic example of how the peak of irrigation was missed with hand measurements, but captured with transducer data, allowing for a comparison between years and even months that was previously not possible. It is our hope that eventually all the wells in the network can be outfitted with data loggers and telemetry.

It should be noted MTH-21 has an extremely high amount of iron bacteria within the well. The presence of the iron bacteria interferes with hand measurements of the depth to water. The data has had more variability than the other wells with data loggers but there is less confidence in those readings. The data still appear comparable, usually within 0.05 to 0.10 feet. Attempts have been made to improve the situation at MTH-21, without success. The two wells at SWS-3 that were disabled because squirrels chewed through the conduit and cable at the station, have been repaired and became operational again during 2016.

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In 2010, the USGS requested we provide a well site for them to use as part of their water level network. MTH-17 was selected and the USGS installed a water table well at MTH-17 in July 2010. The water table well and MTH-17D are outfitted with continuous recorders and the data are available on the USGS website (<http://waterdata.usgs.gov/il/nwis/current/?type=gw>). The station numbers are 401921089282102 and 401921089282103. Figure 3 is a screen shot of the USGS webpage for MTH-17D.

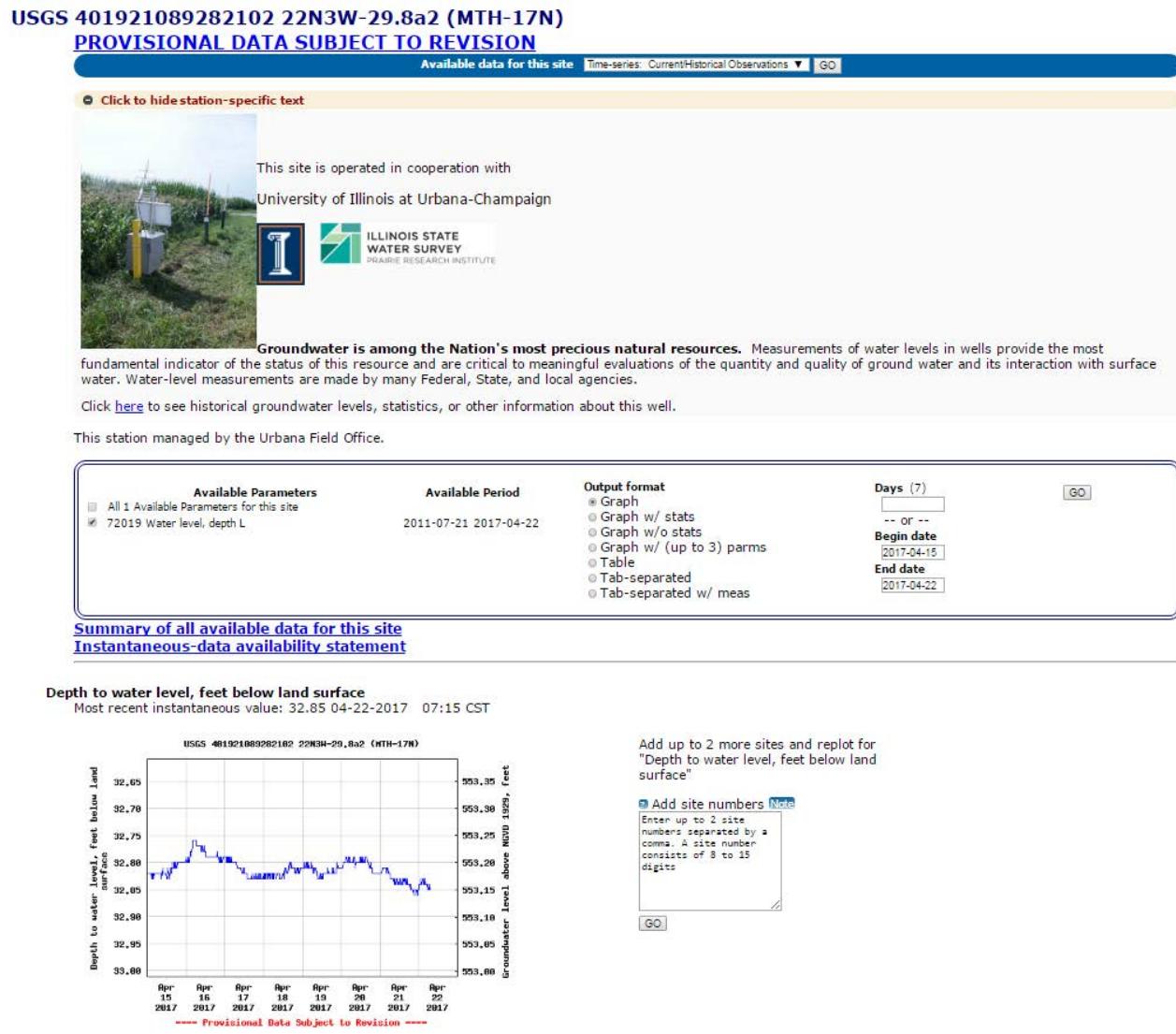


Figure 3. USGS Webpage for MTH-17D.

The ISWS would like to thank the LRPSC for continuing to fund this project. We would also like to thank the City of Bloomington for providing additional resources to outfit the nine wells with telemetry and the Northern Logan County Water Authority for providing resources to outfit five additional wells. The information being gathered is essential to continue to move toward utilization and proper management of the Mahomet Aquifer.

In 2018, Daniel Abrams became lead PI on the Northern Logan County Water Authority monitoring contract and will also assume that role for the remaining McTaz monitoring networks.

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

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Steve Wilson will remain a co-PI and continue to lend his expertise and experience to the region. Two ISWS staff who are newly involved with the McTaz observation well networks are Daniel Hadley, who maintains the groundwater level database, and Vlad Iordache, who develops the online interactive hydrograph tools and webpages. Their involvement has allowed us to integrate our real-time data collection to provide those data on the web.

Sincerely,

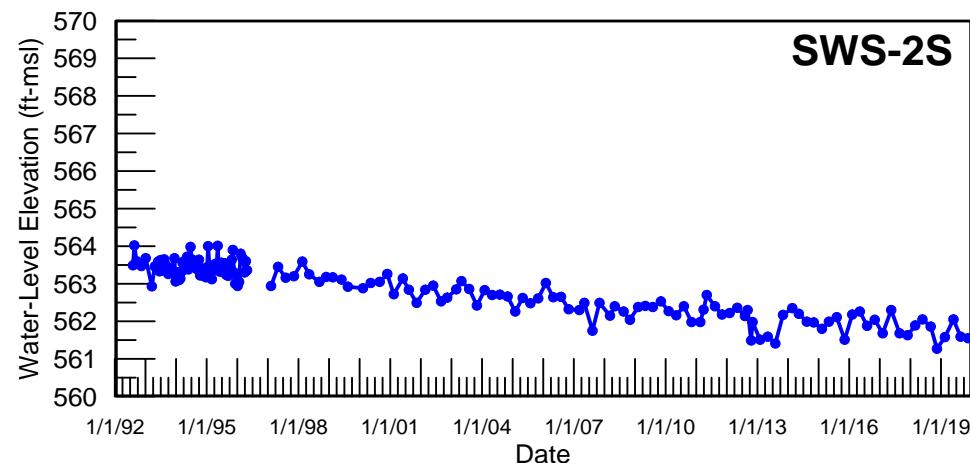
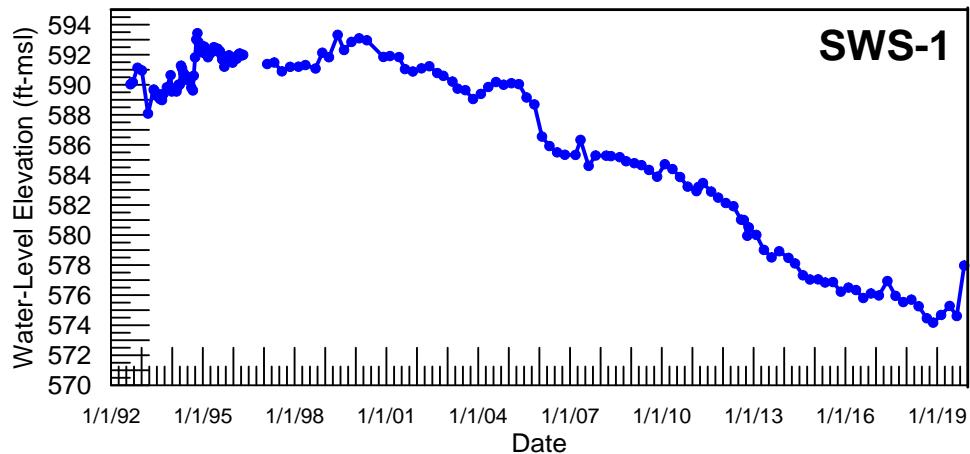
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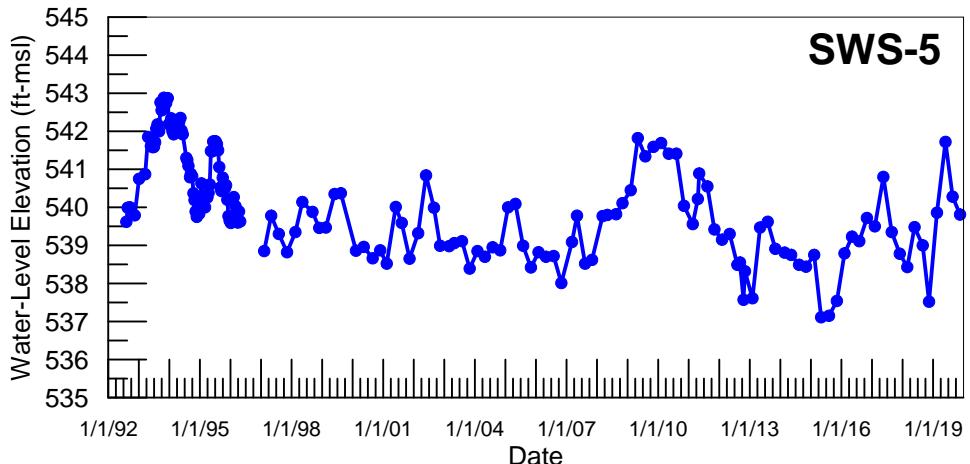
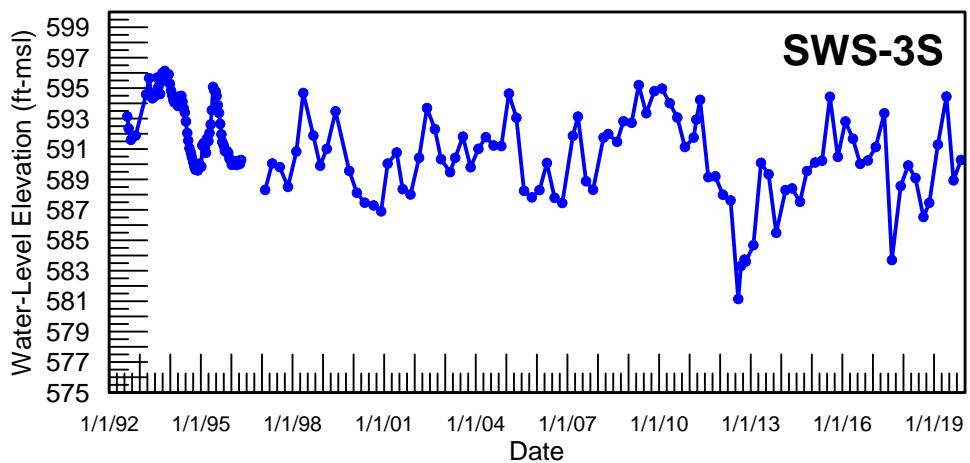
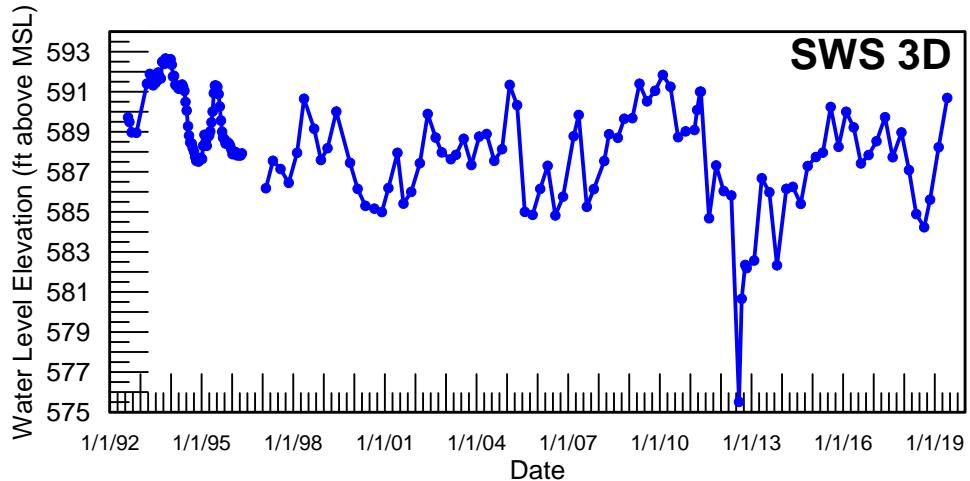
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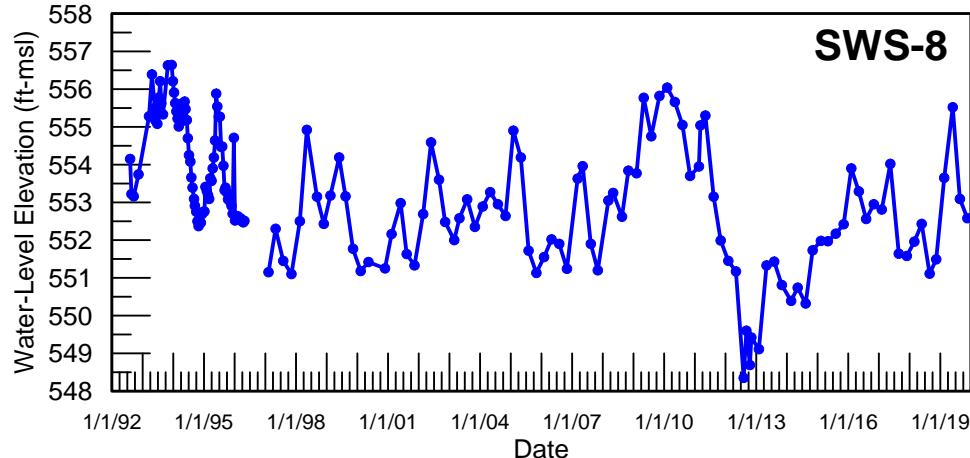
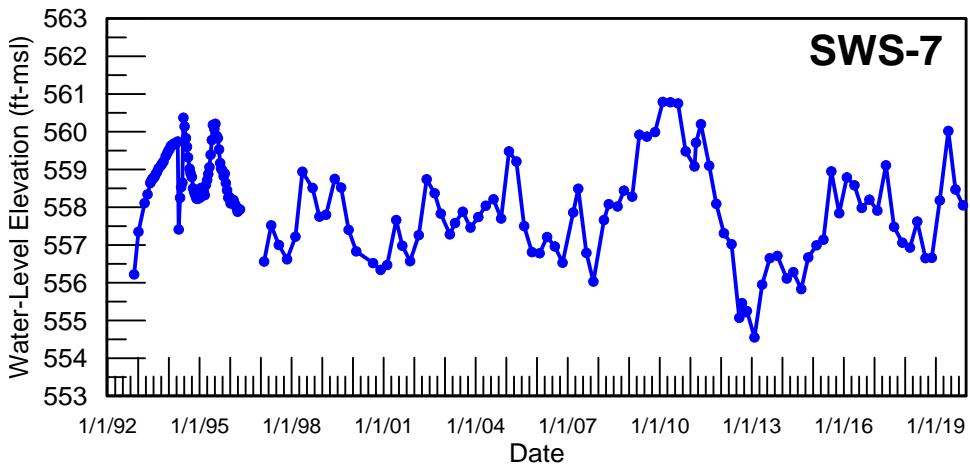
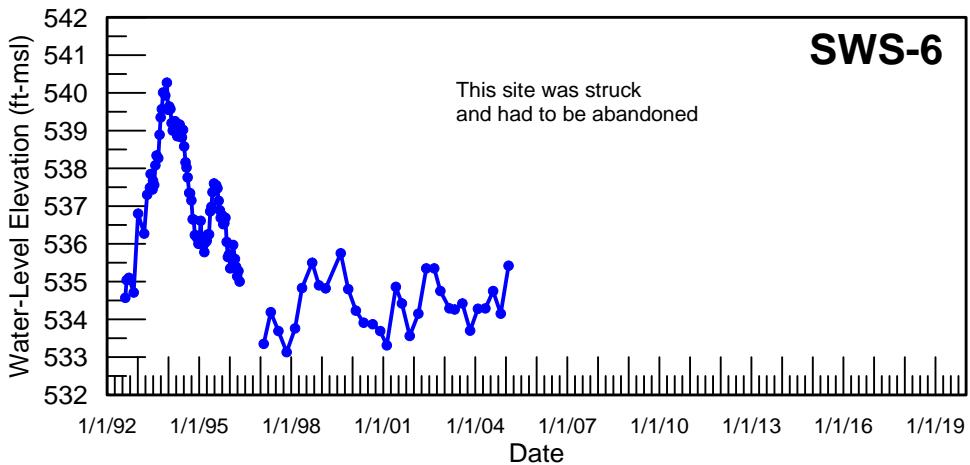
cc:

