LOWER MINNESOTA RIVER
WATERSHED DISTRICT

Executive Summary for Action

Lower Minnesota River Watershed District Board of Managers Meeting

Wednesday, May 21, 2025

Agenda Item

Item 4. A. Presentation of 2024 monitoring results by Dakota County SWCD

Prepared By

Linda Loomis, Administrator

Summary

The 2024 Fen Well Monitoring Report prepared by the Dakota County Soil & Water Conservation District is attached for the Board's information. Lindsey Albright, Monitoring & Outreach Coordinator, will join the meeting to present the findings of the 2024 monitoring and to answer any questions the Managers may have.

Attachments

2024 Fen Well Monitoring Report prepared by Dakota County Soil and Water Conservation District

Recommended Action

Receive and file report

LOWER MINNESOTA RIVER
WATERSHED DISTRICT

2024 Fen Well Monitoring Report

Prepared for the Lower Minnesota River Watershed District
by Dakota County Soil and Water Conservation District

DAKOTA COUNTY
SOIL & WATER
CONSERVATION DISTRICT

Contents

Introduction

The Minnesota River corridor, just upstream of the confluence with the Mississippi River, is a unique habitat consisting of calcareous fens, intersected with small trout streams (see map in Appendix 1). Flora and fauna of the fens and streams rely on groundwater input to maintain water levels and provide cool water. The abundance of dissolved minerals, particularly calcium carbonate, causes the water to be more alkaline (higher pH), a typical signature of streams and wetlands with a significant groundwater influence. This calcium-rich environment supports highly diverse and unique rare plant species.

As a result of development in the area, little natural fen remains and there is concern over the quality of the fen habitat and the ability to support the wildlife that is well adapted to its unique characteristics.

Groundwater pumping, infrastructure, and stormwater input have had a noticeable effect on water quality and quantity. Several assessments of this natural resource and the need for continued monitoring were done, and in 2007 the Lower Minnesota River Watershed District began working with the Dakota County Soil and Water Conservation District (SWCD) to conduct annual fen well monitoring.

Weather Summary

Monthly precipitation data was retrieved from the Minnesota Department of Natural Resources (MNDNR) website for the Minneapolis/St. Paul airport weather station (Figure 1).

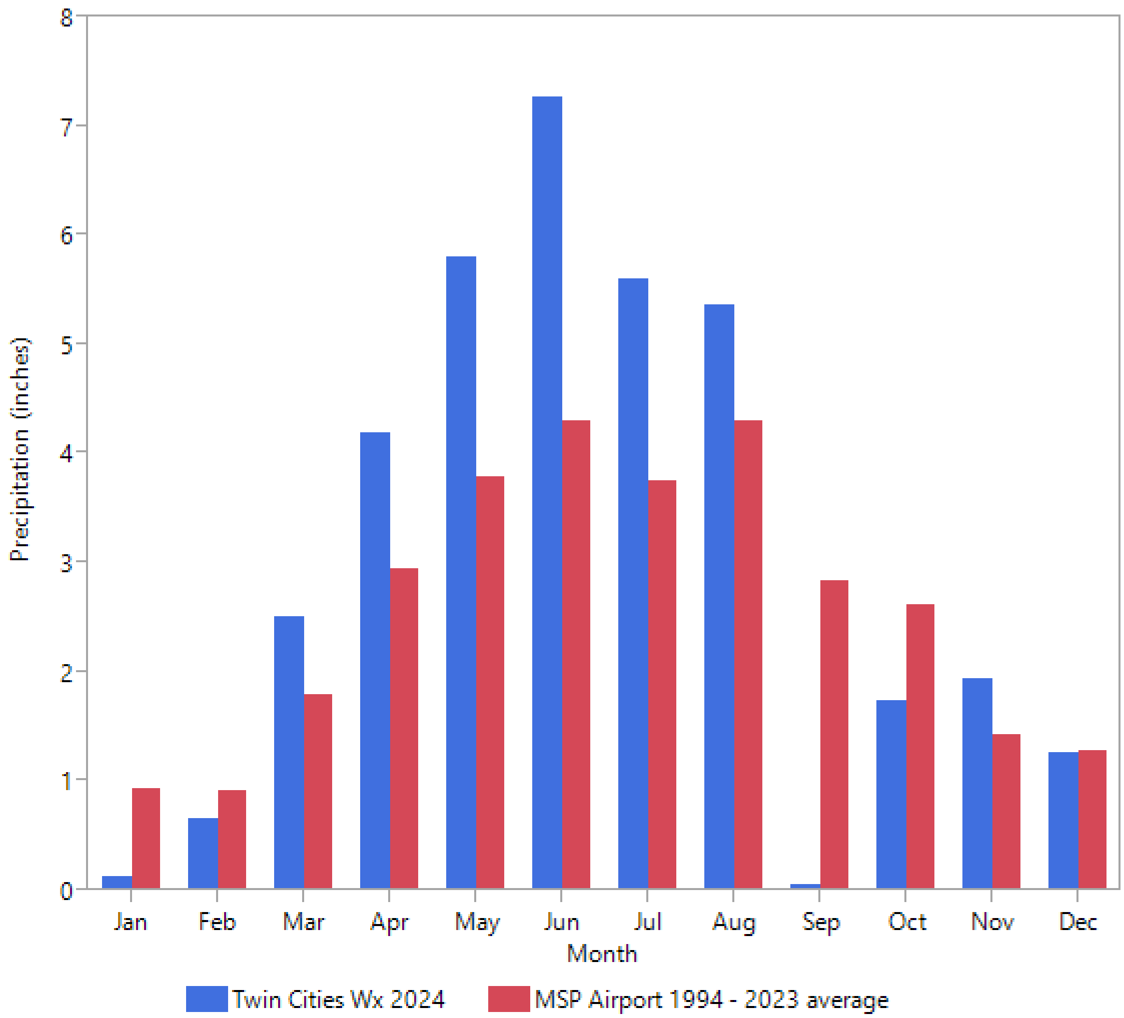


Figure 1. Monthly rainfall (blue) and 30-year (1994-2023) monthly average precipitation at Minneapolis/St. Paul weather station, data courtesy of the MNDNR.

2024 was marked by extreme weather events, with a combination of persistent drought, record-breaking floods, excessive rainfall, and some of the warmest temperatures ever recorded across the state. After experiencing warm, but very dry conditions in the late winter and very early spring months, wetter conditions and warmer temperatures arrived and continued into June.

June 2024 was the fourth-wettest June and the fifth-wettest of any month on record in Minnesota. After the return of more "normal" hydroclimatic conditions for July and August, a dry spell took hold during September and much of October resulting in the 10th-driest autumn on record.

Since 2006, there have been a mix of years with precipitation above (2007, 2010, 2013, 2014, 2015, 2016, 2017, 2018, 2019) and below (2006, 2008, 2009, 2011, 2012, 2020, 2021, 2022, 2023) the 30-year average, as shown in Figure 2. The 2024 annual precipitation (36.55 inches) was above average (30.9 inches) for the first time since 2019.

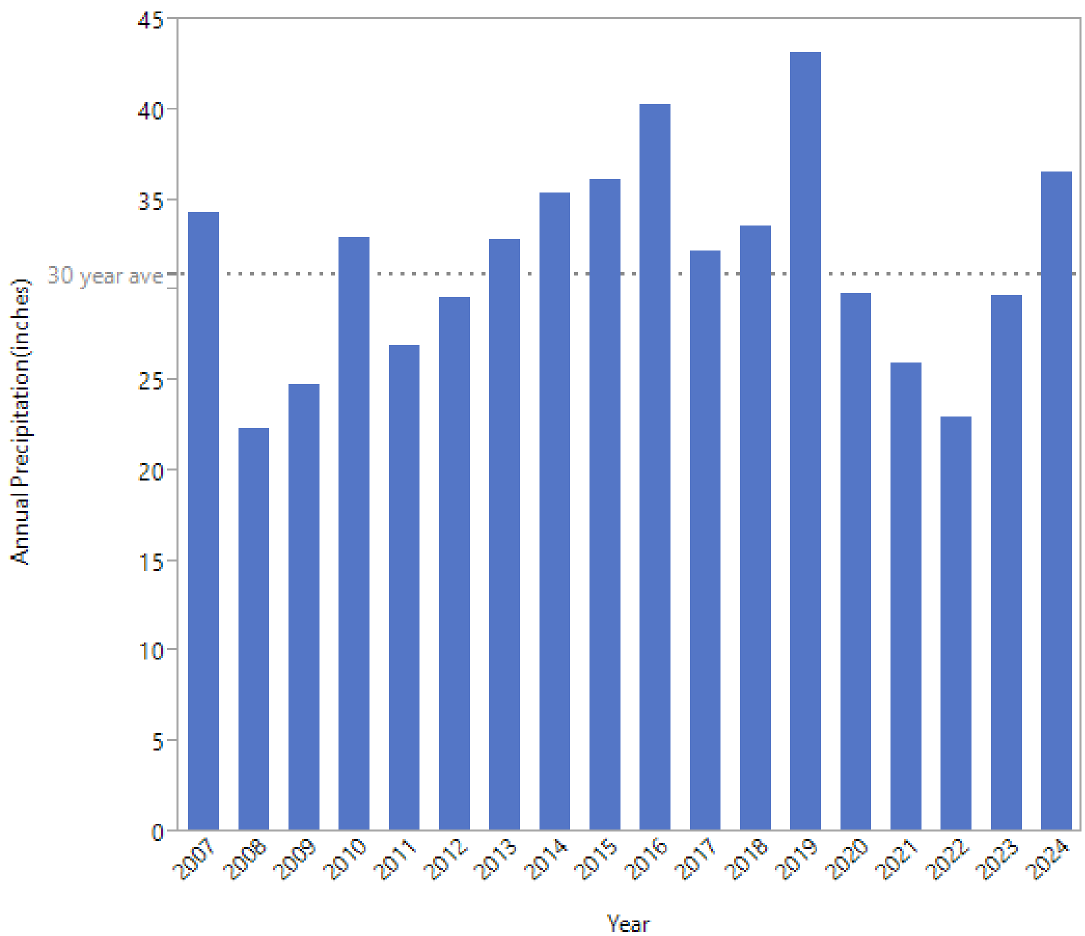


Figure 2. Total rainfall (inches) from 2007-2024 at Minneapolis/St. Paul weather station, data courtesy of the MNDNR. Gray dotted line indicates the 30-year (1994-2023) total annual average precipitation of 30.9 inches.

In the Quarry Island and Fort Snelling fens, well water level does not appear to change in response to precipitation during previous years or in the current one. Water levels in some of the wells are either decreasing or increasing, but there doesn't seem to be a seasonal or annual influence (i.e. did not see elevated levels in 2019-2020 following the high rainfall amount in 2019).

Historically, the Nichols wells appeared to be heavily influenced by precipitation. According to the "Environmental Monitoring of Nichols Fen" study conducted in 2008 by WSB & Associates, Inc., the Nichols fen has an 18-24 month response time to precipitation. Past monitoring data supported the idea that a year with higher well level measurements was preceded by a year when total precipitation was above average. Alternatively, years with lower well level measurements were preceded by years in which total precipitation was below average.

The impact of rainfall on water levels continues to be less conclusive than in previous years. While consecutive years of drought most likely influenced the decreasing water levels seen from one year to the next at some of the wells, this was not universal. In fact, water levels at some wells appear to be rising or remained stable.

Methods

Fen wells were monitored monthly from March through December 2007 through 2024 (no monitoring in 2014). The monitoring network consists of two wells in the Quarry Island fen, 13 wells in the Fort Snelling fen, and 13 wells in the Nichols fen for a total of 28 wells.

A Solinst Water Level Meter (Model 101) was used to measure the distance from the benchmark at the top of the well casing down to the water surface. Data was later transcribed into mean sea level and reported as elevation, in feet. In cases where the water level was "flowing" or too shallow to measure, the elevation of the pipe casing was used. In cases where the water in the pipe was frozen, no level data was recorded. See figures captions and fen grouping summaries for more description.

Data are reported to the Minnesota Department of Natural Resources and can be retrieved by going to the Cooperative Groundwater Monitoring (CGM) website.

Interpreting Statistical Values

Kendall's tau (T) test is commonly used to evaluate monontonic trends in water quality data as a function of time. Most generally, it is a test for whether well elevations tend to increase or decrease with time. The test determines which wells are significantly trending but does not seek to explain the cause of the trend.

The P-value is used to quantify the statistical significance of the data. It shows the likelihood that the null hypothesis is true, i.e., there is no change in well level over time. A P-value of 0.001 means there is a 0.1% probability that there is no change in well level over time. Since this probability is so small, it indicates that the pattern in the data would be highly unlikely if there was no trend (change in level over time). Thus, we can reject the null hypothesis and be fairly confident that there is a change in well level over time. Generally, a P-value below 0.05 is acceptable.

The Pearson correlation coefficient (R) is used to describe the noisiness and direction of a linear relationship. If the well level is decreasing over time there will be a negative R value close to -1, if the well level is increasing over time there will be a positive R value close to 1. If there is no clear linear trend and points are scattered around the line, the R value will be close to 0.

The coefficient of determination (R^2) is a measure of how well the predicted regression line approximates the observed data points. Data that are closely associated with the line have an R^2 close to 1, while data that are very scattered around the line have an R^2 close to 0. R^2 does not indicate whether the independent variables are a cause of the changes in the dependent variable; and thus, R^2 alone cannot be used to determine if a variable is significantly trending (up or down) or not.

Fen Well Monitoring Results and Discussion

Several statistical parameters were calculated to determine if well levels were significantly increasing or decreasing with time (Table 1). Linear regressions for each dataset are shown in Appendix 3. MNDNR visited the fen wells in September 2016 and recorded new elevations for 21 of the 28 wells. Elevations at seven wells in the Fort Snelling fen did not change as they are installed on more stable ground that does not experience seasonal and annual shifts.

Table 1. Water level trends over time for each fen well. Statistics are included only for those wells in which P-values were statistically significant. No clear trend[1] although the P-value is acceptable, the R and R^2 values do not indicate a strong trend and more data is needed.