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Mel Pleines, Pleines & Assoc.  
Kevin Whitehouse, City Of Bloomington  
John Burkhart, Director of Water, Town of Normal  
Pam Reese, City Manager, Town of Normal  
Greg Troemel, Director of Inspections, Town of Normal  
Tari Renner, Mayor, City of Bloomington  
Tim Gleason, City Manager, City of Bloomington  
Tom Cross, Chairman of the Northern Logan County Water Authority  
George Roadcap, Hydrogeologist, ISWS  
Walt Kelly, Groundwater Science Section Head, ISWS  
Steven Wilson, Groundwater Hydrologist, ISWS  
Kevin Rennels, Field Research Specialist, ISWS  
Daniel Abrams, Groundwater Flow Modelers, ISWS  
Hideyuki Terashima, Outreach Data Technical Specialist, ISWS  
Vlad Iordache, Water Resources Application Developer, ISWS  
Daniel Hadley, Hydrogeologist, ISWS  
Lisa Young, Grants & Contracts Coordinator, PRI  
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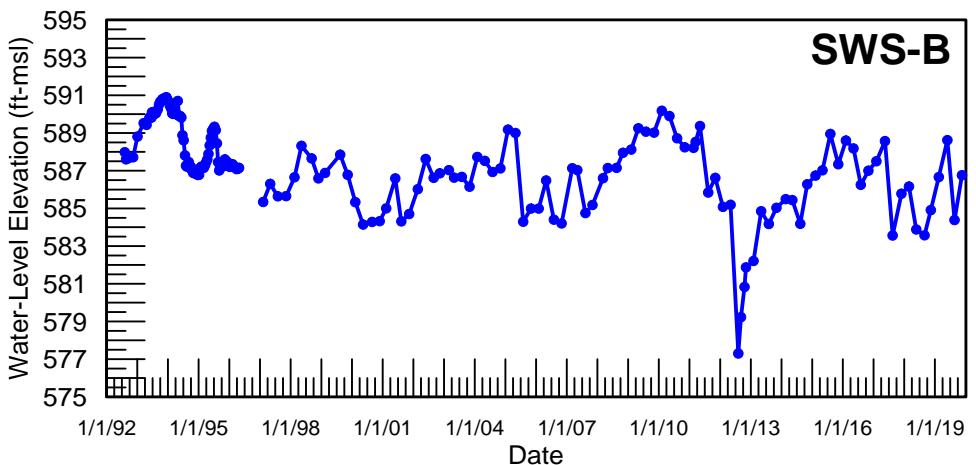
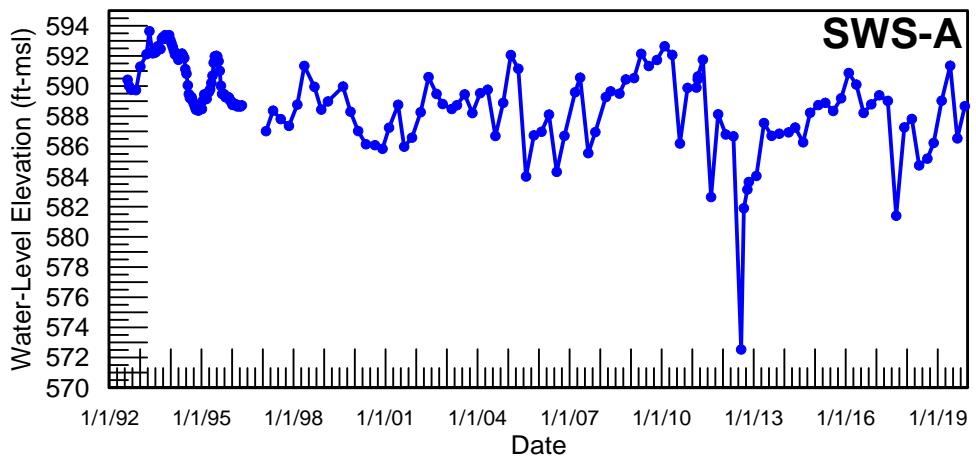
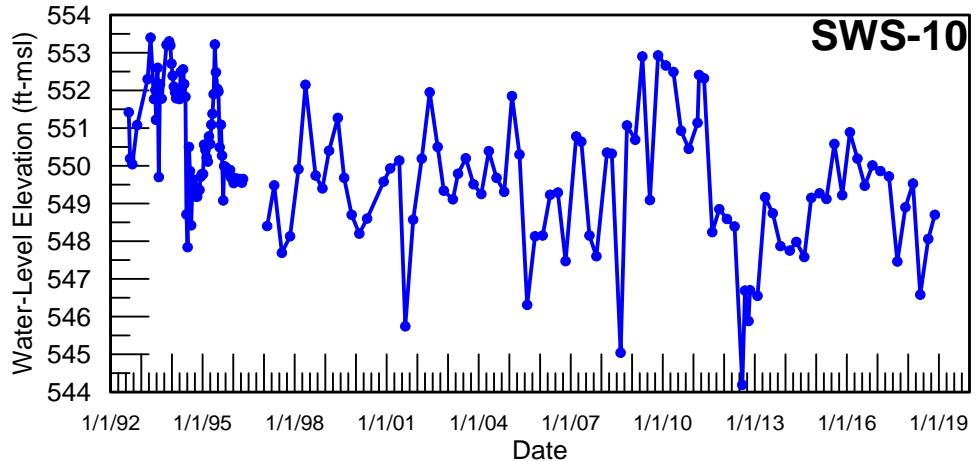


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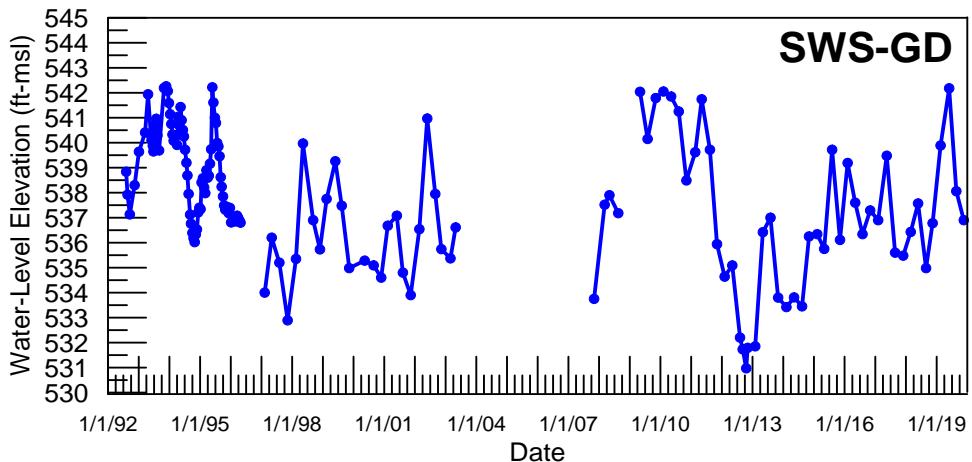
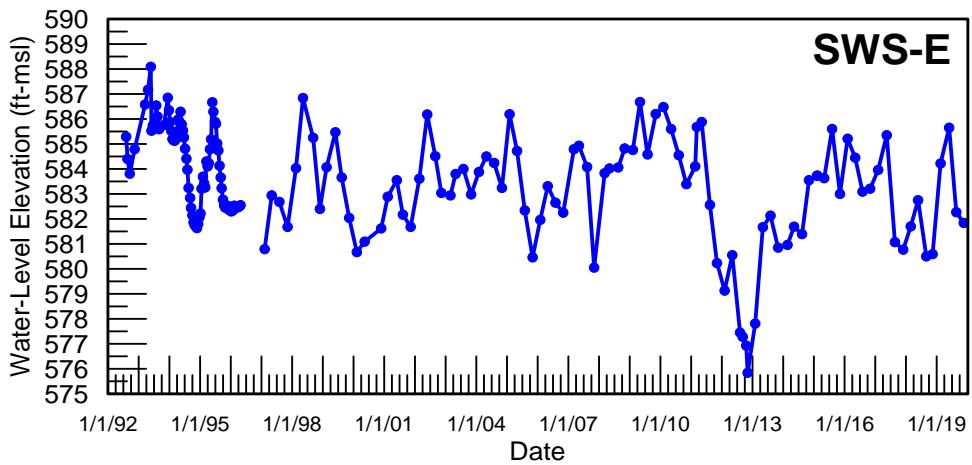
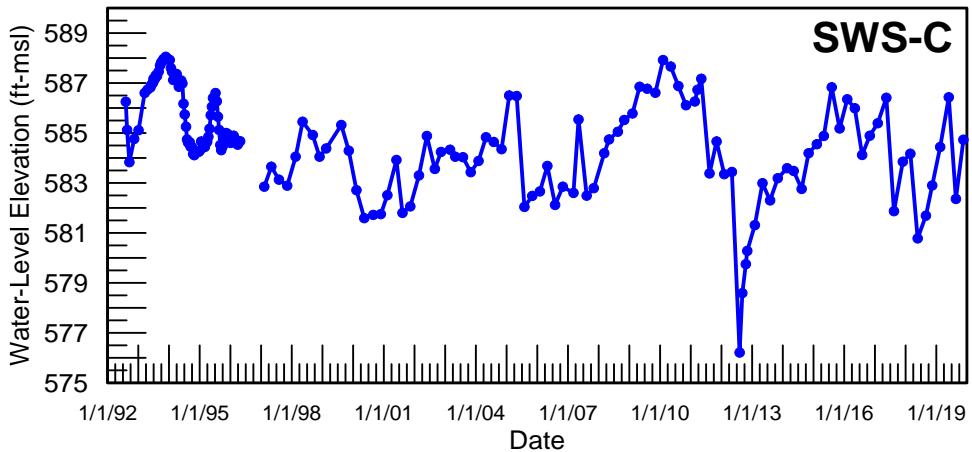




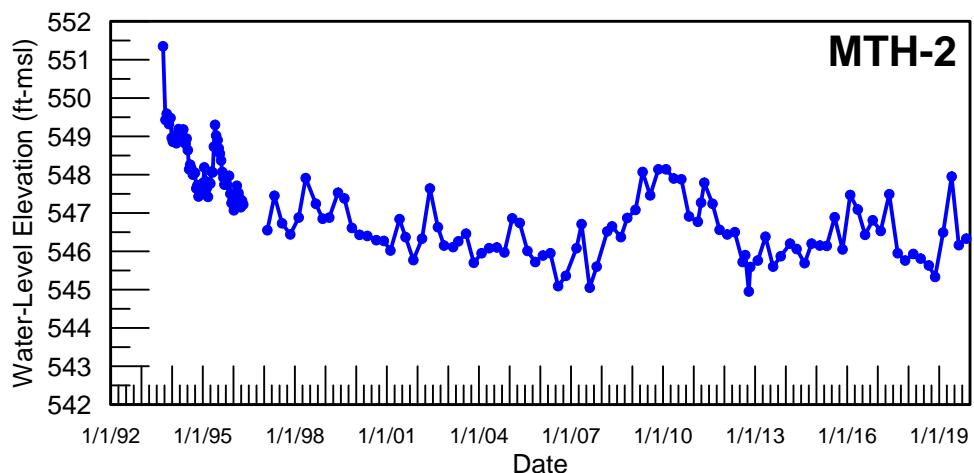
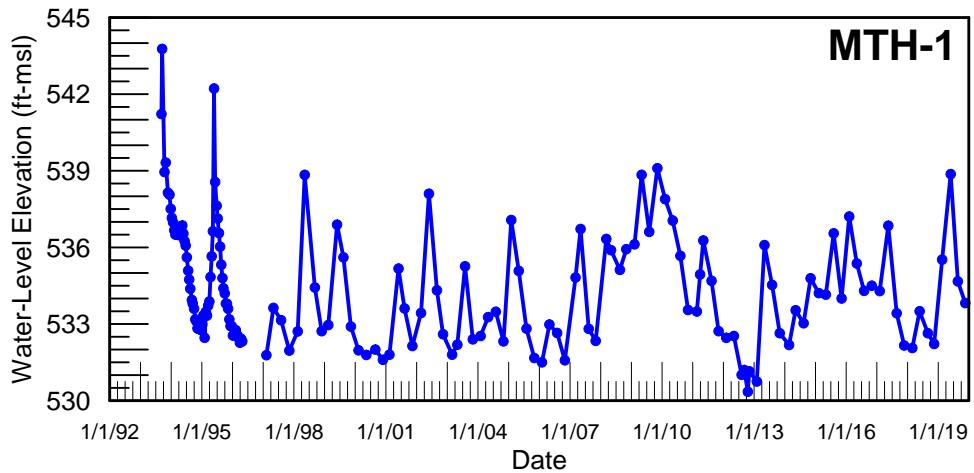
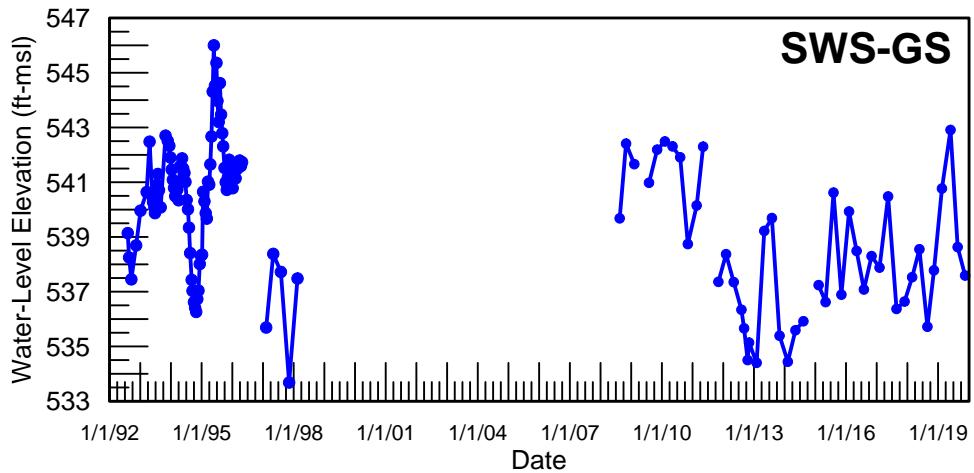
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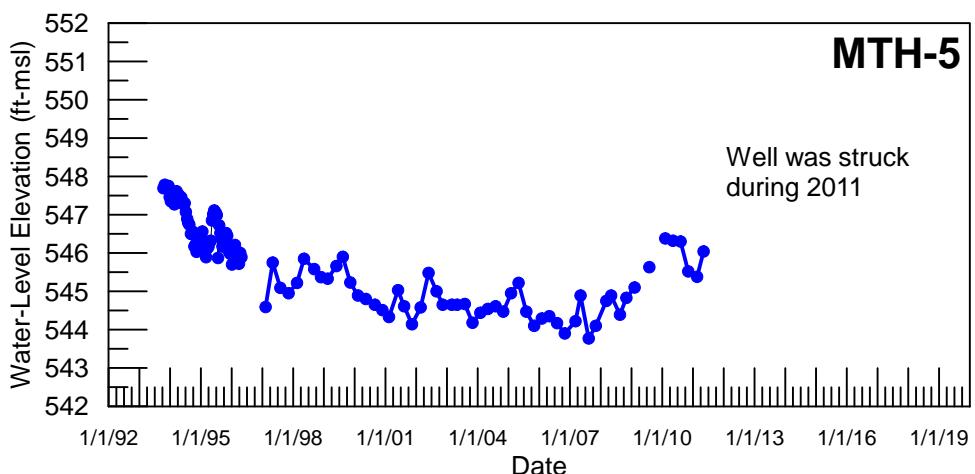
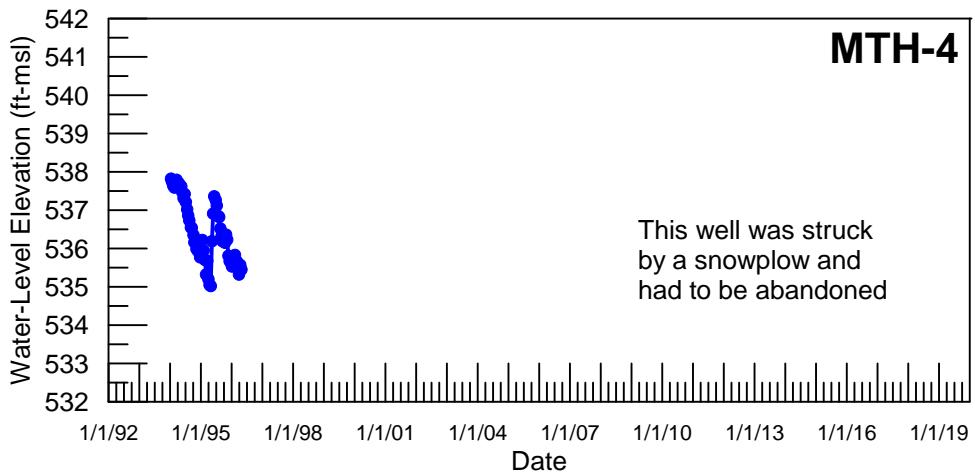
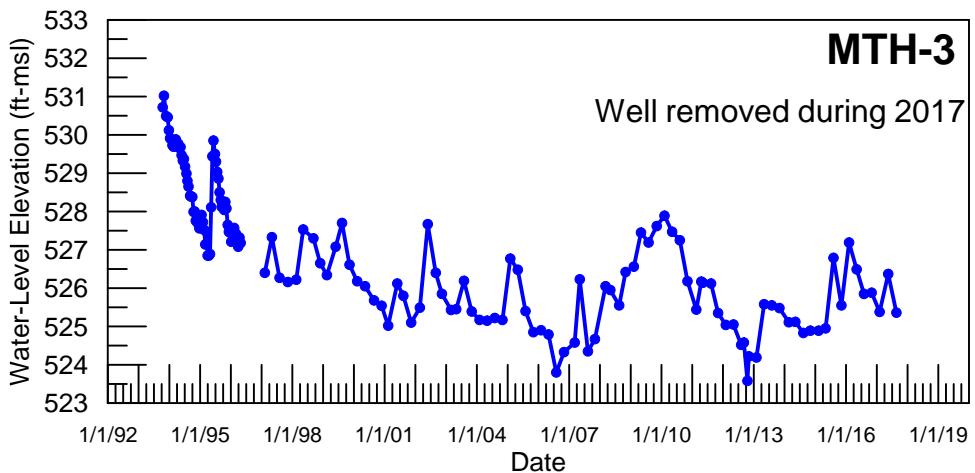
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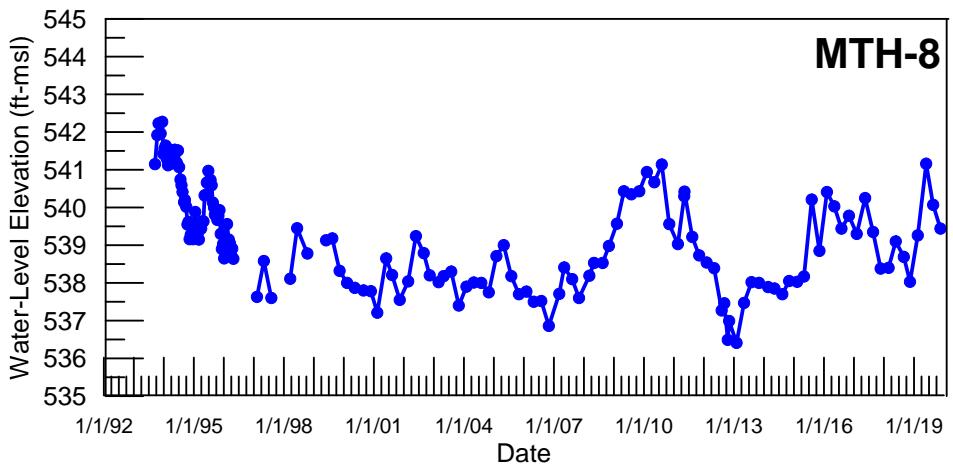
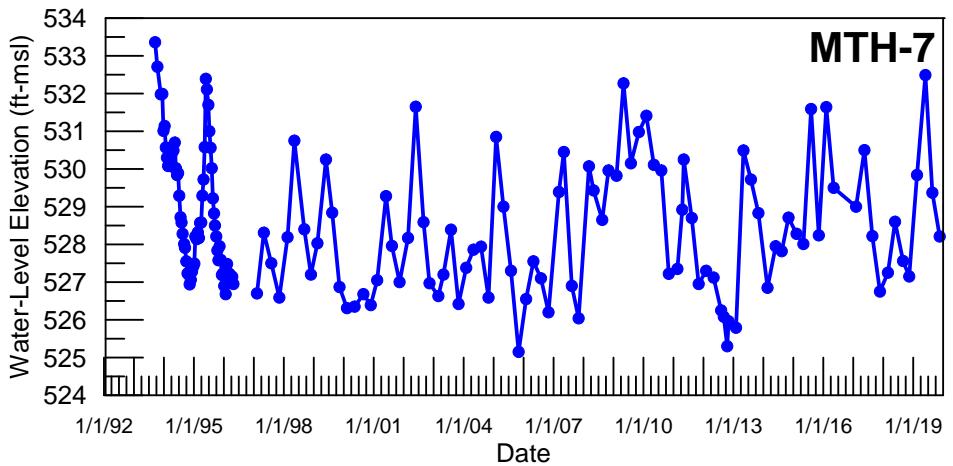