	Well	Trend	Kendall's T, P-value	R	R^2
Quarry Island	P1-S	No clear trend			
	P1-D	Decreasing	-0.3851; <0.0001*	-0.0522	0
Fort Snelling	N3	Increasing	0.4514; <0.0001*	0.5853	0.338
	N4	Increasing	0.4932; <0.0001*	0.6568	0.418
	N5	Increasing	0.4776; <0.0001*	0.6349	0.398
	W1	Increasing	0.3718; <0.0001*	0.4147	0.167
	W2	Increasing	0.4105; <0.0001*	0.4527	0.203
	W3	Increasing	0.3845; <0.0001*	0.5173	0.262
	W4	No clear trend			
	S1-USGS	Increasing	0.5790; <0.0001*	0.8647	0.36
	S1	Decreasing	-0.4113; <0.0001*	-0.7708	0.23
	S2-USGS	No clear trend			
	S2	No clear trend[1]	0.1833; .0311*	0.6855	0.15
	S3-USGS	No clear trend			
	S3	No clear trend			
Nichols	1LN	No clear trend			
	1LS	No clear trend			
	F3	No clear trend			
	F4	No clear trend			
	WN1-USGS	No clear trend			
	WN5-USGS	No clear trend			
	WT-1	Decreasing	-0.3052; 0.0002*	-0.7035	0.16
	WT-2	No clear trend			
	WT-3	Decreasing	-0.4349; <0.0001*	-0.8251	0.34
	WT-4	Increasing	0.3411; <0.0001*	0.8153	0.27
	WT-5	No clear trend			
	F1	No clear trend			
	F2	No clear trend			

Quarry Island

The Quarry Island Fen had originally been part of the larger Snelling Fen complex and was cut off during the construction of Highway 494 and watershed development. There may be little potential for restoration in the fen as the watershed is largely developed already.

The shallower well (P1-S) monitors water level in the peat layer while the deeper well (P1-D) monitors the layer immediately below the peat. MNDNR visited the fen wells in September 2016 and recorded a new elevation for both wells. Beginning in October 2016, water levels have been adjusted to reflect the new elevations (demarcated by red line).

Water levels in the Quarry Island Fen continues to decrease over time with a high level of variability at P1-S in recent years. At P1-D, individual monitoring events have a statistically significant downward trend and historically show annual seasonality with measurements collected in the early fall having the lowest level measurements (Figure 3). Potential explanations for the 2024 variability are unknown at this time. Recent data shows less variability in water level than in previous years at P1-S. Continued monitoring is necessary to understand the annual and seasonal dynamics of this well.

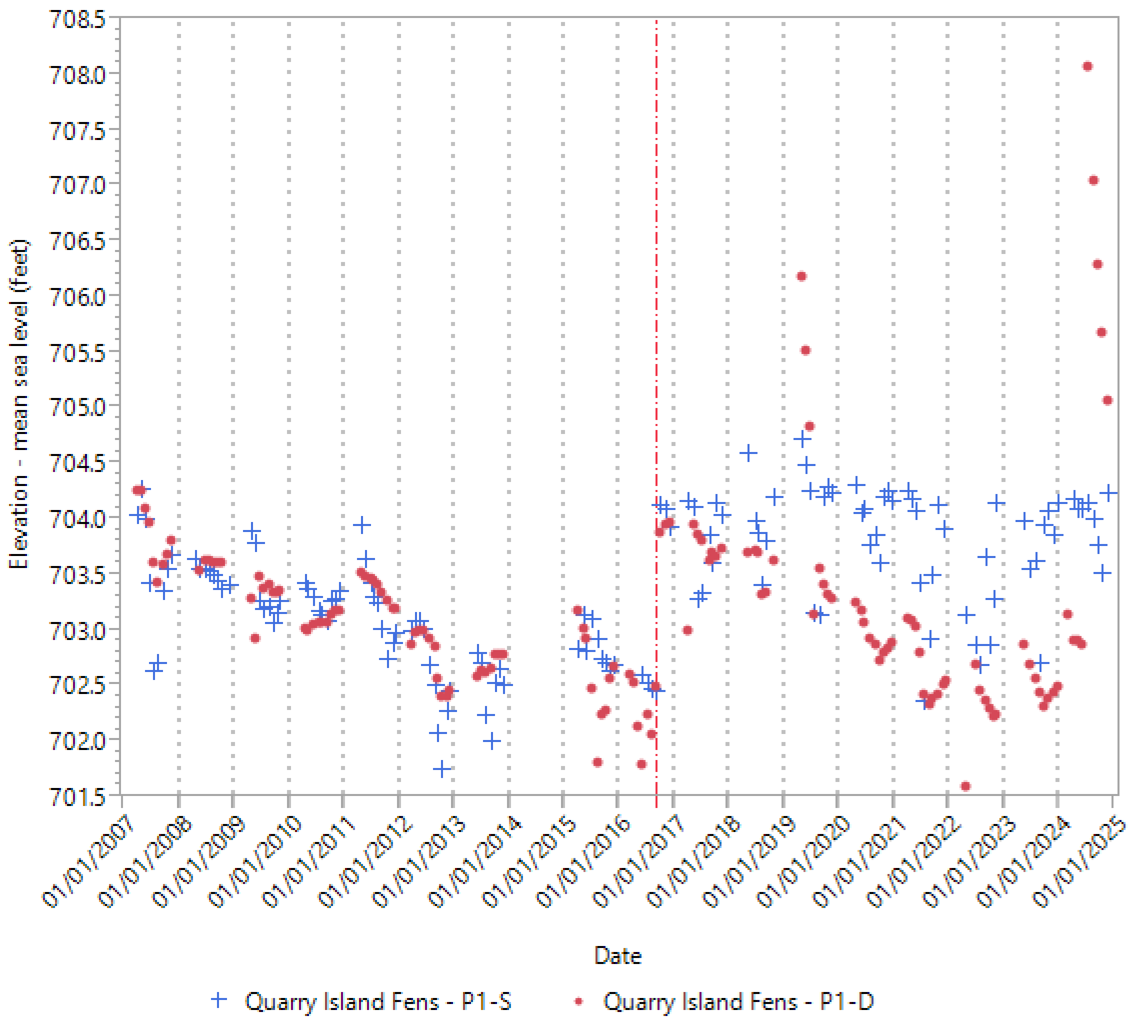


Figure 3. Water level elevation for Quarry Island Fen wells.

Fort Snelling

The Fort Snelling fen is of good quality and seems to be quite stable, if not increasing in water level (Figure 4). MNDNR visited the fen wells in September 2016 and recorded a new elevation for the S# and S#-USGS wells. Beginning in October 2016, there is a visible shift in the water levels of the walls to reflect the new elevations (demarcated by red line). Until 2016, S1-USGS was trending downward in water level; now has a significant upward trend and S1 is significantly decreasing. Water level readings at S2 are consistent but show no clear trend. Many of the other sites show increasing water levels over time with increased variability during the season. N3, N4, and N5 show seasonal changes in water levels with an overall increasing trend. W1, W2, and W3 also have significantly increasing trends.

Continued monitoring of the Fort Snelling fen will strengthen trend analyses and allow for any degradation to be more quickly recognized and addressed.

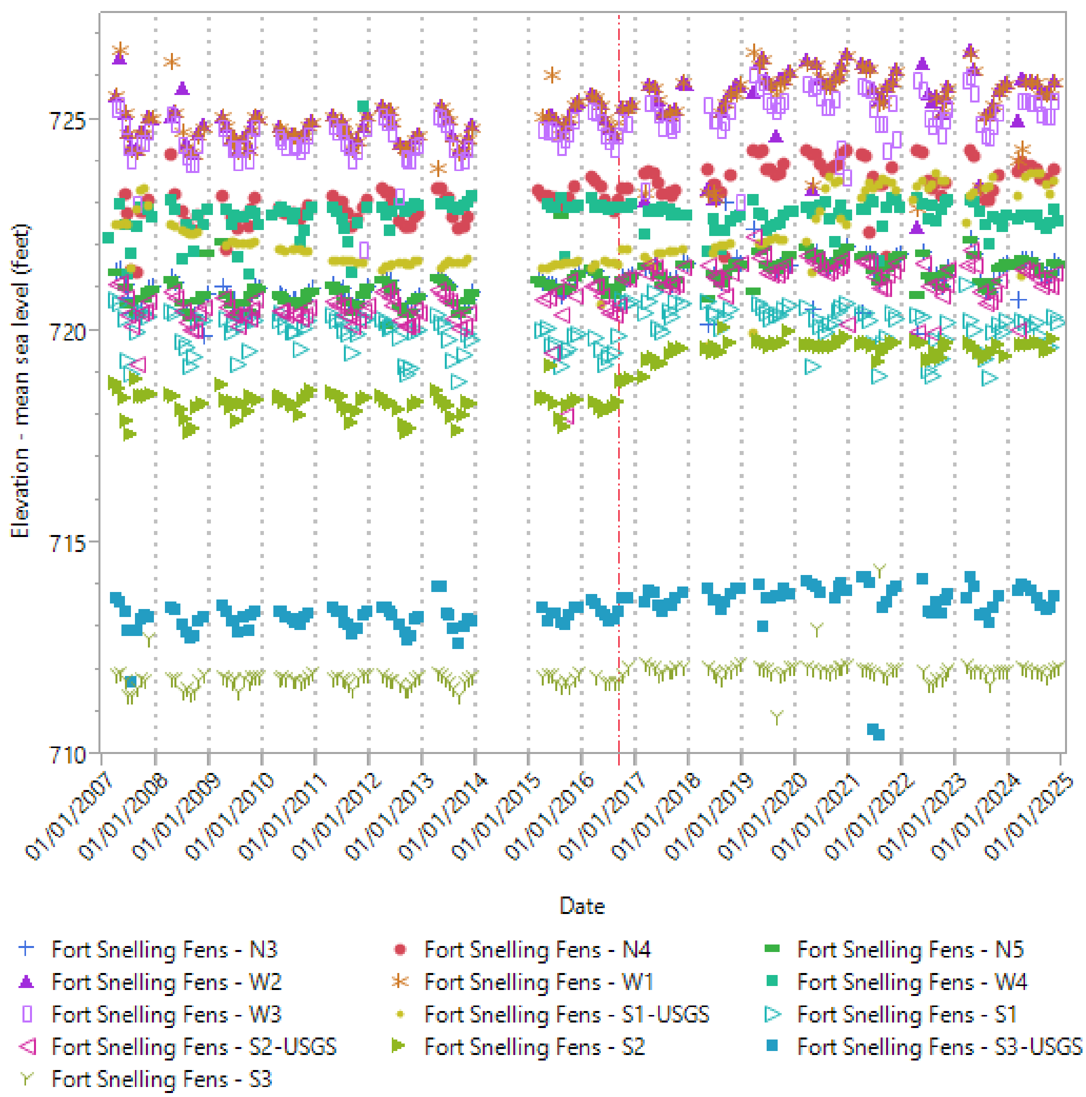


Figure 4. Water level elevation for the Fort Snelling fen wells. At well S3-USGS, when the water was overflowing, the elevation of the top of the pipe (Historical - 713.97 and 2016 – 714.18) was recorded. See individual well graphs in Appendix 3.

Nichols

Figures 5-7 summarize the results of the SWCD's fen well level measurements from 2007 through 2024 (no data were collected in 2014). Data are presented across several figures for clarity and grouping is based on proximity, not hydrologic characteristics. MNDNR visited the fen wells in September 2016 and recorded a new elevation for the wells. Beginning in October 2016, water levels have been adjusted to reflect the new elevations (demarcated by red line).

Historically, several of the wells showed increasing trends. Unfortunately, since the elevation change, two of the wells (WT-1 and WT-3) are showing a water level trend – decreasing – while wells WT-4 showed a significant increasing trend. In 2023, Metropolitan Council installed continuous data loggers in several of the wells in the Nichols Fen due to the fen's proximity to the Seneca Wastewater Treatment Plant. All wells continued to be monitored by the SWCD except for F3 as the logger set up blocked access at the top of the well.

Many of the wells in this fen show some amount of seasonality throughout the monitoring season with the lowest level measurements recorded in the late summer and higher levels recorded in early spring and summer. With the change in known well elevations in this fen, continued monitoring is necessary to improve confidence in the historical trends and determine if there is long-term drawdown of the water table due to watershed impacts or if the groundwater levels in the Nichols fen are recovering and stabilizing.

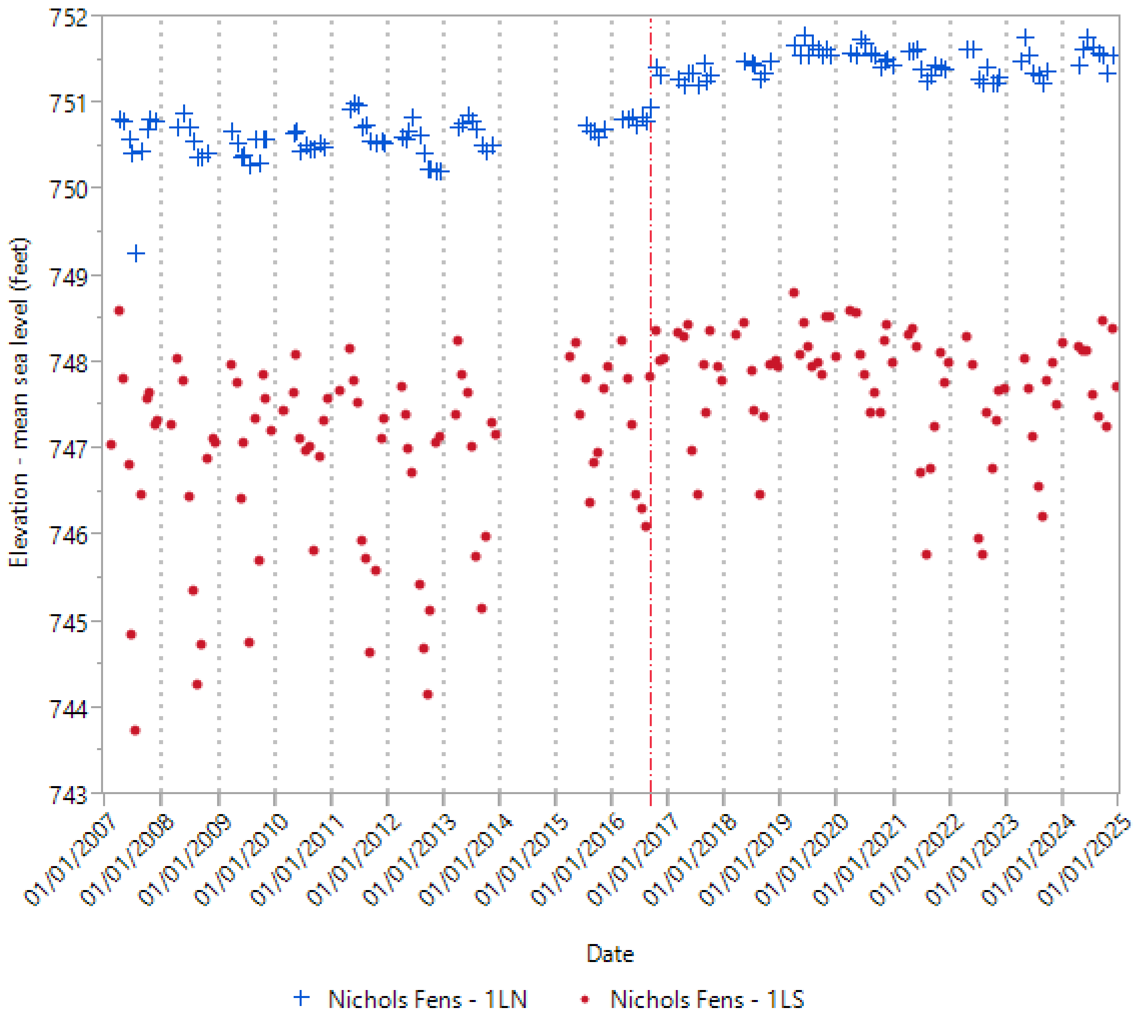


Figure 5. Water level elevation for the Nichols Fen wells (set 1 of 3).