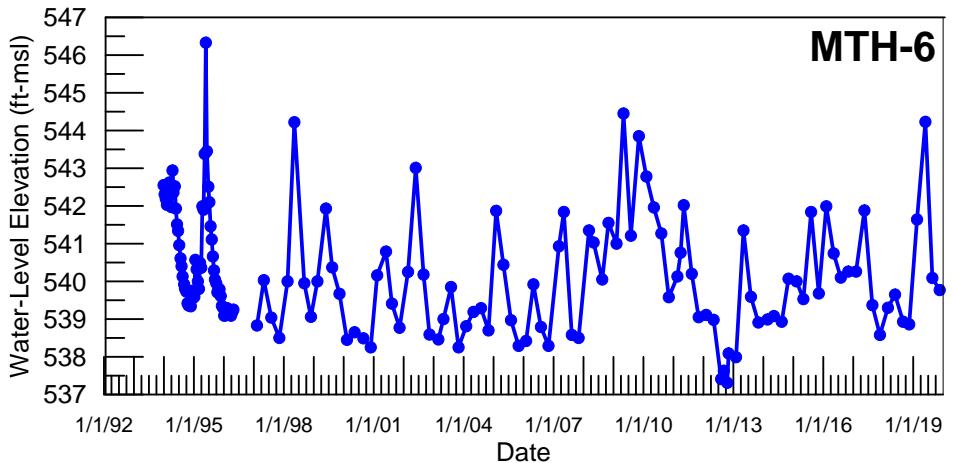
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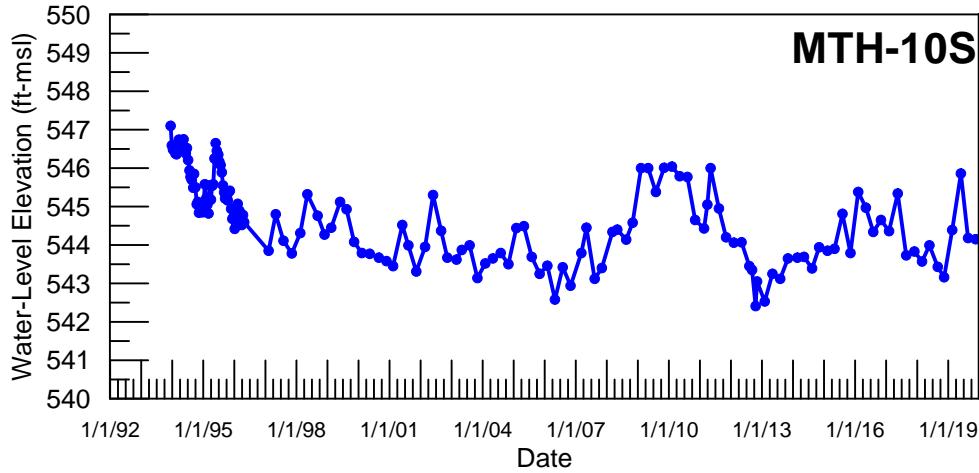
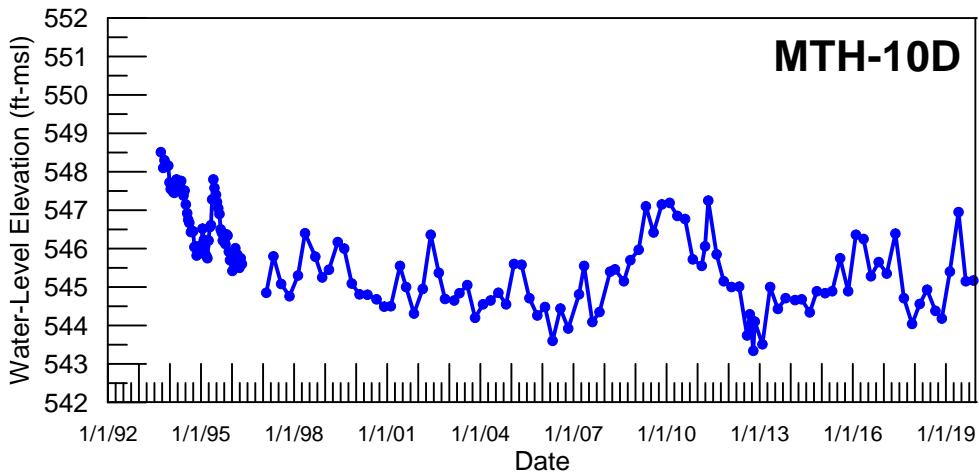
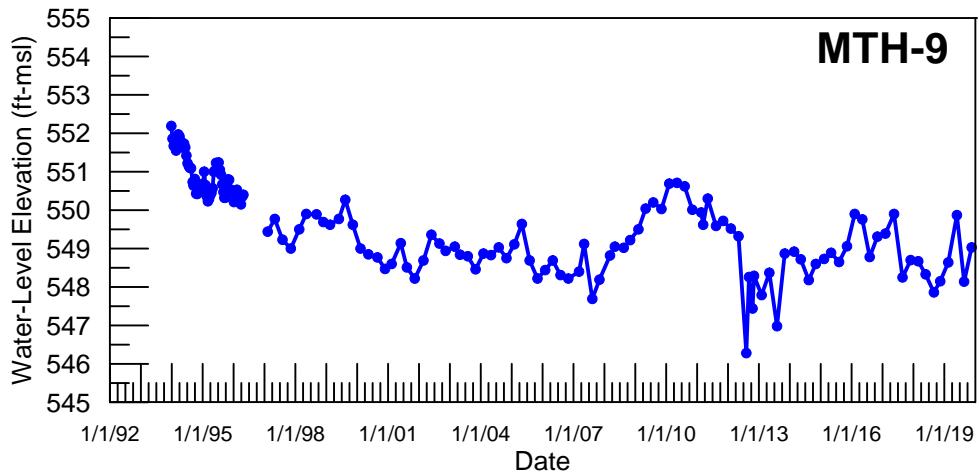
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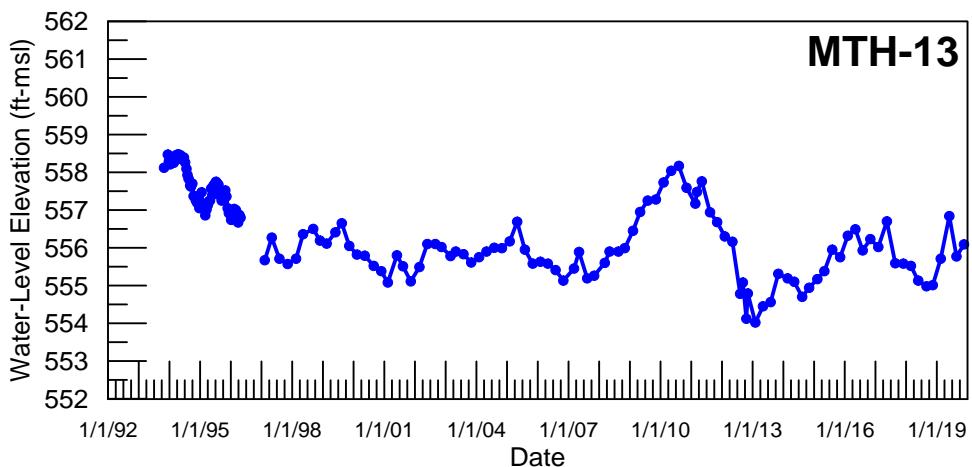
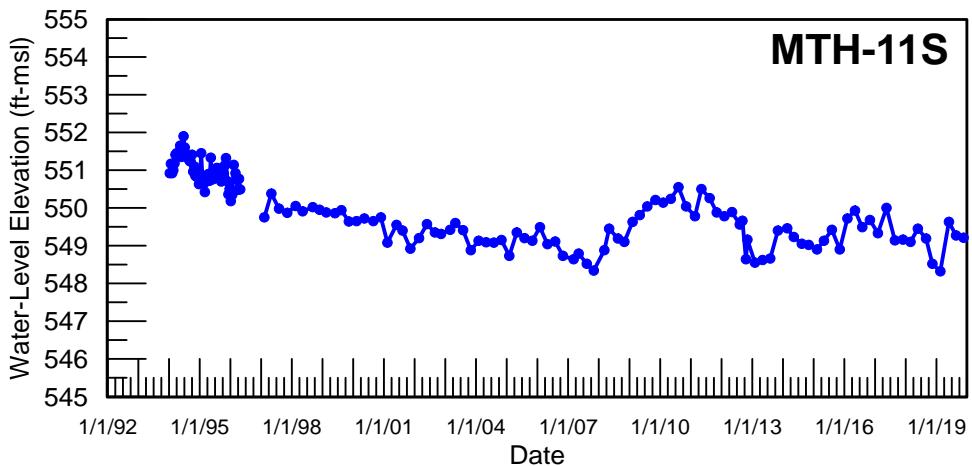
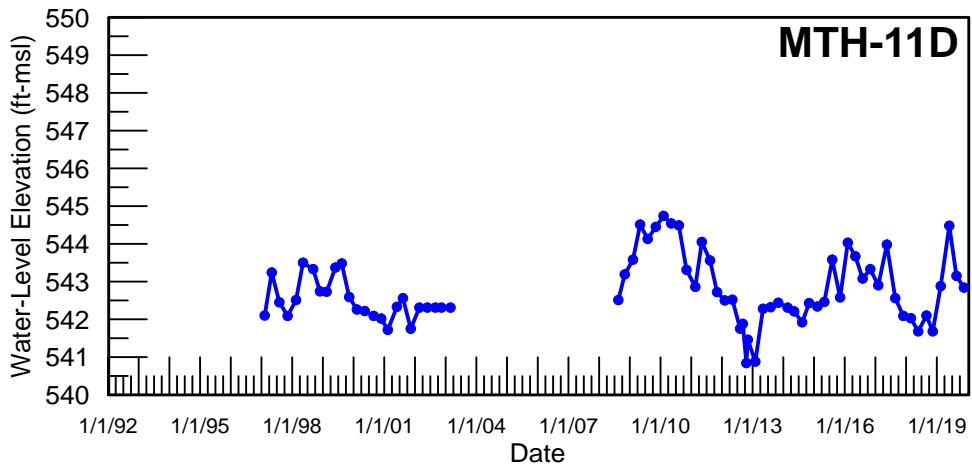
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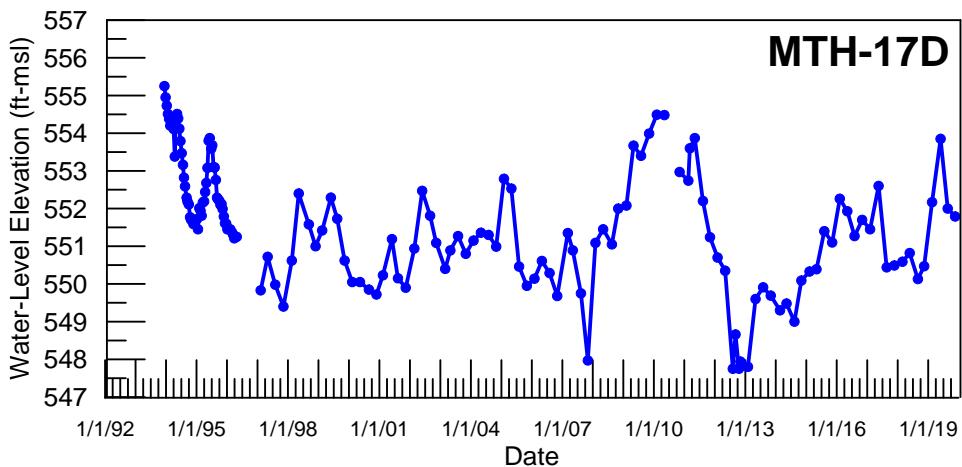