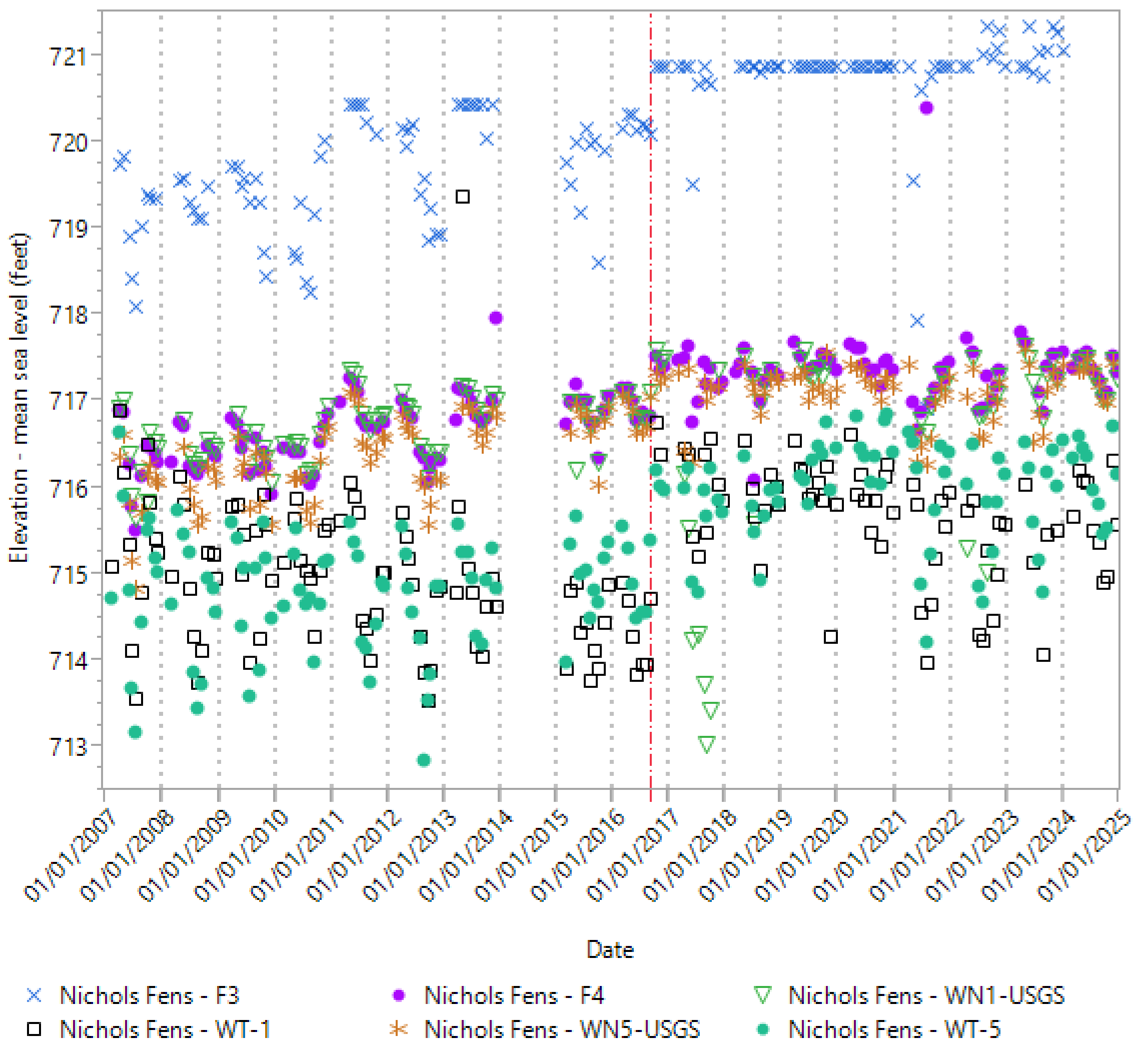


Figure 6. Water level elevation for the Nichols Fen wells (set 2 of 3). At well F3 and WT-1, the water was often overflowing and the elevation of the top of the pipe (F3: Historical - 720.43 and 2016 – 720.88; WT-1: Historical - 719.37 and 721.25) was recorded. See individual well graphs in Appendix 3.

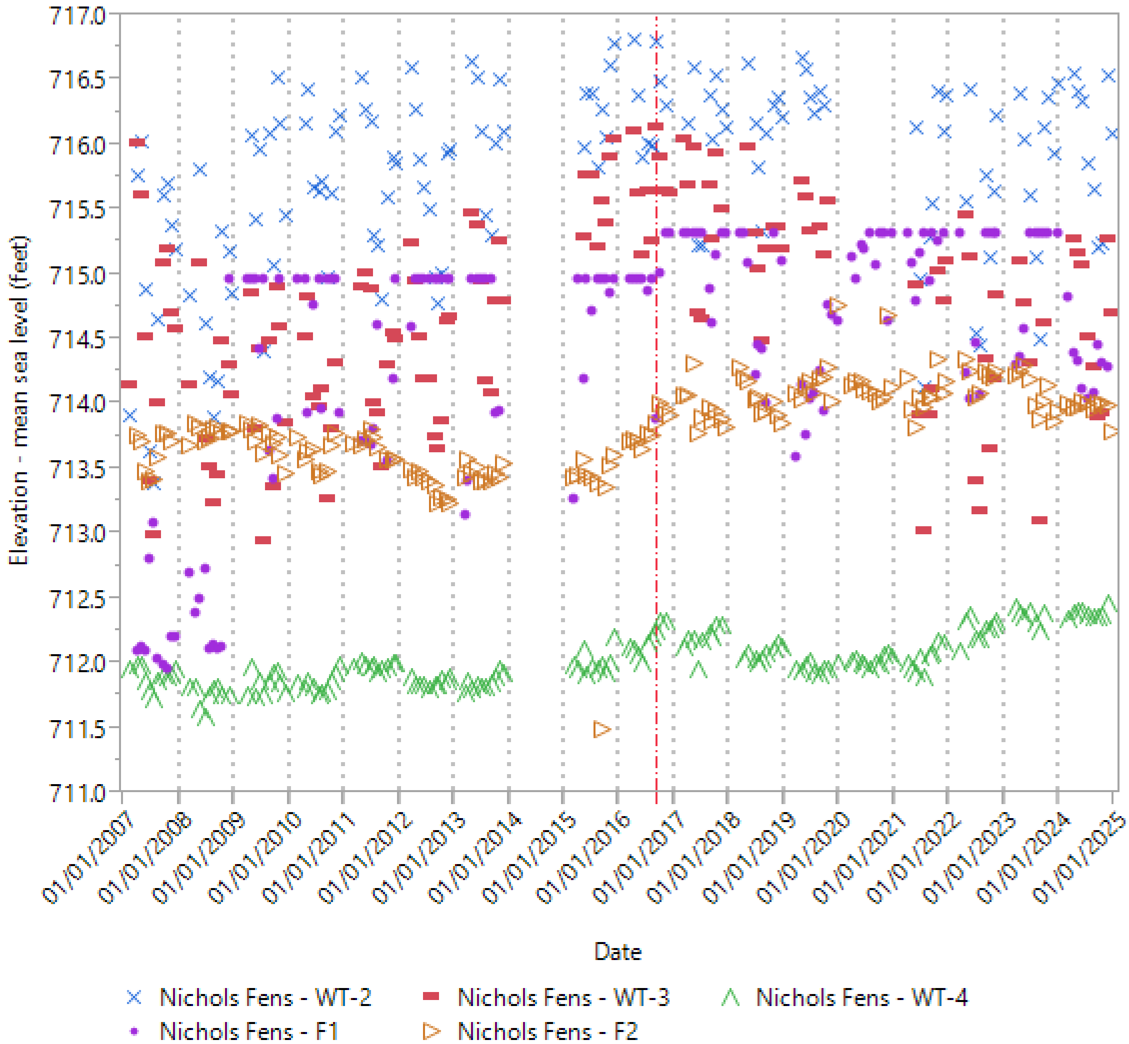


Figure 7. Water level elevation for the Nichols Fen wells (set 3 of 3). At well F1, the water was often overflowing and the elevation of the top of the pipe (Historical - 714.97 and 2016 – 715.32) was recorded. See individual well graphs in Appendix 3.

Conclusion

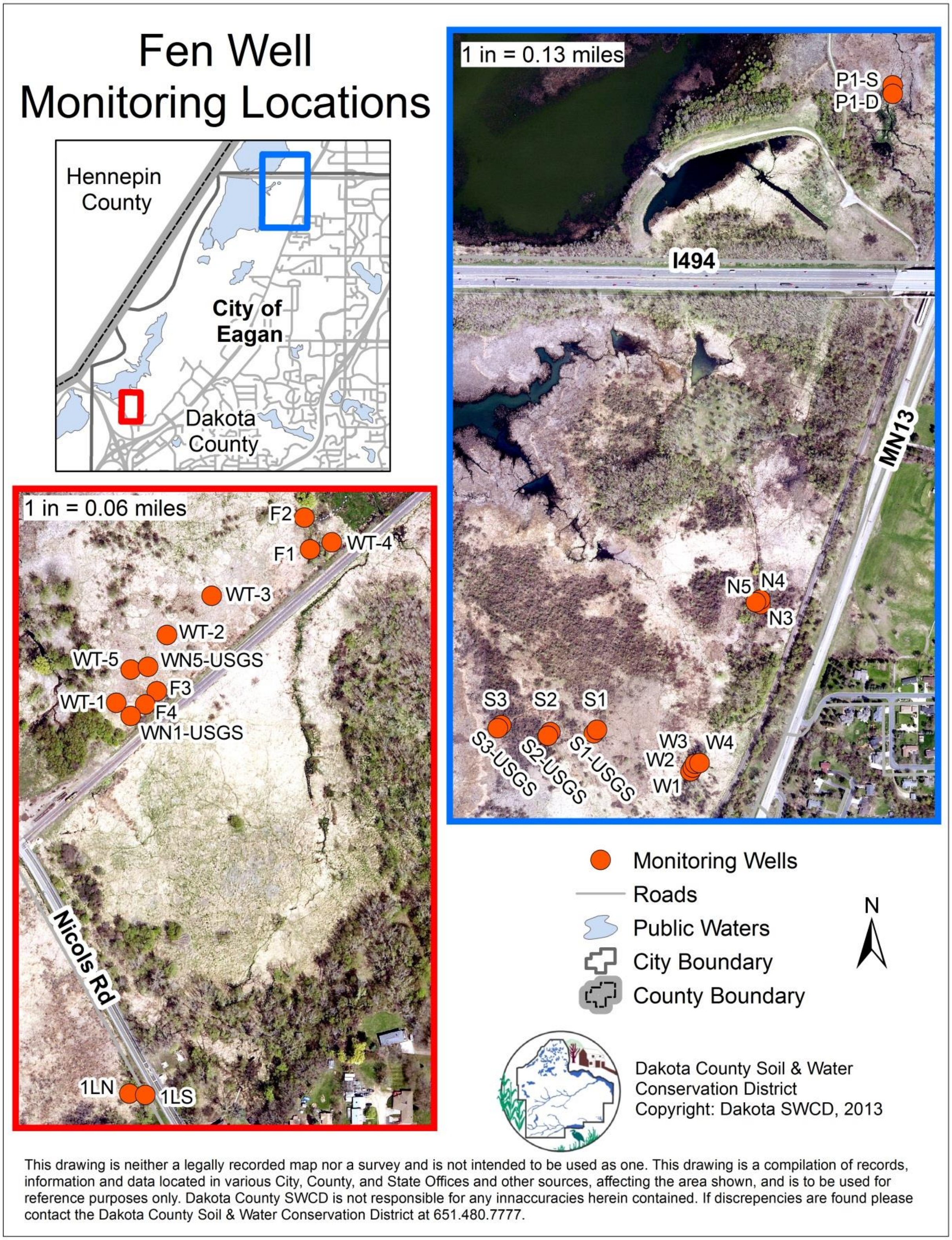
Due to the resurveying of well elevations in the fall of 2016, determining trends in groundwater levels is difficult as the data record is now only eight years for most of the wells in the three fens along the Minnesota River. The data record at the seven wells that were not resurveyed in 2016 was maintained through the 2024 monitoring season. Six of those wells (N3, N4, N5, W1, W2, and W3) show an increasing trend in groundwater level. Continued monitoring is recommended to increase the dataset and strengthen the trend data.

Six of the wells surveyed in 2016 show a significant water level trend (S1-USGS and WT-4 – increasing; P1-D, S1, WT-1, and WT-3 - decreasing). Continued monitoring in the fens is recommended as more data is needed to reestablish trends for all wells post 2016 survey.