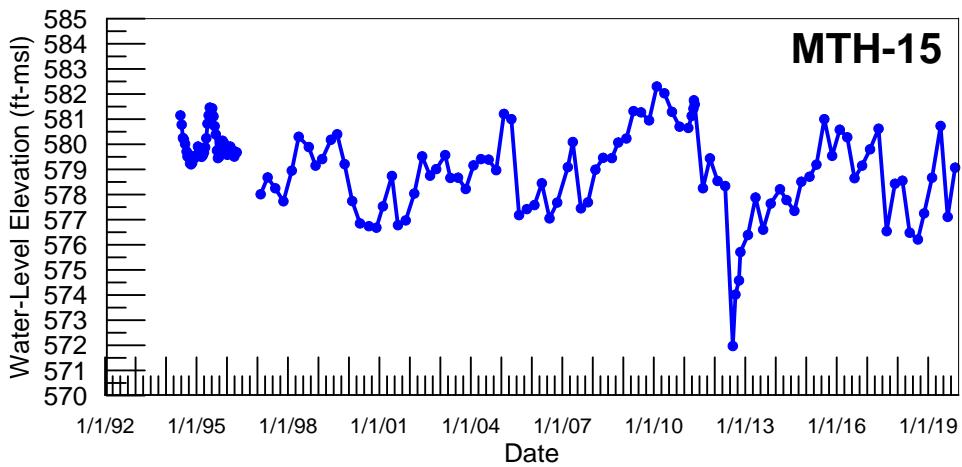
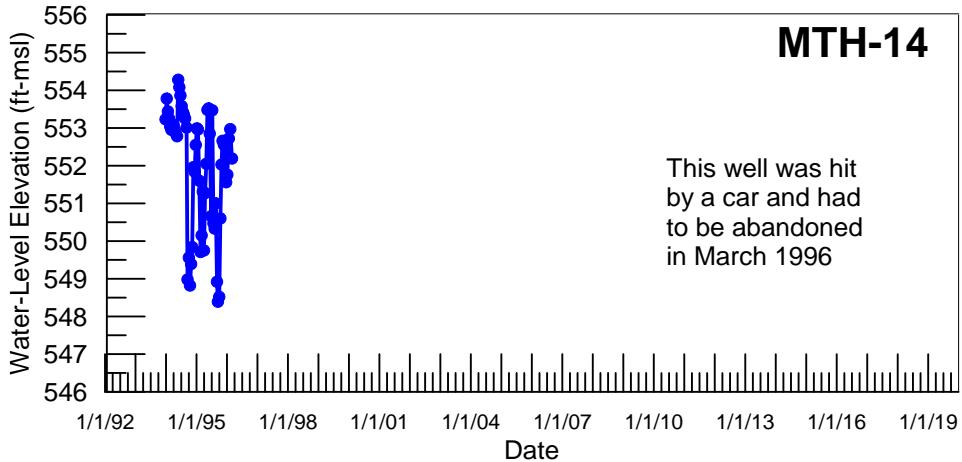
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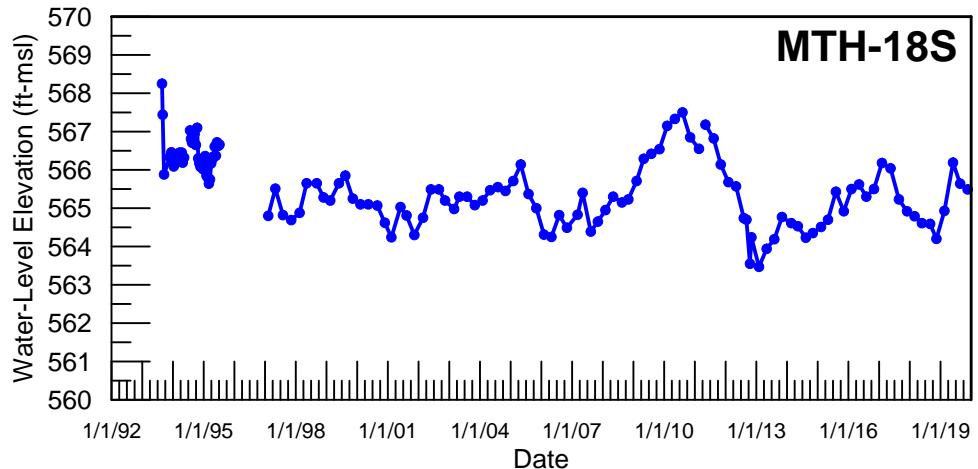
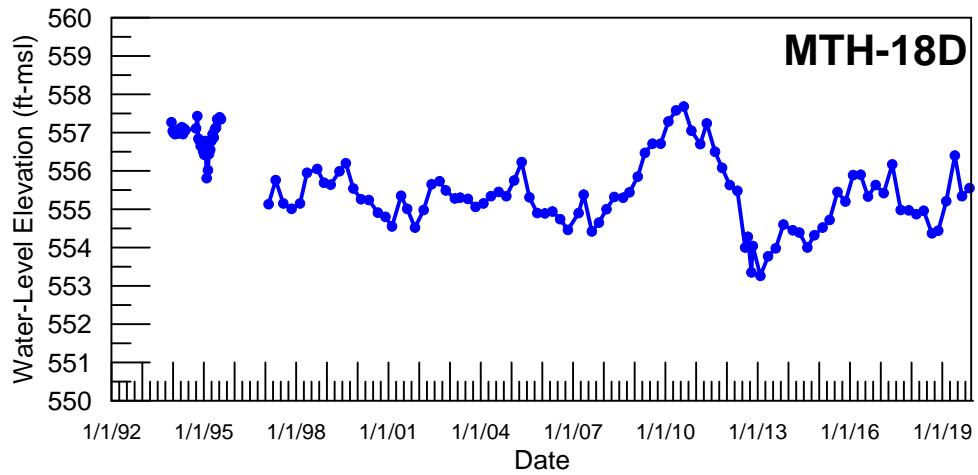
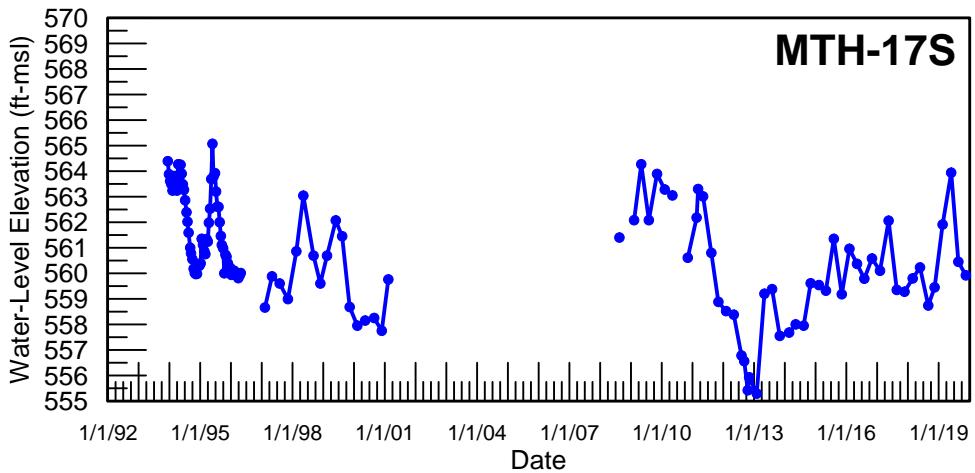
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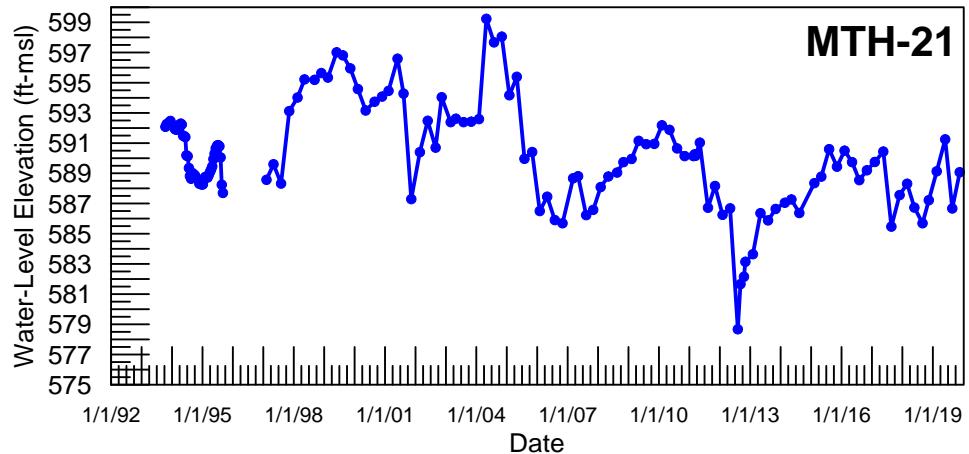
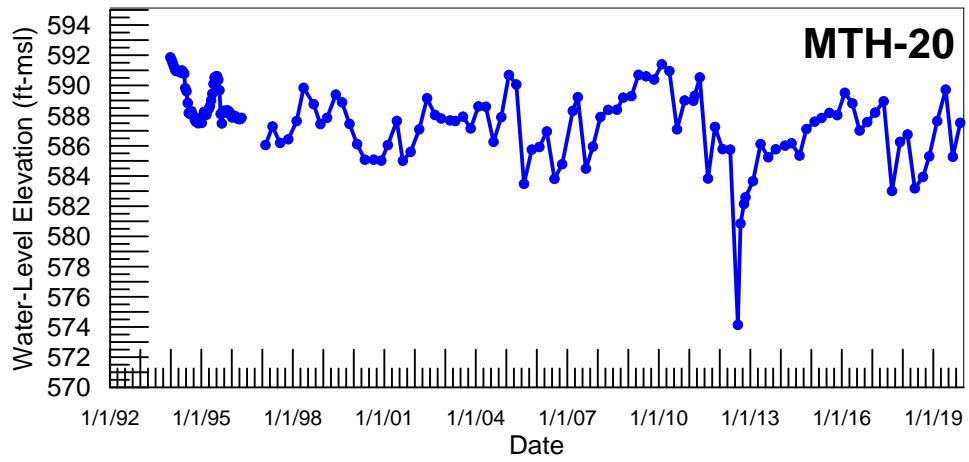
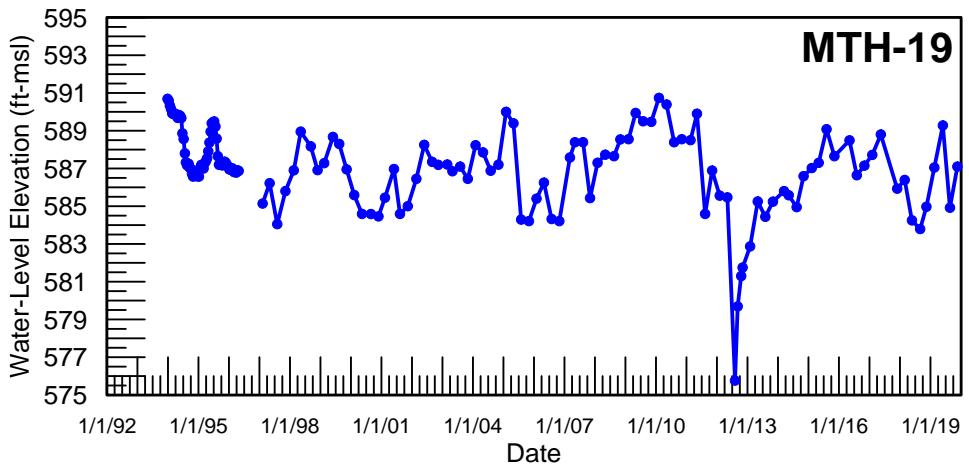