When evaluating groundwater levels in a fen, it is important to consider that seasonal changes in temperature, precipitation, flow, etc., can influence fen well water levels, especially over short periods of time. Minnesota has experienced significant drought conditions each year since 2021 as persistent moisture deficits combined with above-normal temperatures across the state. For some of the fen wells, water levels fluctuate seasonally, as well as annually, based on current and past weather patterns. At one time, above average precipitation years seemed to be followed by higher well level measurements during subsequent years (as well as the opposite case of low rainfall amounts leading to low water level readings). Recent data shows much more variability, though trends are becoming established.

Longer datasets are needed to confirm the overall state of each fen. Historical monitoring showed each fen in a varied state of degradation or recovery, but due to low rainfall amounts in recent years, water level data is showing increased variability. More information will help to ascertain the true state of each fen and allow for proper management decisions to be made and acted upon.

Appendix 1: Map of Fen Well Monitoring Locations



Appendix 2: Well Metadata

Approximate depth, coordinates, and mean sea-level elevation for each well (data courtesy of Minnesota Department of Natural Resources). Elevations at W1, W2, W3, W4, N3, N4, and N5 did not change in 2016, so no values are recorded.

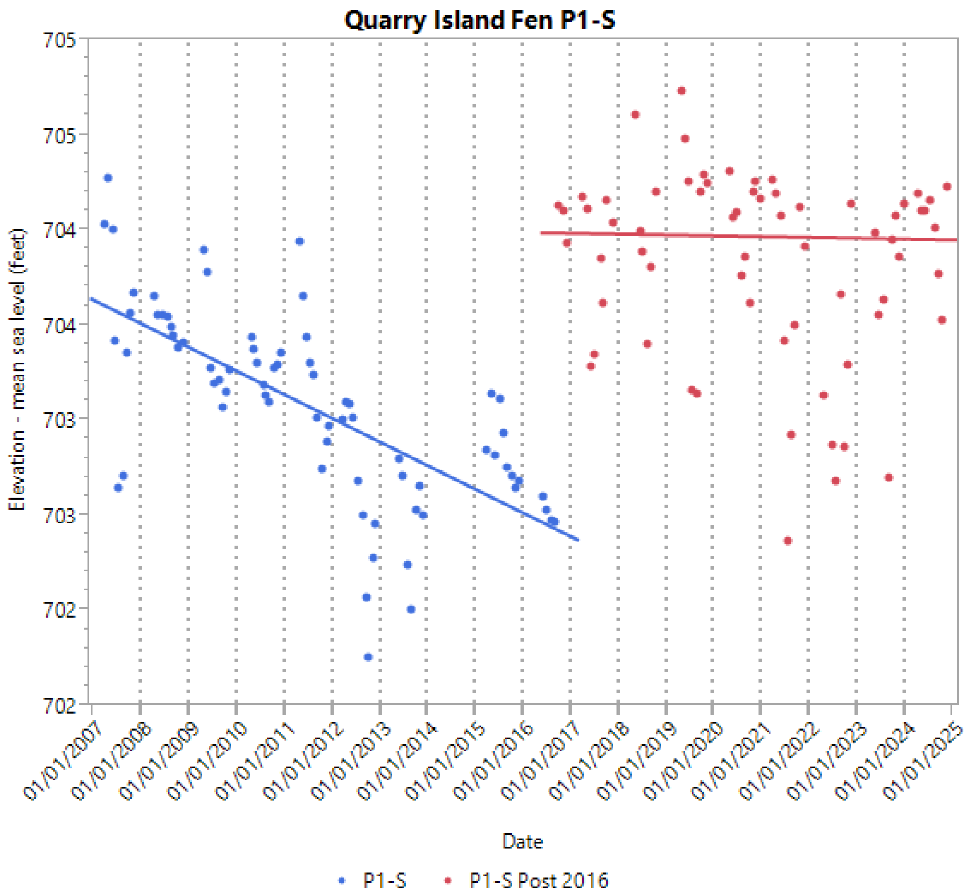
Well	Approximate depth (feet)	Northing (UTM)	Easting (UTM)	Elevation (feet)	2016 Elevation (feet)
P1-S	4	243025.4	535925.6	707.29	708.56
P1-D	8	243024.2	535925	706.98	708.67
N3	45.21	240030.6	535345.7	723.87	
N4	75.34	240030.5	535349.3	724.27	
N5	21.69	240035.5	535347.4	724.06	
W1	77.00	239330.3	535121.9	728.45	
W2	50.12	239325.1	535119.2	728.47	
W3	21.83	239330.7	535130.5	726.87	
W4	12.00	239333.3	535130.2	727.6	
S1-USGS	20.67	239503.2	534796.5	723.44	723.83
S1	5.35	239502.7	534796.6	723.83	722.98
S2-USGS	27.00	239519.2	534506.9	722.35	722.77
S2	5.25	239518.1	534507	721.13	721.59
S3-USGS	21.68	239547.5	534222.3	713.97	714.18
S3	21.68	239548.3	534222.9	715.06	715.32
1LN	29	226915.8	525306.8	751.59	751.93
1LS	8	226913.4	525308.8	751.43	751.78
F3	75	228058.8	525367.6	720.43	720.88
F4	21	228055.9	525364.7	720.36	720.65
WN1-USGS	19.82	228054.3	525357.3	719.51	719.92
WN5-USGS	16.08	228125.3	525293.5	717.92	718.13
WT-1	9	228054.7	525356	719.37	721.25
WT-2	9	228222.7	525372.2	719.88	719.55
WT-3	8	228330.4	525514.2	721.27	718.26
WT-4	6	228457.4	525783.2	713.58	713.63
WT-5	7	228126	525293	720.69	721.51
F1	N/A	228466.4	525785	714.96	715.32
F2	15	228454.9	525794.3	714.68	714.77

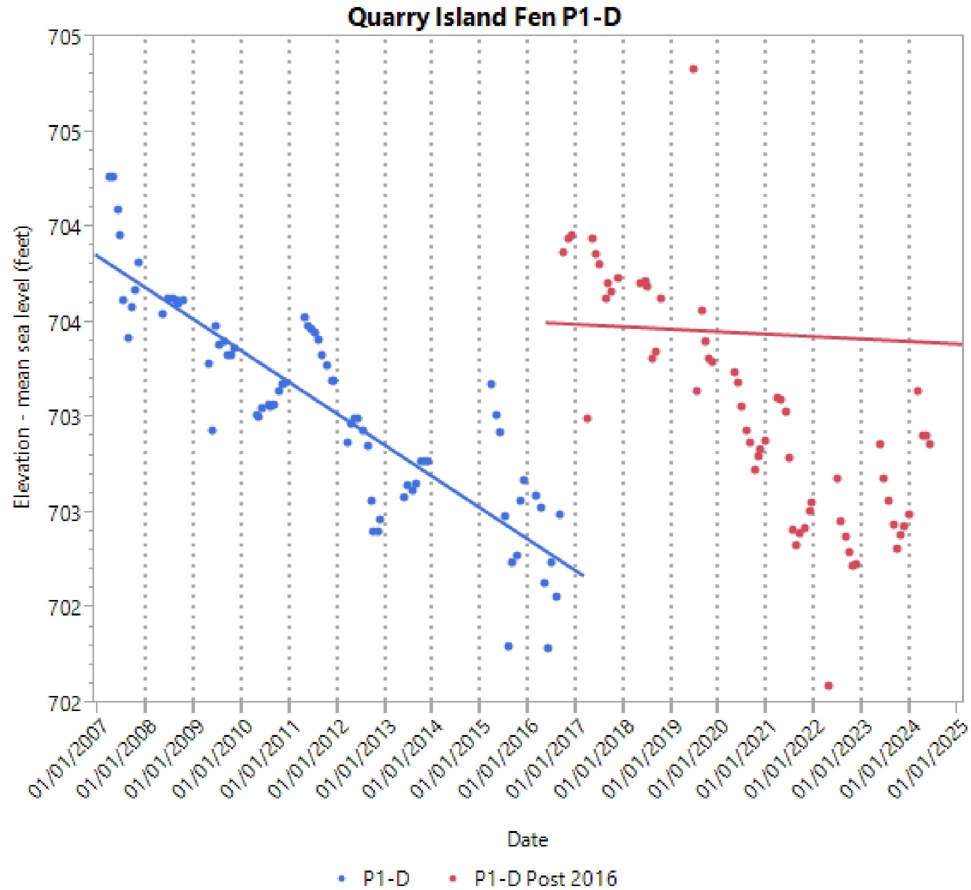
Appendix 3: Linear Regressions for Each Well Dataset

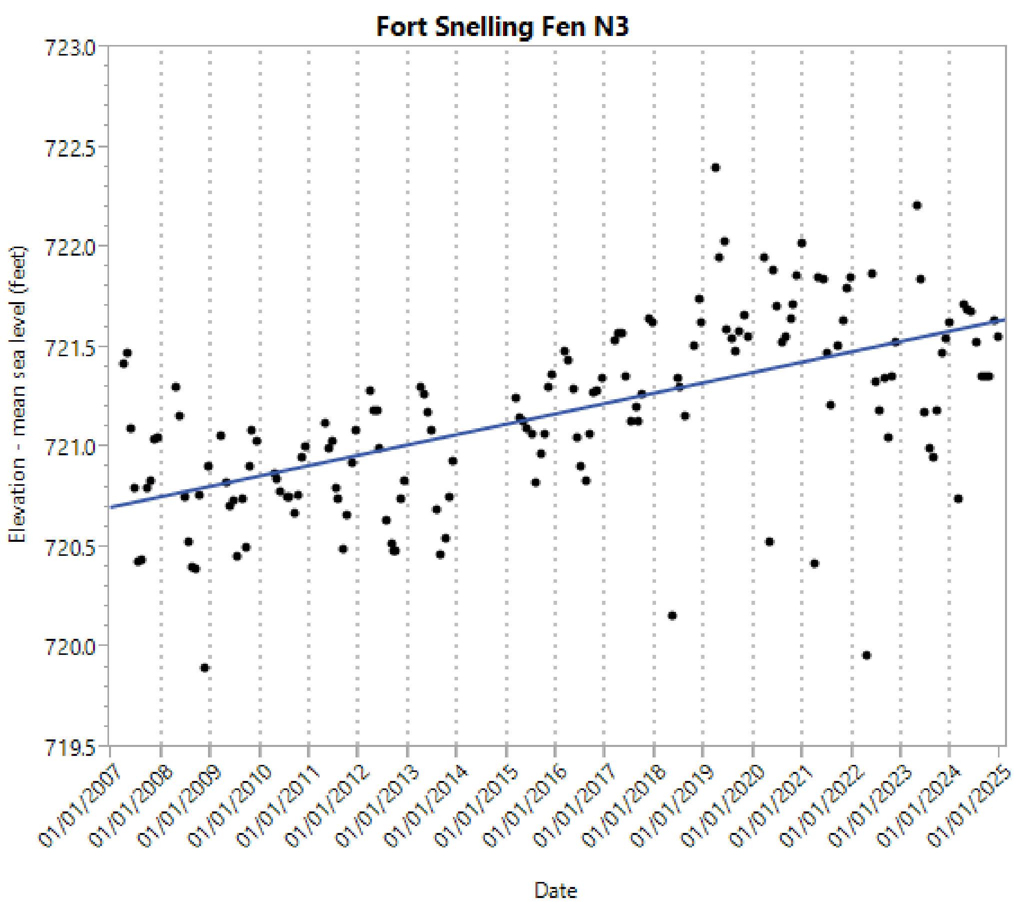
Linear regressions are included for each of the wells. As well elevations were resurveyed in the fall of 2016 for all but seven of the wells, updated linear regressions lines are shown for 2024. More data is needed to further determine trends in these wells.

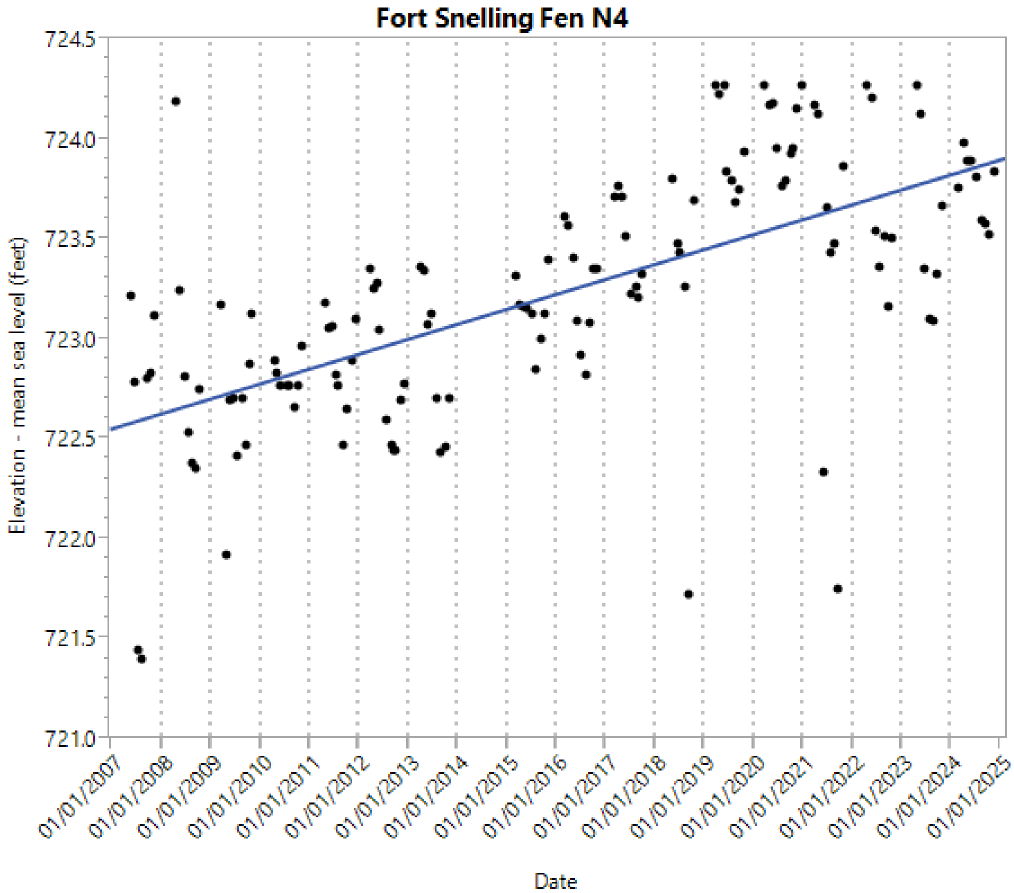
Two of the well nests in Fort Snelling Fen have more stable footing and were not resurveyed as part of the 2016 effort. Elevations at W1, W2, W3, W4, N3, N4, and N5 did not change in 2016, so there is a single linear regression on the graphs. The continuous data record for F3 was not available at the time of this report.