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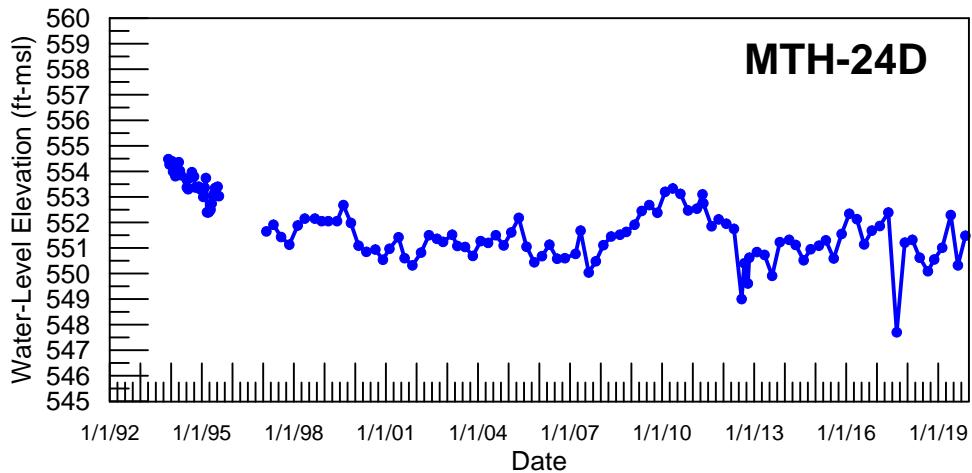
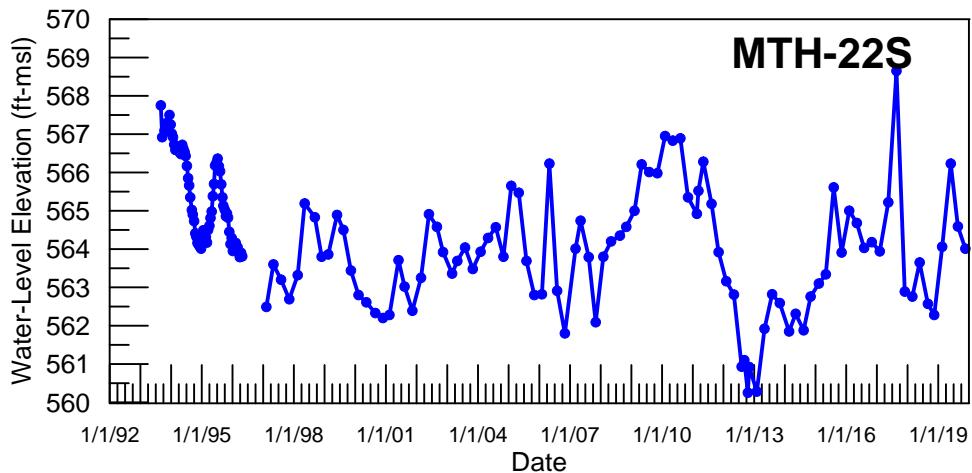
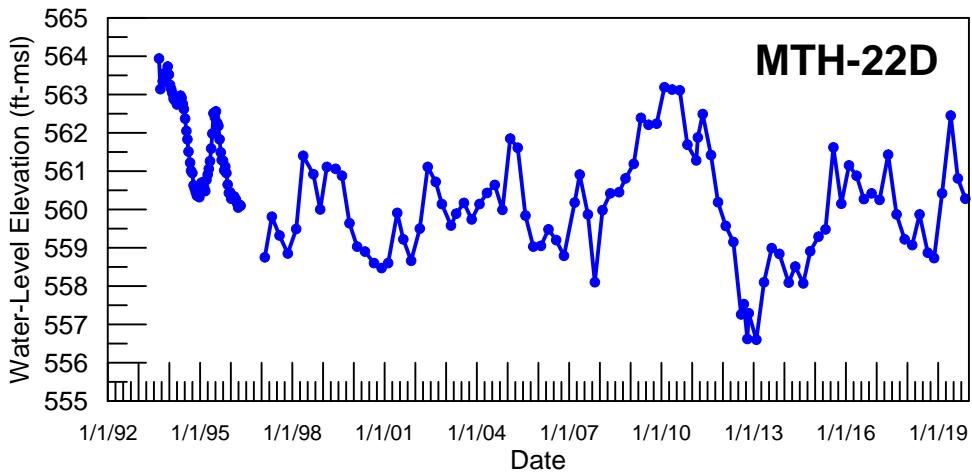
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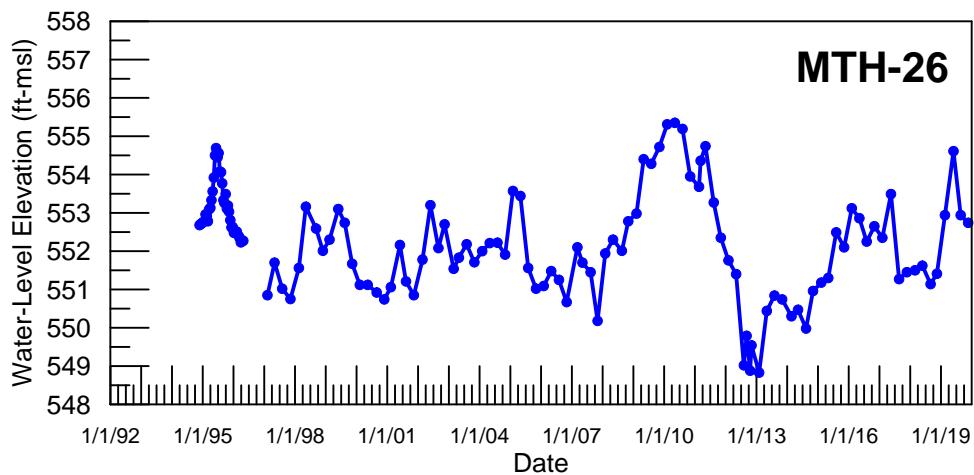
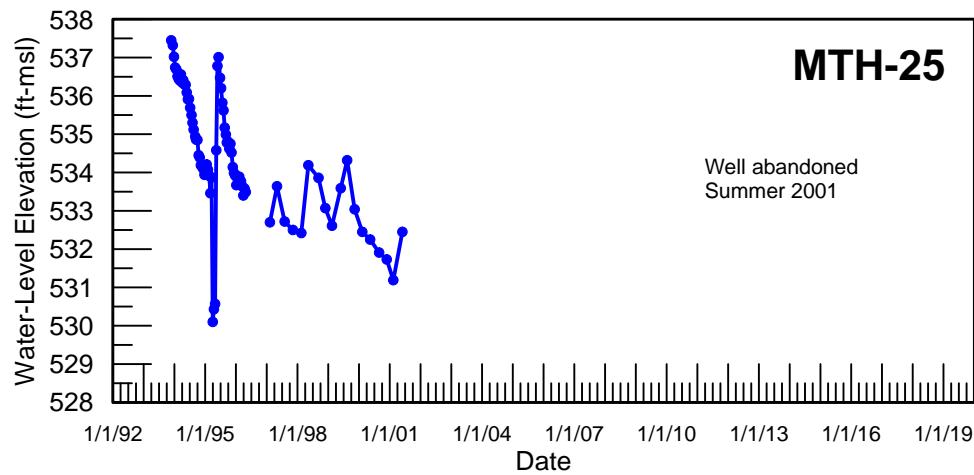
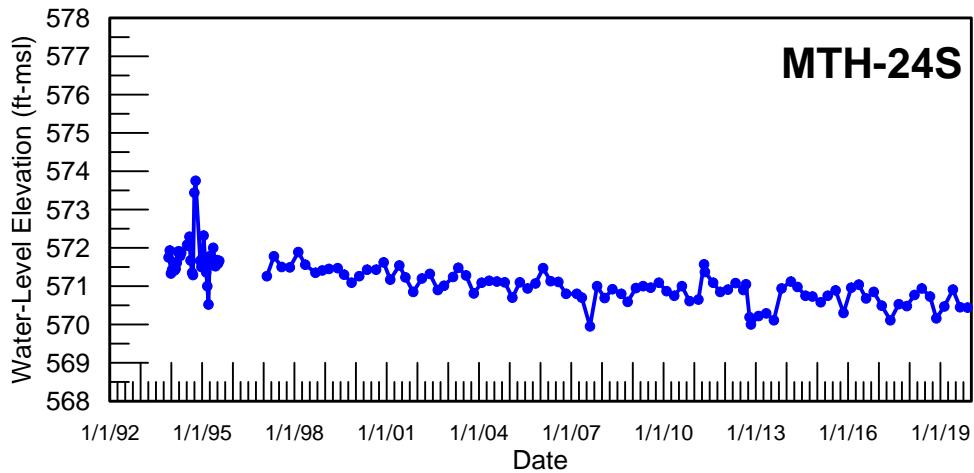
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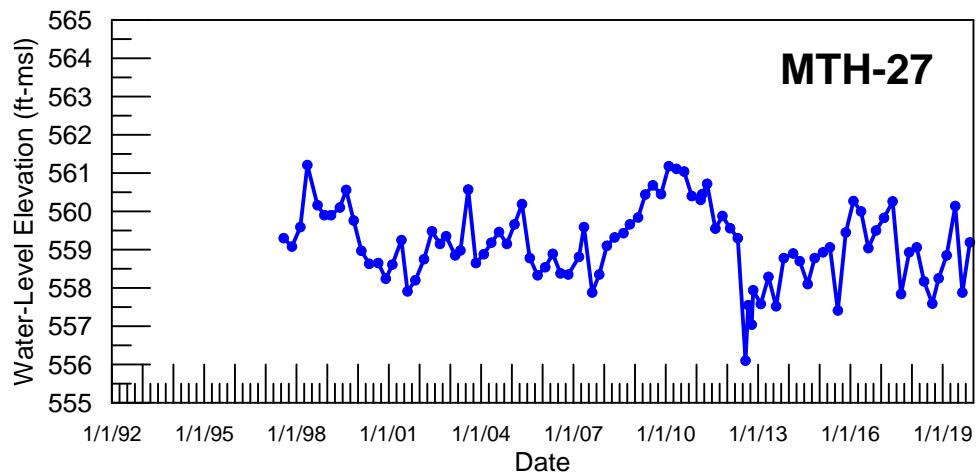