In cases where wells were overflowing, the top of the pipe elevation was recorded and is shown with a black dashed line. When the water in the well was frozen, no water level measurement was recorded.




Quarry Island Fen P1-D
Elevation - mean sea level (feet)
Date
P1-D
P1-D Post 2016


Fort Snelling Fen N3
Elevation - mean sea level (feet)
Date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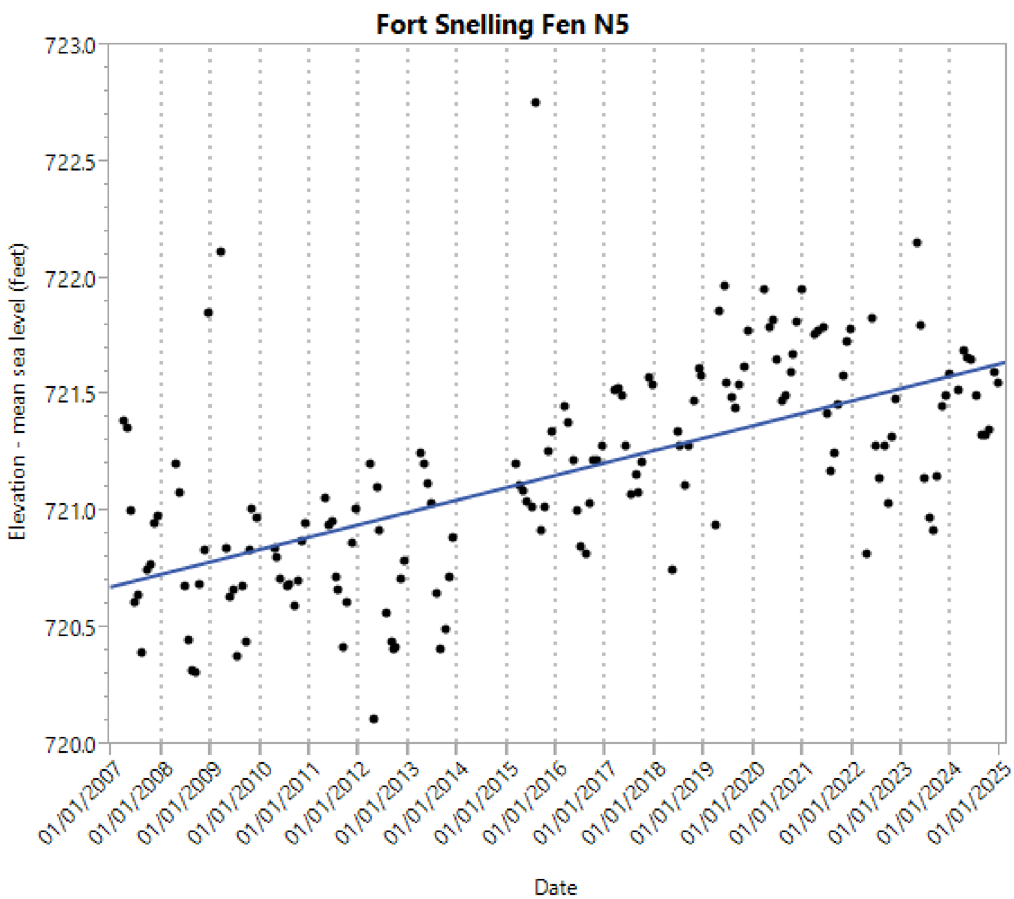
Date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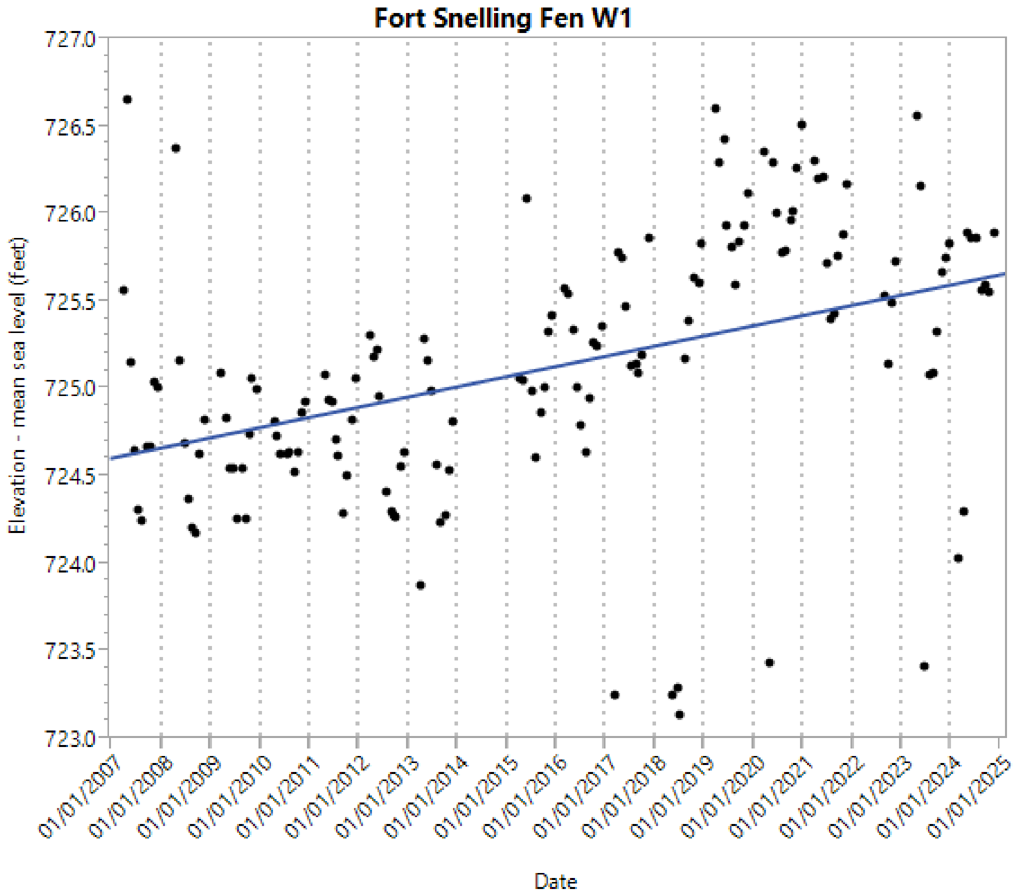
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724.0
723.5
723.0
Elevation - mean sea level (feet)
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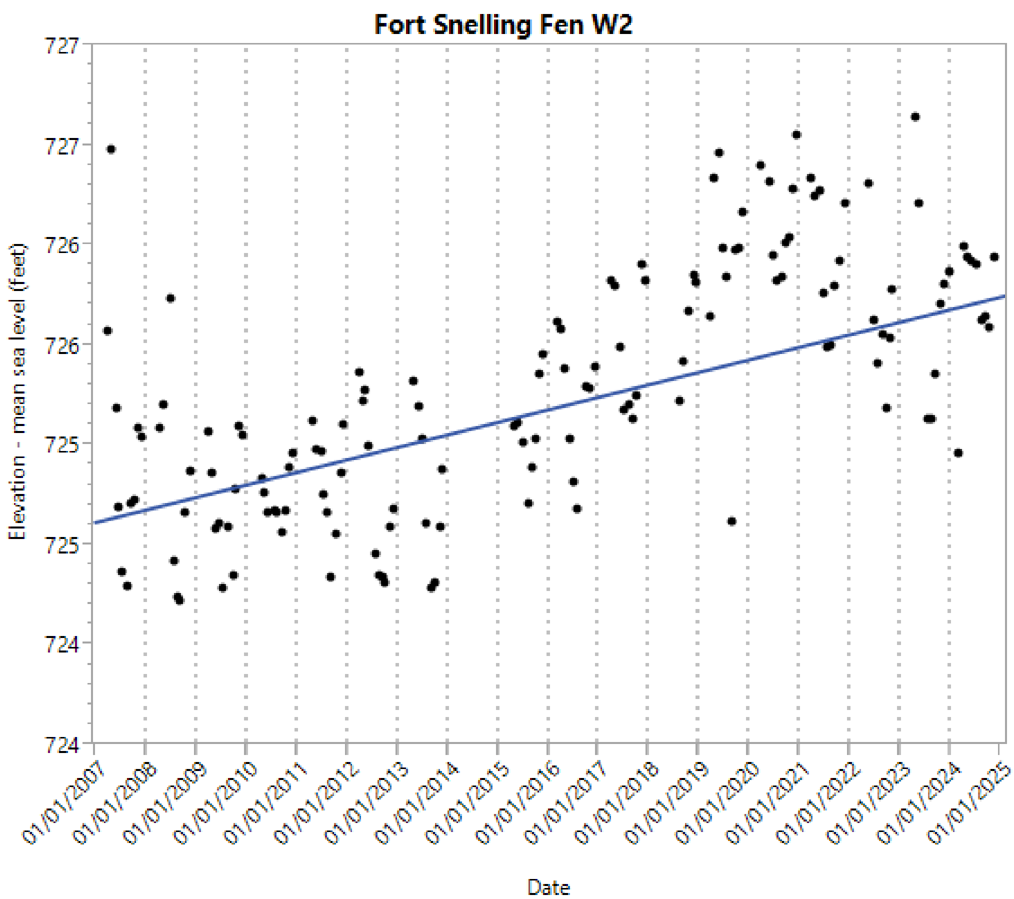
Date


Fort Snelling Fen W2
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727
726
726
725
725
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724
Elevation - mean sea level (feet)
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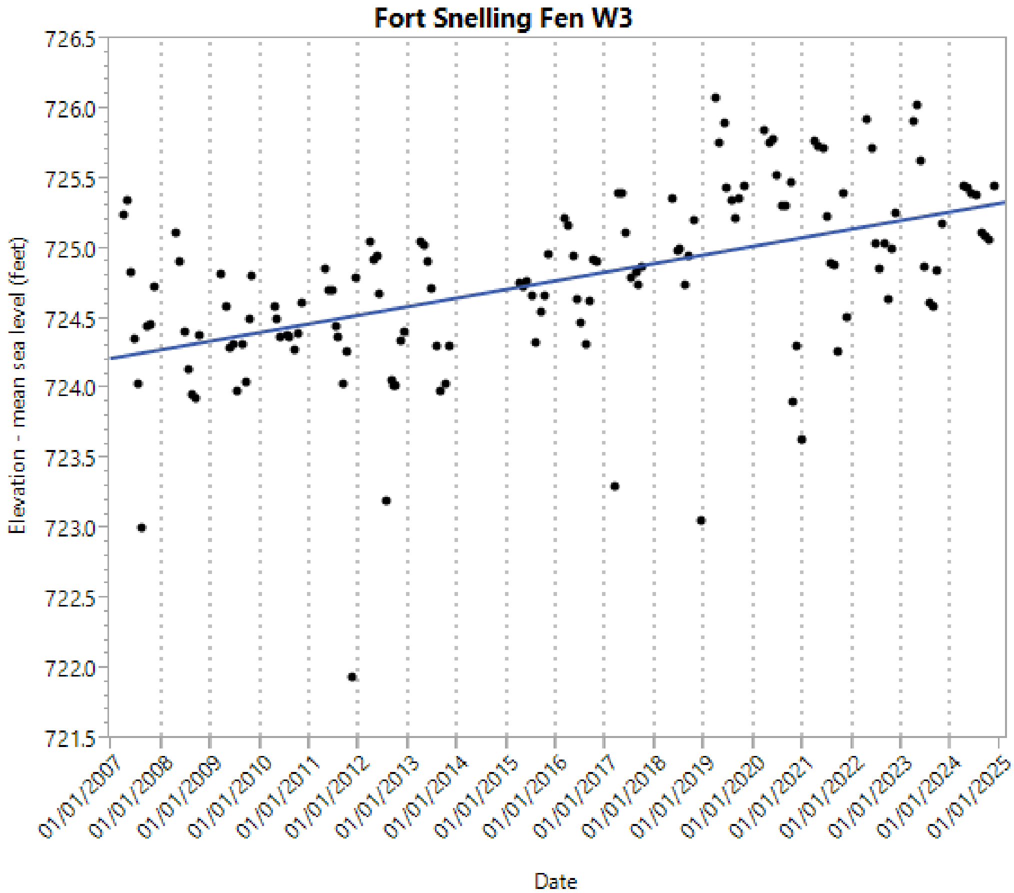
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722.0
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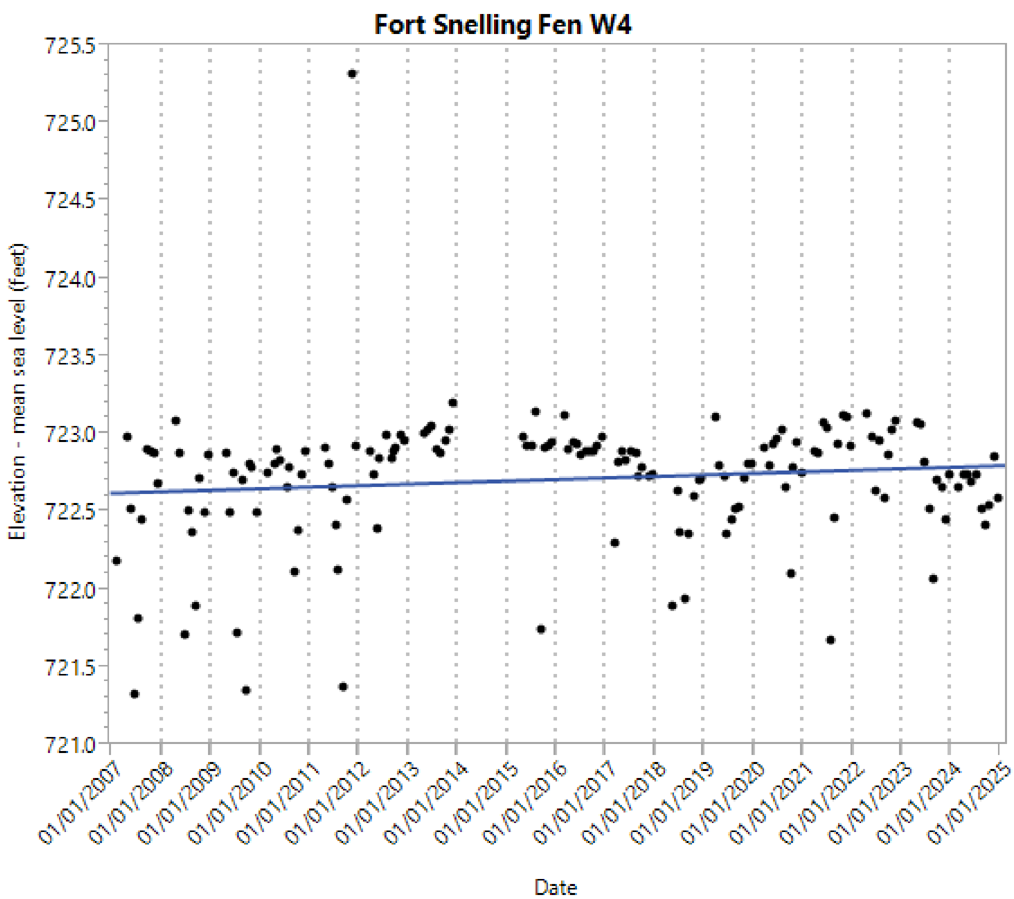
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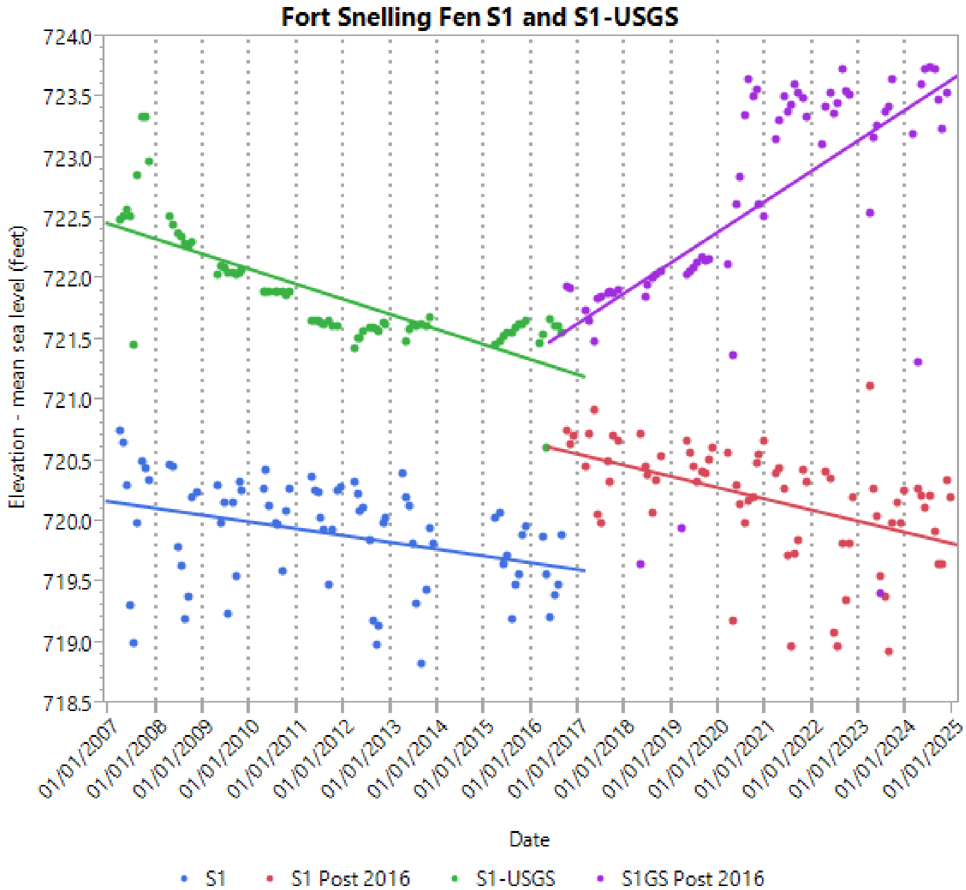
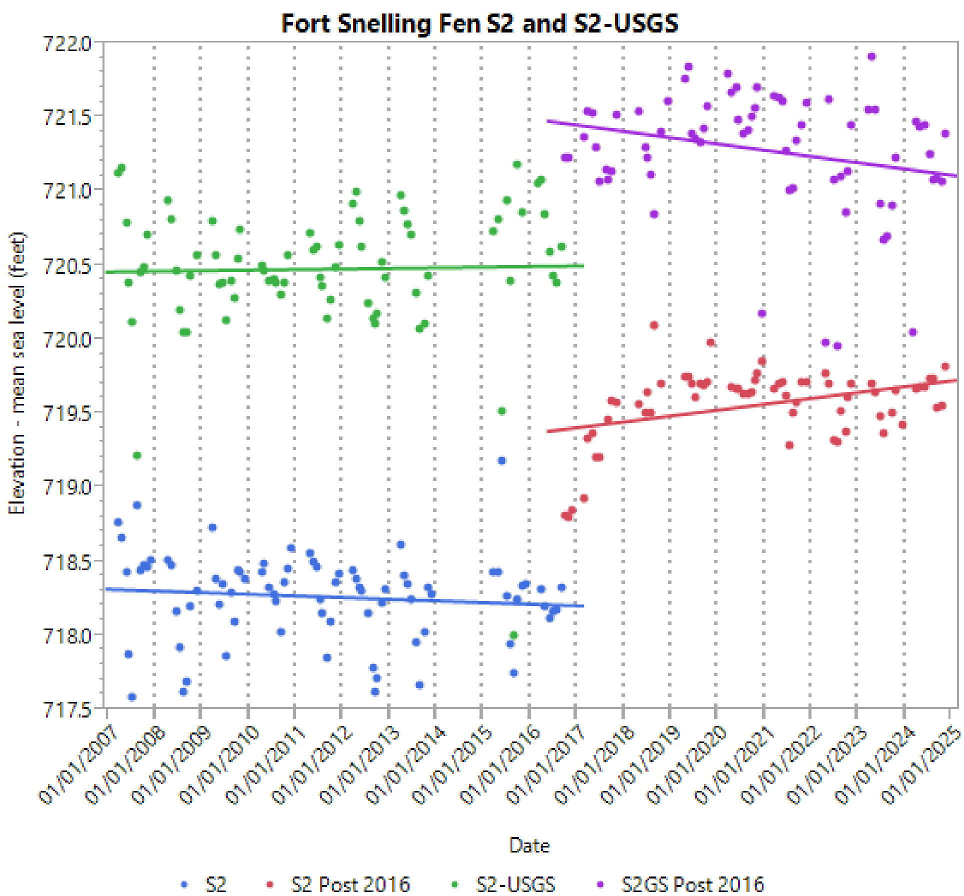
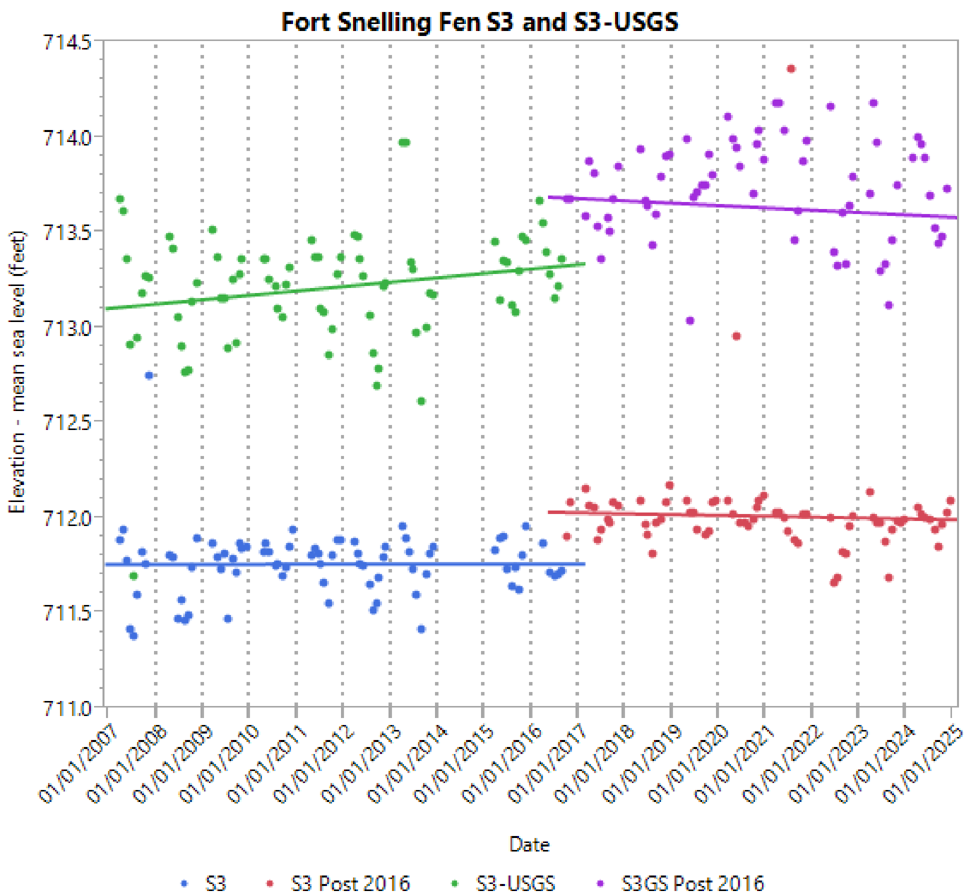
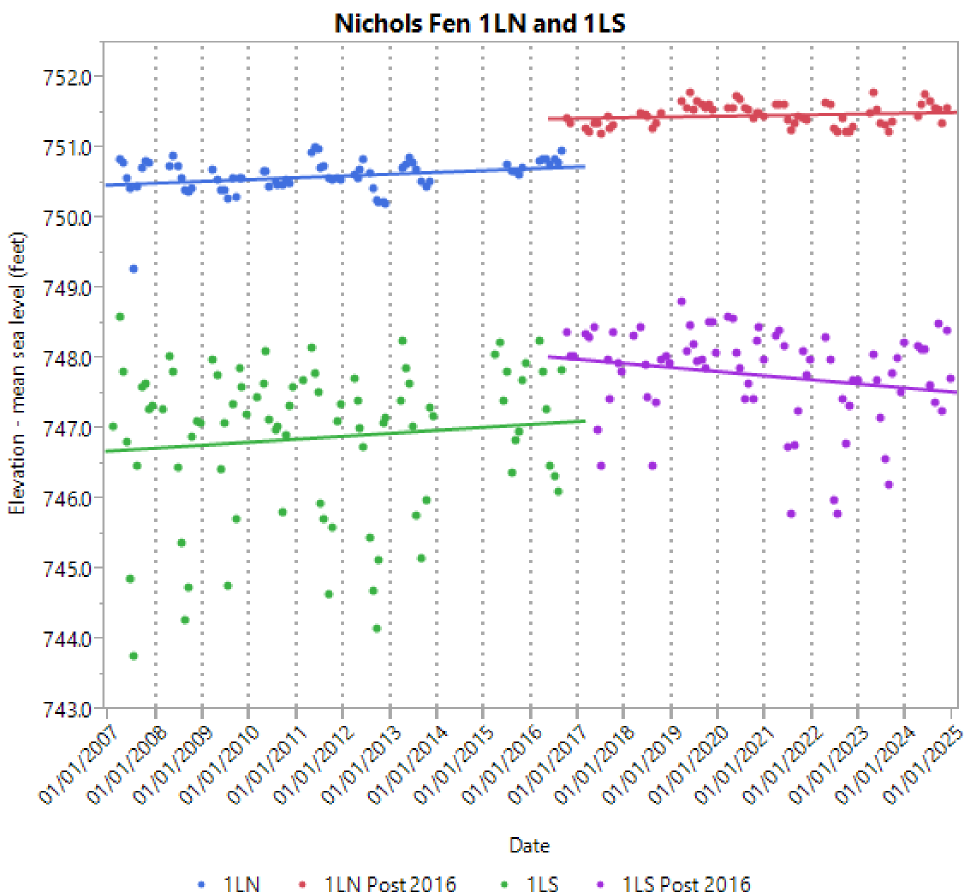
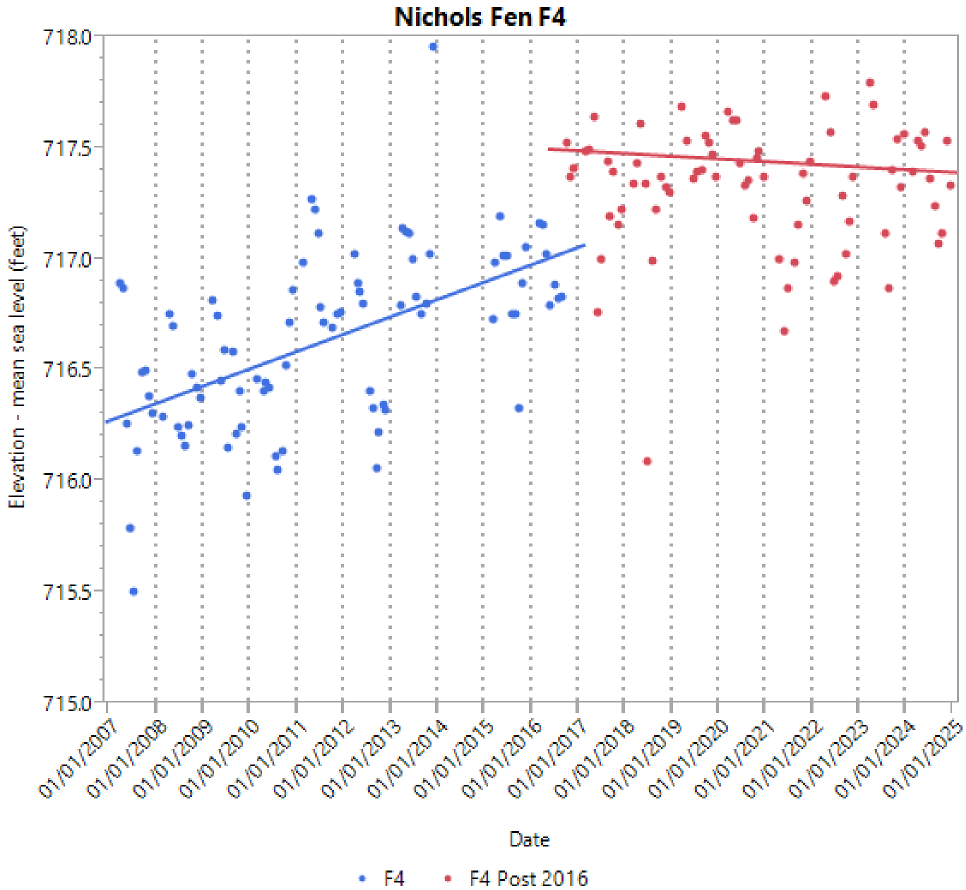
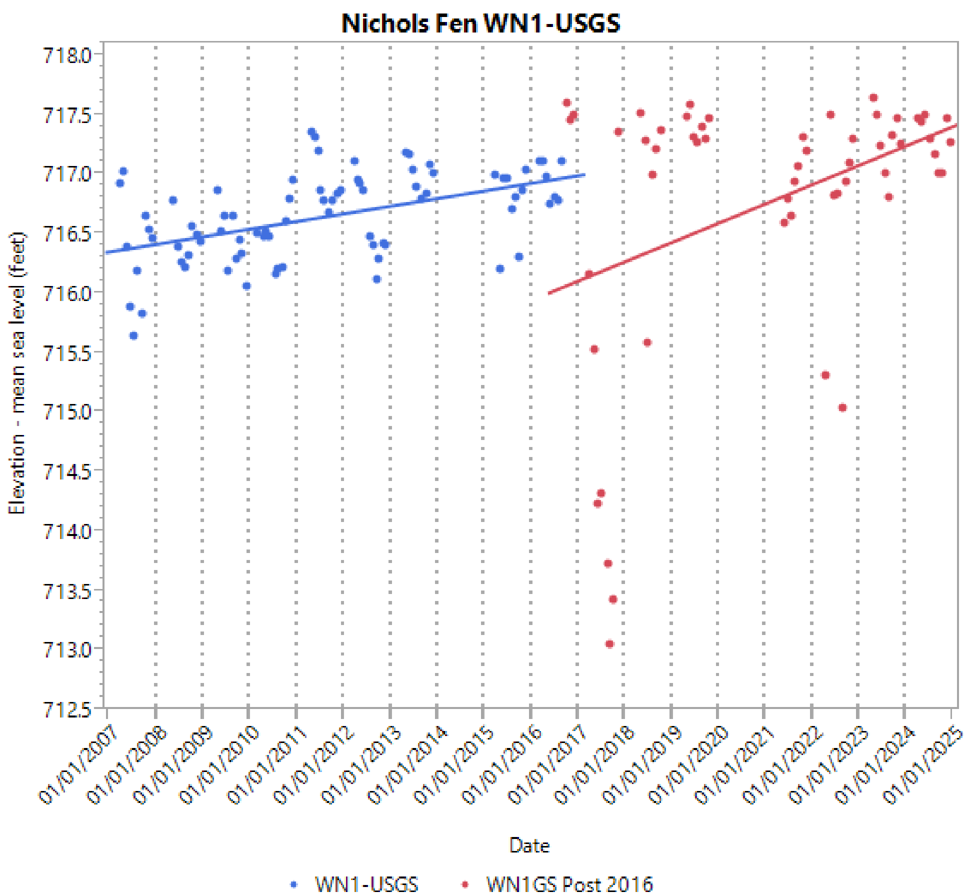