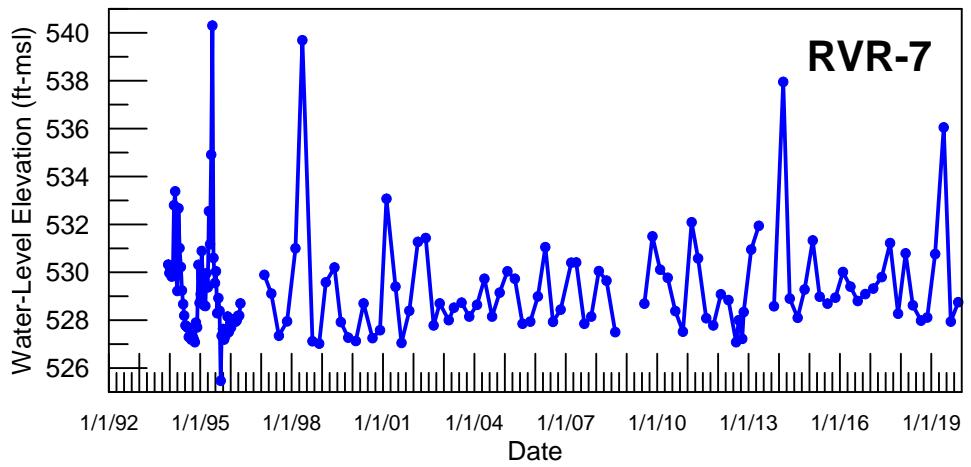
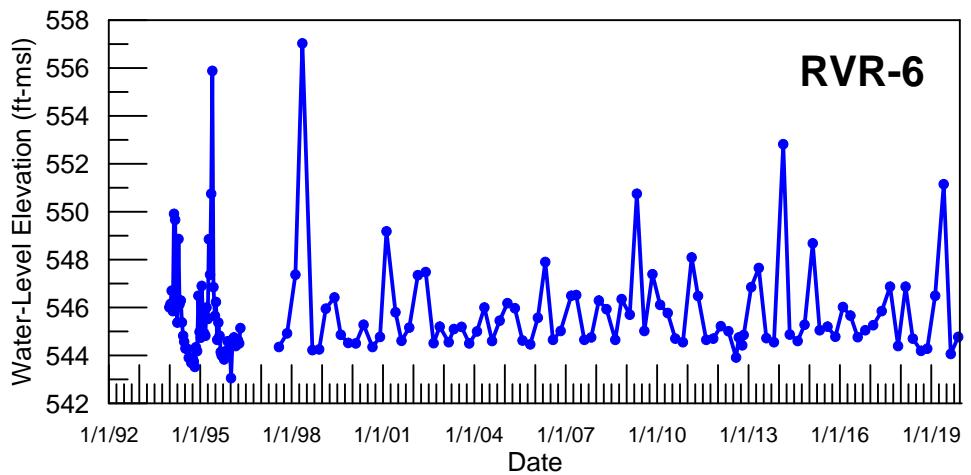
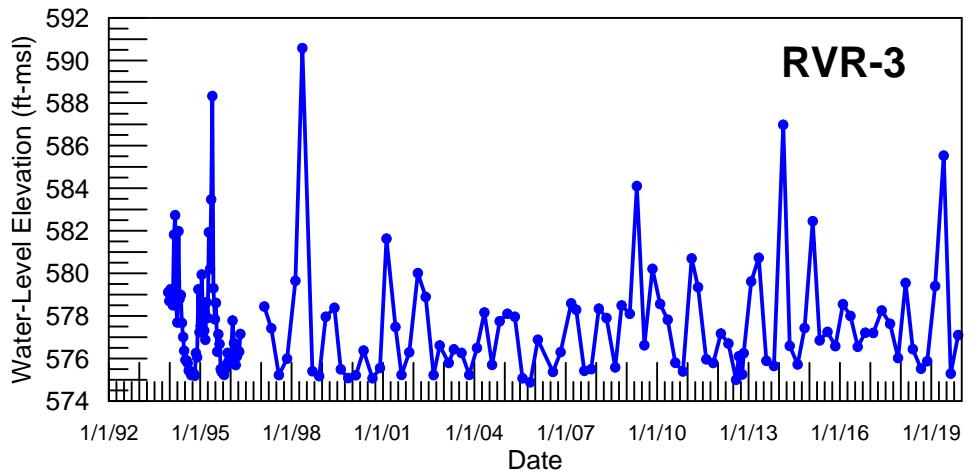
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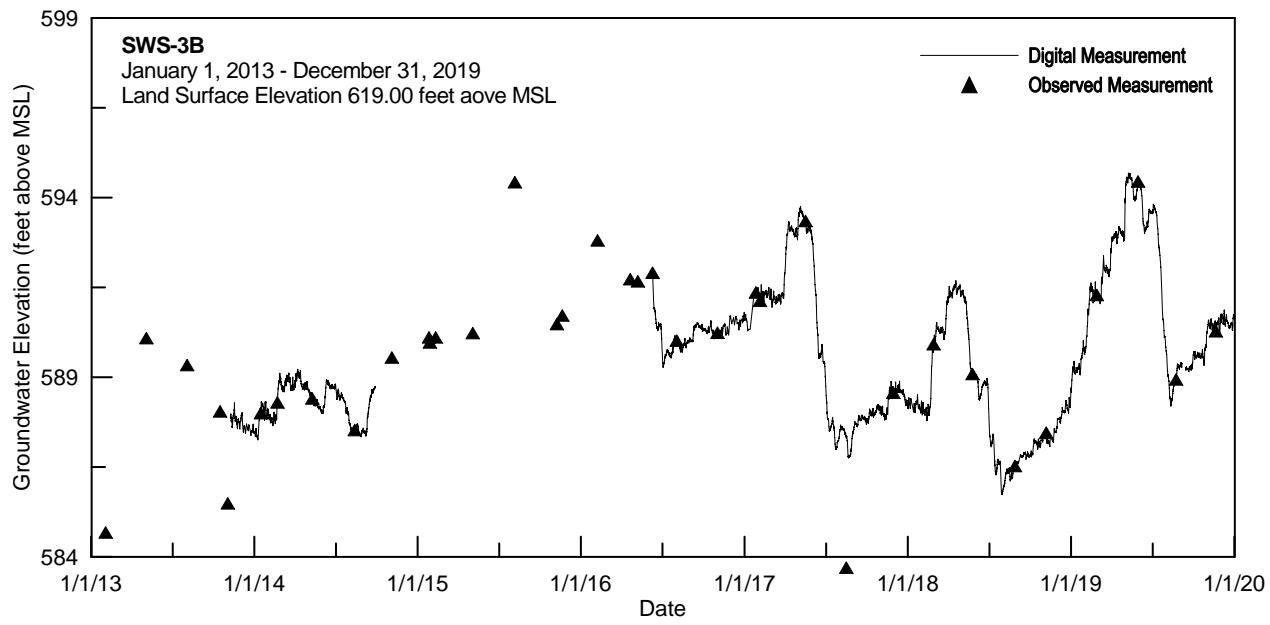
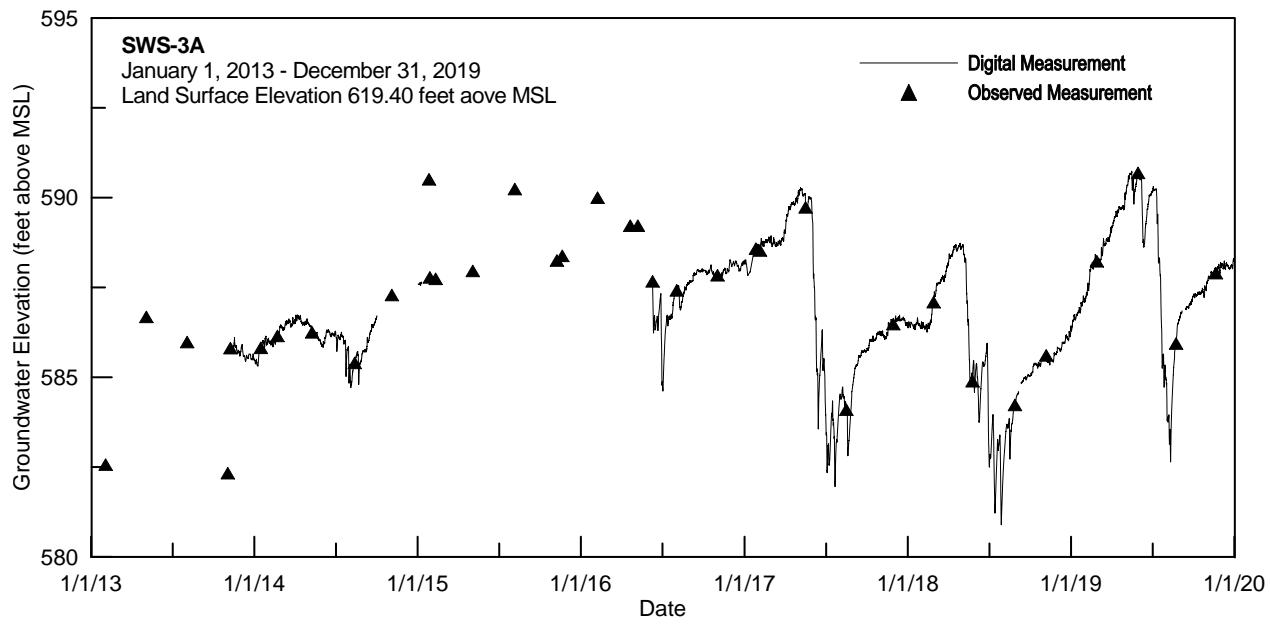
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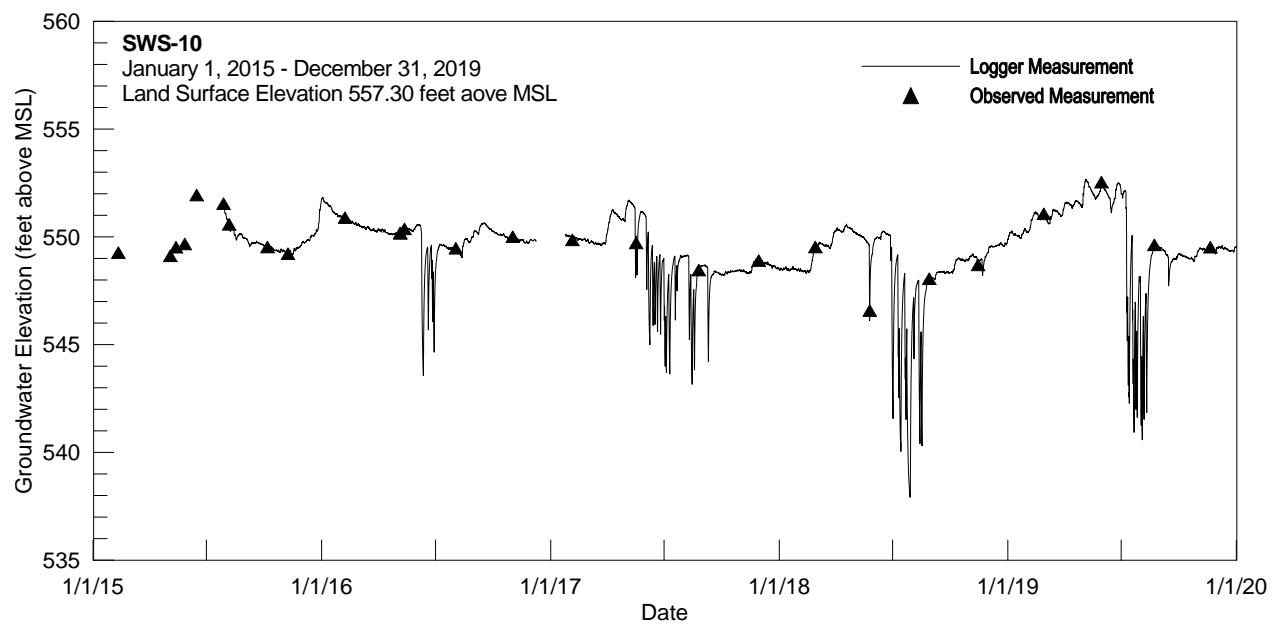
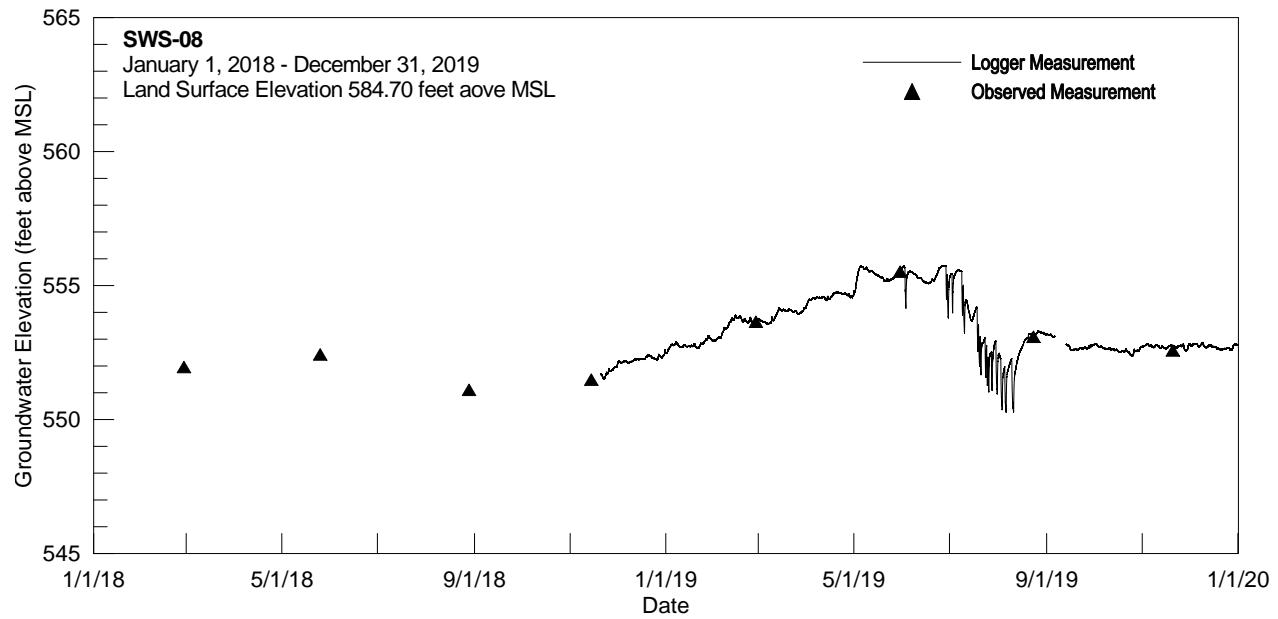