Fort Snelling Fen S1 and S1-USGS
Elevation - mean sea level (feet)
724.0
723.5
723.0
722.5
722.0
721.5
721.0
720.5
720.0
719.5
719.0
718.5
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025
Date
S1
S1 Post 2016
S1-USGS
S1GS Post 2016

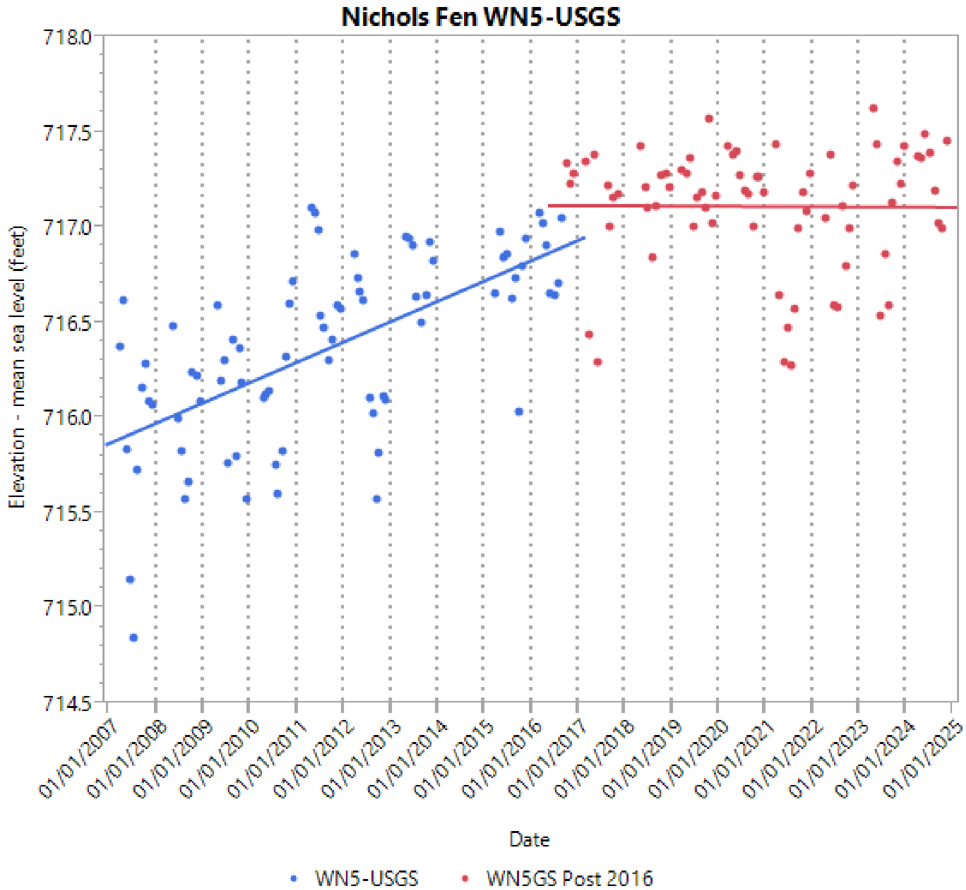

Fort Snelling Fen S2 and S2-USGS
Elevation - mean sea level (feet)
722.0
721.5
721.0
720.5
720.0
719.5
719.0
718.5
718.0
717.5
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025
Date
S2
S2 Post 2016
S2-USGS
S2GS Post 2016

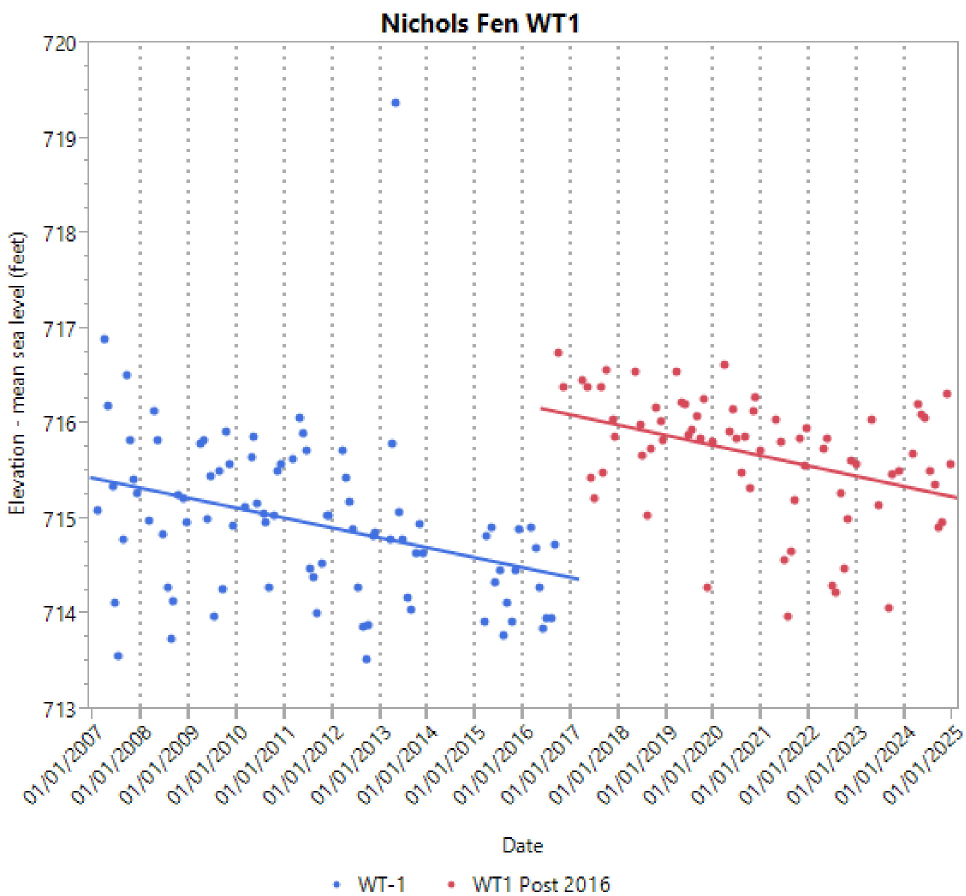

Fort Snelling Fen S3 and S3-USGS
Elevation - mean sea level (feet)
714.5
714.0
713.5
713.0
712.5
712.0
711.5
711.0
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025
Date
S3
S3 Post 2016
S3-USGS
S3GS Post 2016

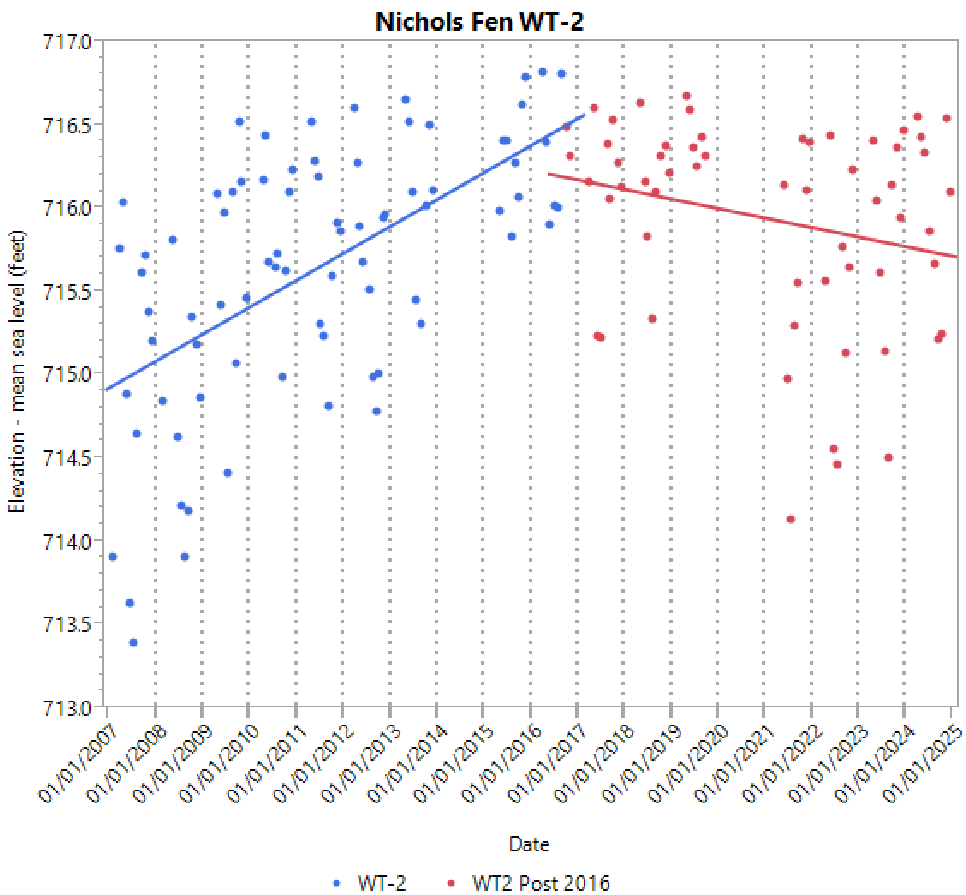

Nichols Fen 1LN and 1LS
Elevation - mean sea level (feet)
752.0
751.0
750.0
749.0
748.0
747.0
746.0
745.0
744.0
743.0
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025
Date
1LN
1LN Post 2016
1LS
1LS Post 2016

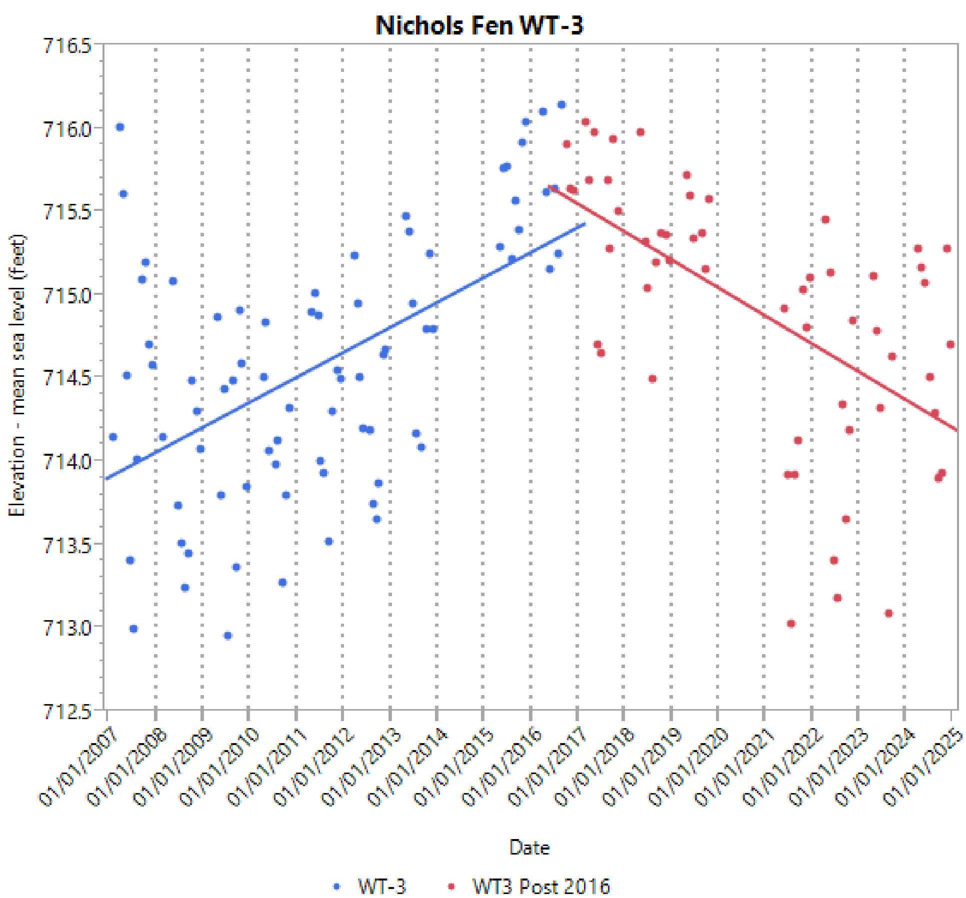

Nichols Fen F4
Elevation - mean sea level (feet)
718.0
717.5
717.0
716.5
716.0
715.5
715.0
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025
Date
F4
F4 Post 2016

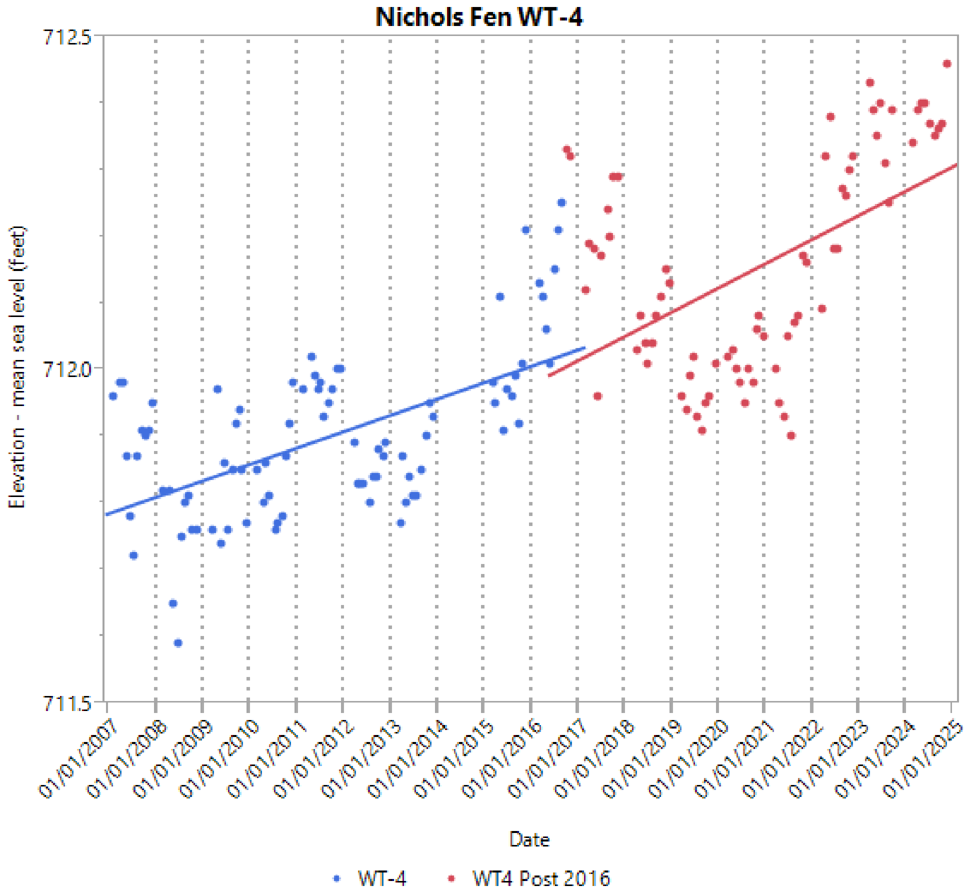

Nichols Fen WN1-USGS
Elevation - mean sea level (feet)
718.0
717.5
717.0
716.5
716.0
715.5
715.0
714.5
714.0
713.5
713.0
712.5
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025
Date
WN1-USGS
WN1GS Post 2016

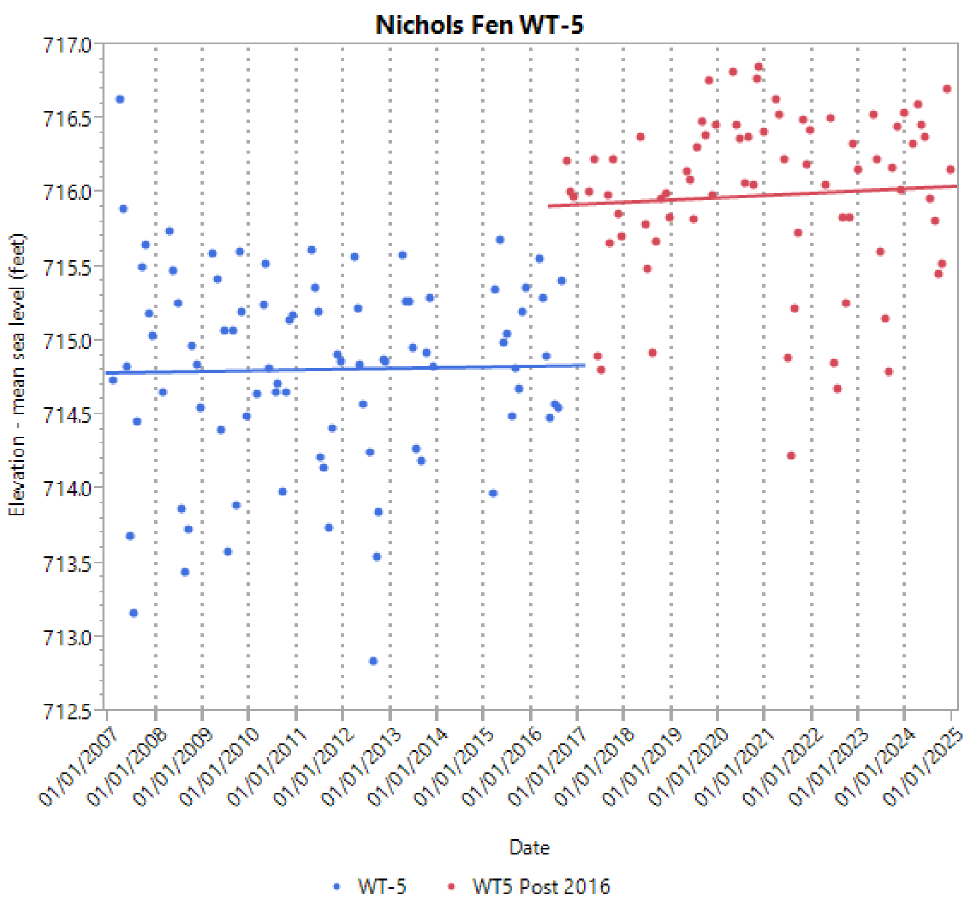

Nichols Fen WN5-USGS
Elevation - mean sea level (feet)
718.0
717.5
717.0
716.5
716.0
715.5
715.0
714.5
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025
Date
WN5-USGS
WN5GS Post 2016

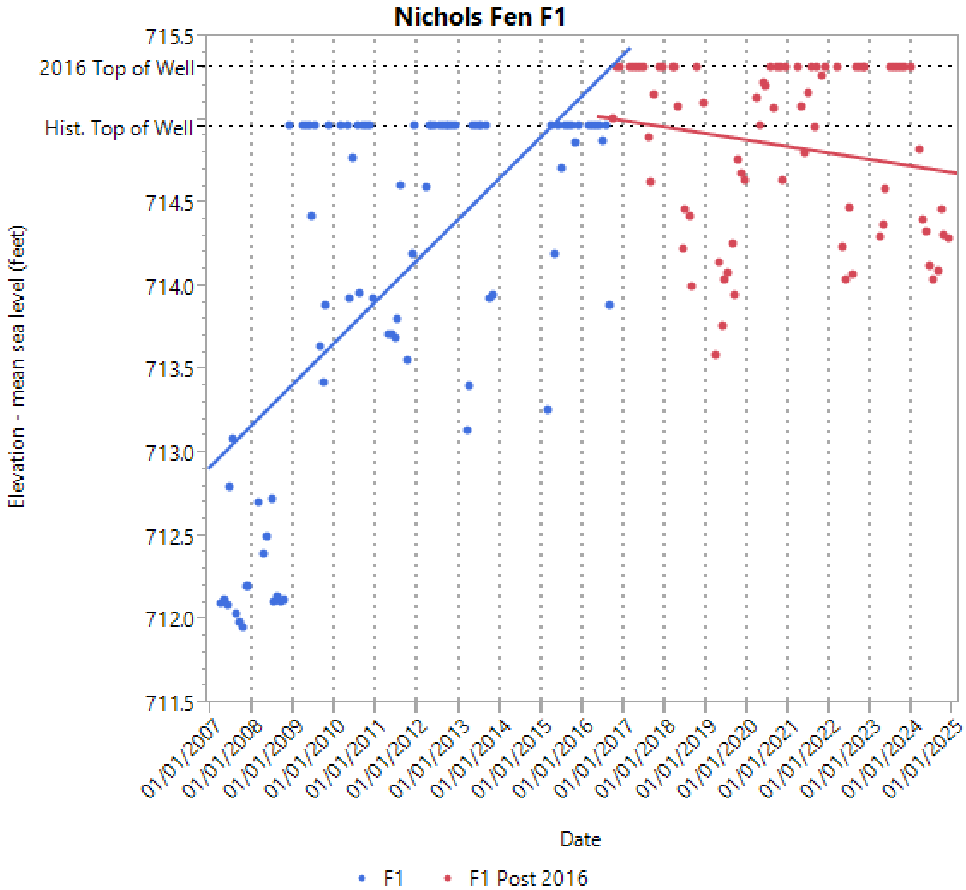

Nichols Fen WT1
Elevation - mean sea level (feet)
720
719
718
717
716
715
714
713
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025
Date
WT-1
WT1 Post 2016

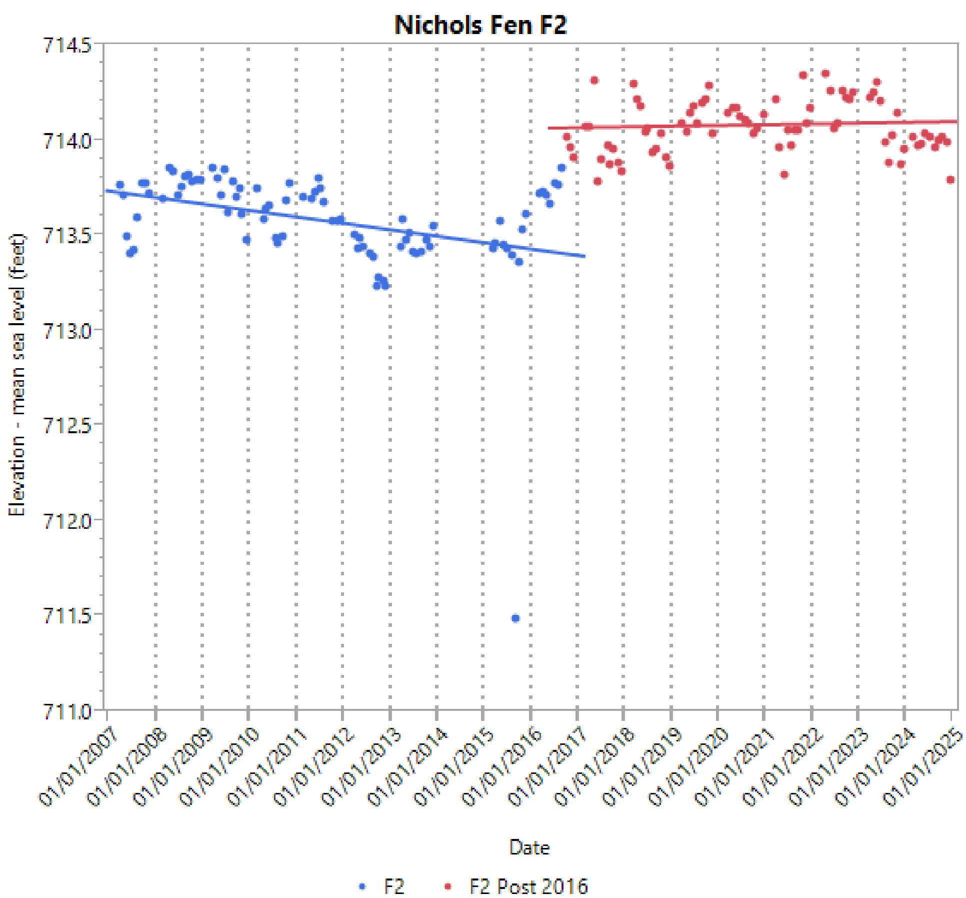

Nichols Fen WT-2
Elevation - mean sea level (feet)
717.0
716.5
716.0
715.5
715.0
714.5
714.0
713.5
713.0
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025
Date
WT-2
WT2 Post 2016


Nichols Fen WT-3
Elevation - mean sea level (feet)
716.5
716.0
715.5
715.0
714.5
714.0
713.5
713.0
712.5
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025
Date
WT-3
WT3 Post 2016


Nichols Fen WT-4
712.5
712.0
711.5
Elevation - mean sea level (feet)
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025
Date
WT-4
WT4 Post 2016


Nichols Fen WT-5
717.0
716.5
716.0
715.5
715.0
714.5
714.0
713.5
713.0
712.5
Elevation - mean sea level (feet)
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025
Date
WT-5
WT5 Post 2016


Nichols Fen F1
715.5
2016 Top of Well
Hist. Top of Well
714.5
714.0
713.5
713.0
712.5
712.0
711.5
Elevation - mean sea level (feet)
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025
Date
F1
F1 Post 2016


Nichols Fen F2
714.5
714.0
713.5
713.0
712.5
712.0
711.5
711.0
Elevation - mean sea level (feet)
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025
Date
F2
F2 Post 2016