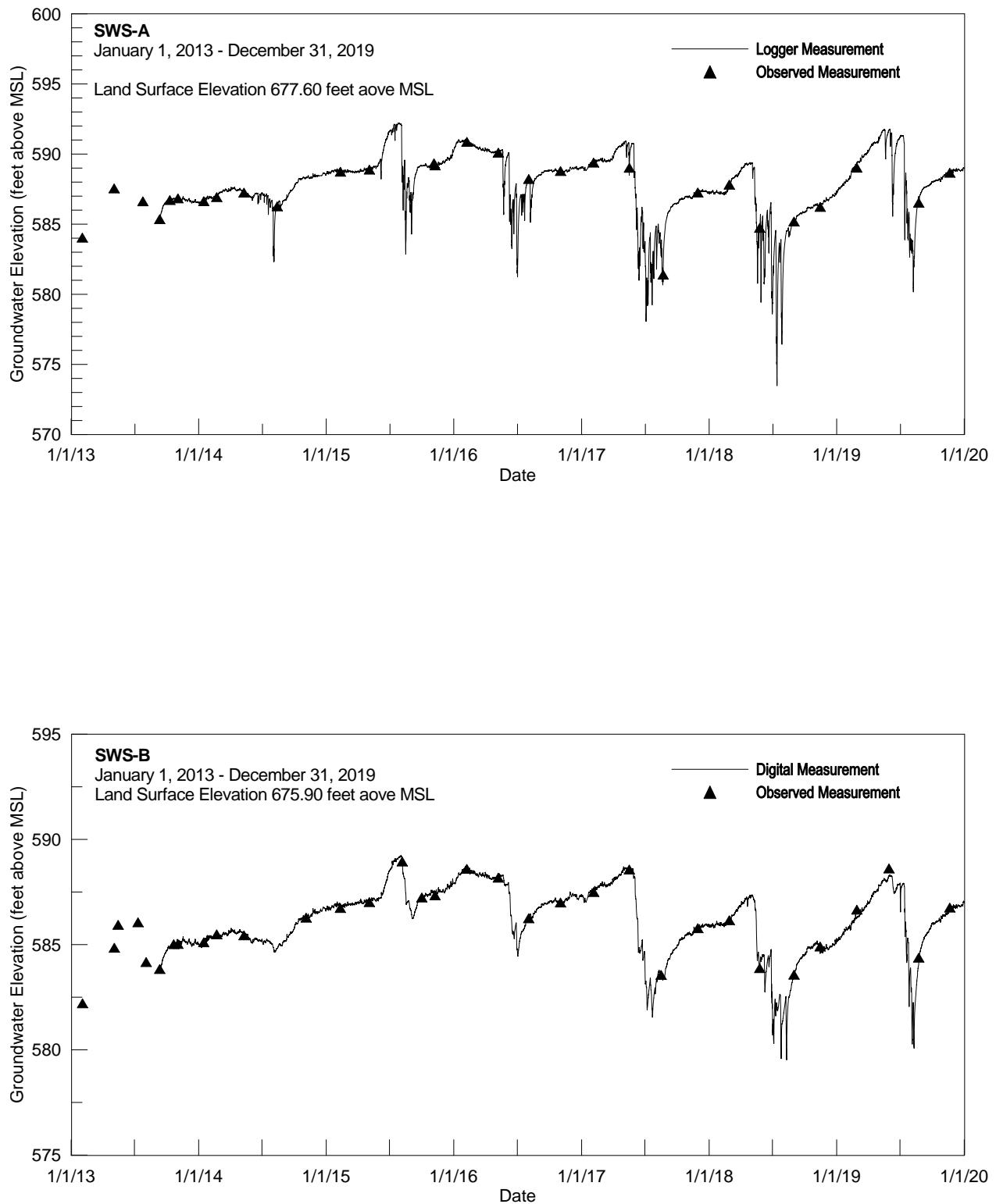
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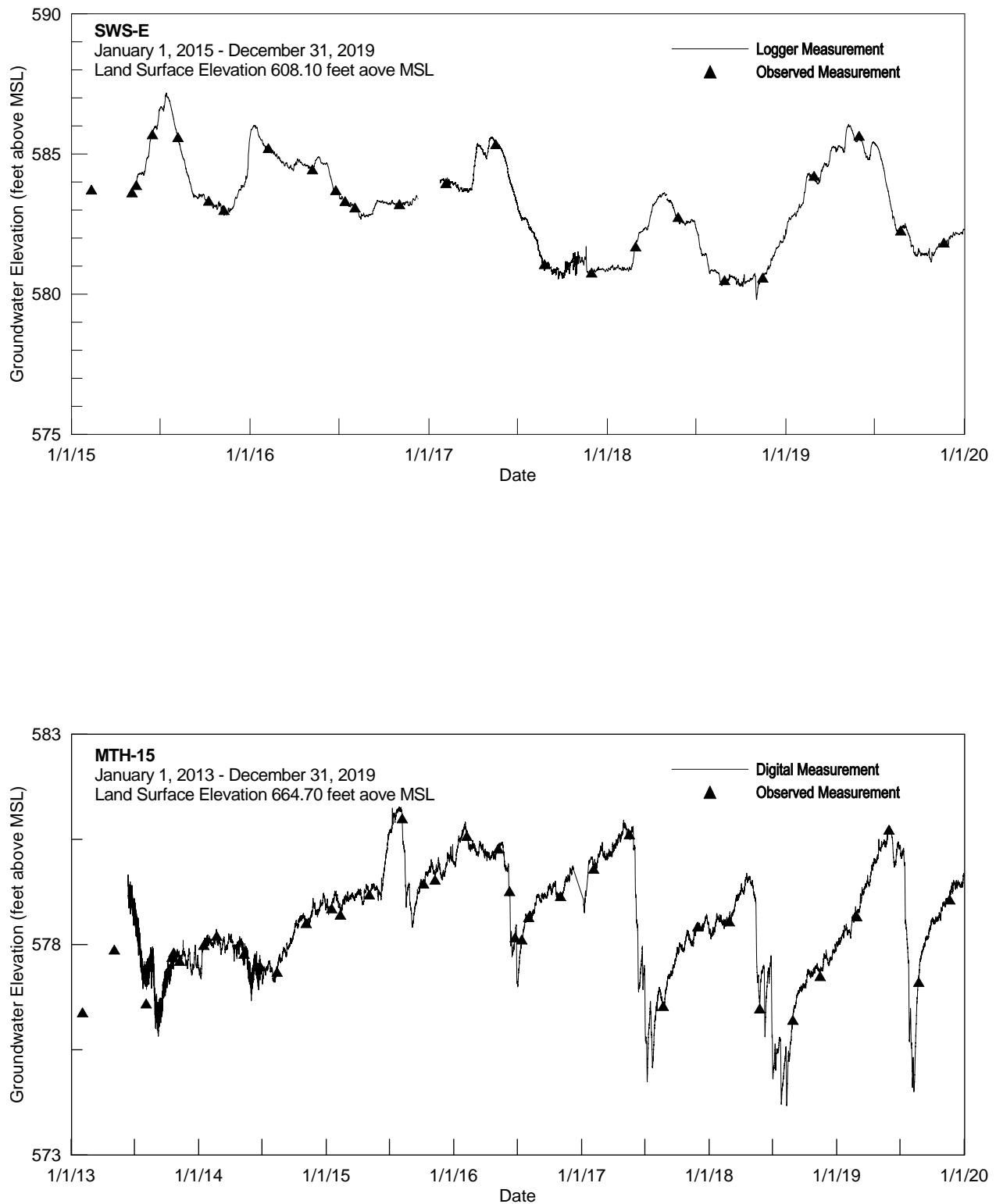
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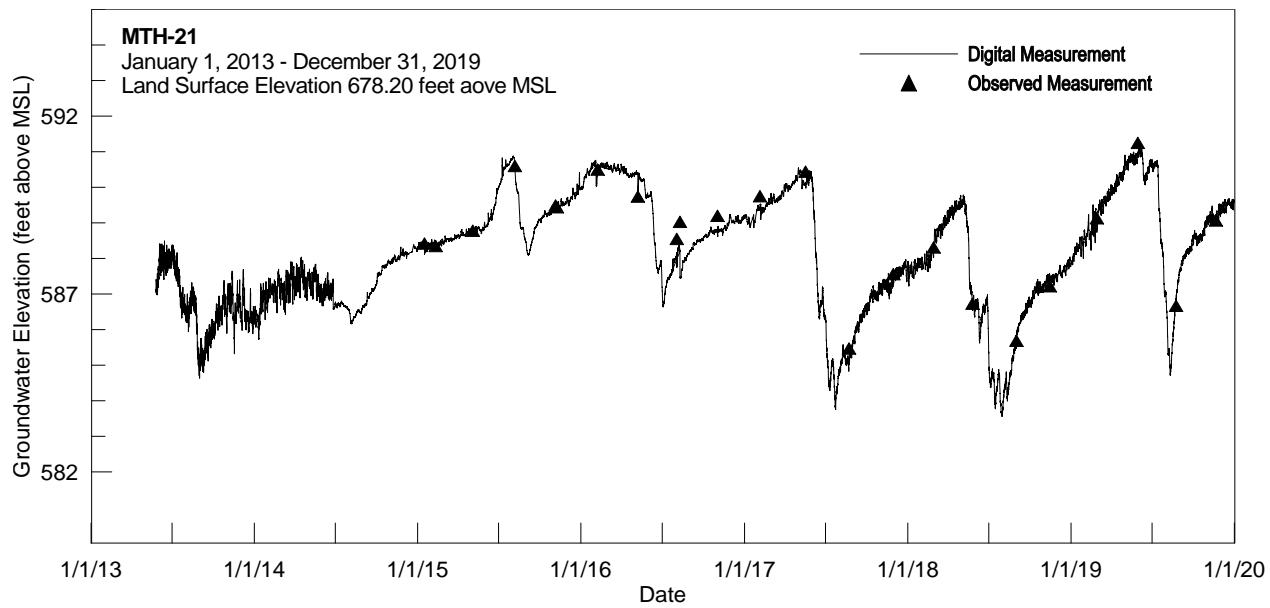
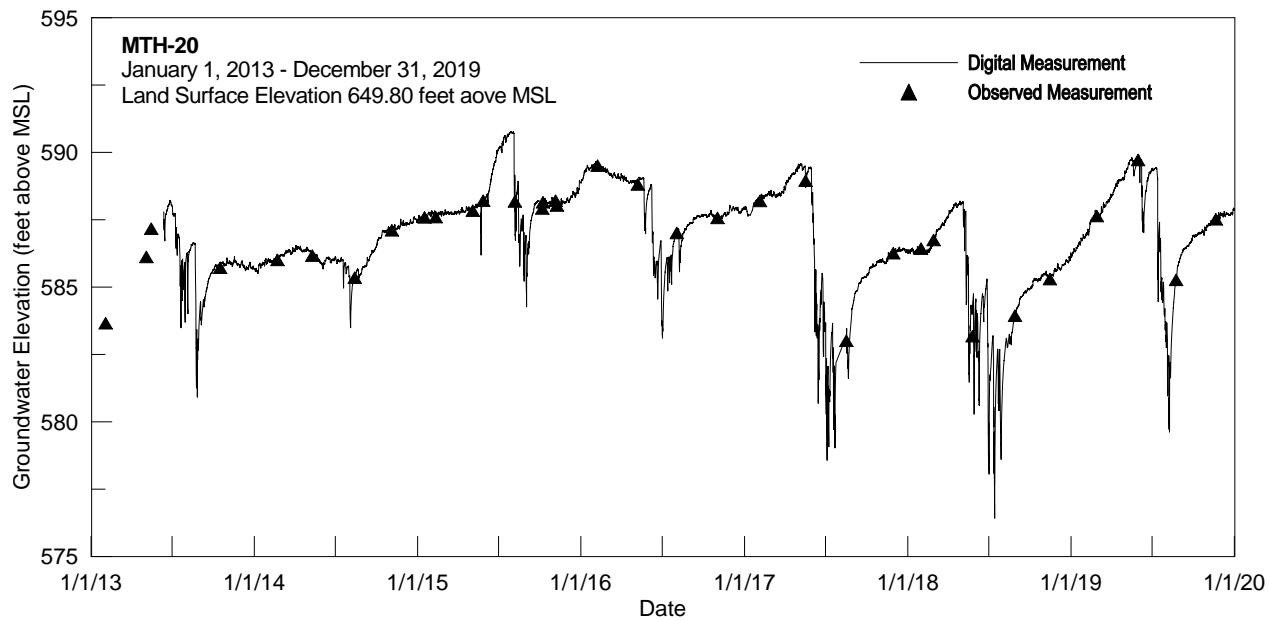
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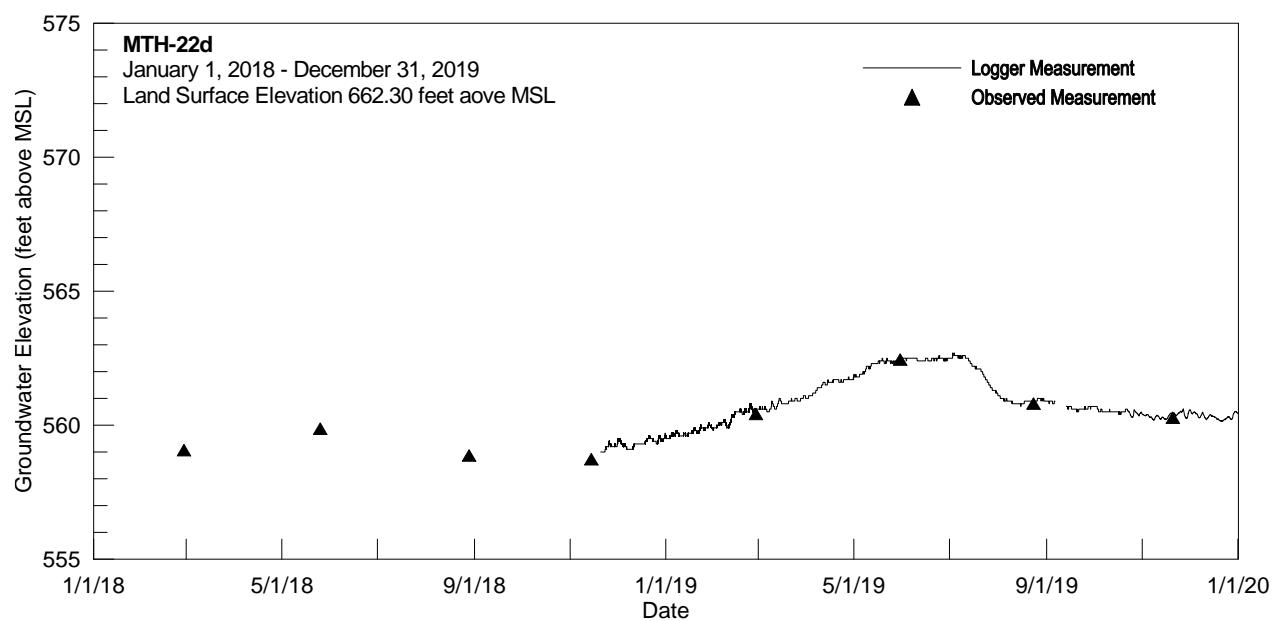
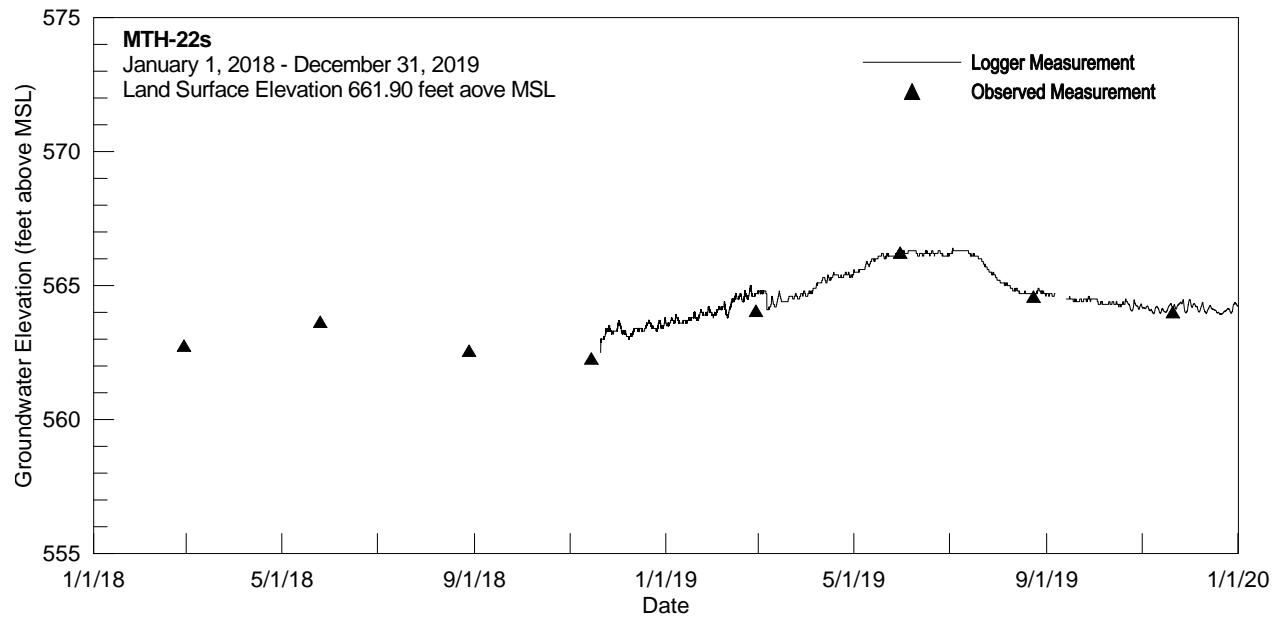
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