2010 Lower Minnesota River Watershed District Fen Well Monitoring Report

Prepared for:
Lower Minnesota River Watershed District

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Dakota County Soil and Water Conservation District

Introduction

A series of calcareous fens and trout streams run parallel to the Minnesota River, along the northwestern edge of Dakota County, in an area located between I-494 and Hwy. 77. Groundwater monitoring wells have been installed in these fens to determine if groundwater, originating from upland areas, is providing enough cool groundwater to recharge these valuable natural resources (Appendix 1).

Several government agencies, including the United States Geological Survey, the Minnesota Department of Natural Resources (MNDNR), the Metropolitan Council, and the Ft. Snelling State Park have been involved in monitoring groundwater resources in this area. However, in recent years very little monitoring has taken place. In order to continue documenting groundwater levels, the Lower Minnesota River Watershed District (LMRWD) began contracting with the Dakota County Soil and Water Conservation District (SWCD) in 2007, to collect monthly "depth to water" measurements, for a network of 28 fen wells. In 2010, the LMRWD contracted with the SWCD to continue collecting monthly well measurements. This report summarizes the well measurements made in 2010.

2010 Activities

- Monthly "depth to water" measurements were collected at all wells.
- All data are made available on the Minnesota Climatology Workgroup Website (http://climate.umn.edu/ground_water_level/ground_water_level_data_lmrwd.htm)

Weather Summary

Groundwater levels are often influenced by recent precipitation, especially in relatively shallow wells, similar to those monitored in the LMRWD. The 2008-2010 average monthly precipitation was 2.16 inches and has been relatively consistent on an annual basis, with larger amounts occurring during late summer and early fall (Figure 1). When compared against 50 year precipitation records (Figure 2), the 2010 total precipitation amount (32.68 inches) was wetter than the 50 year average (28.95 inches).

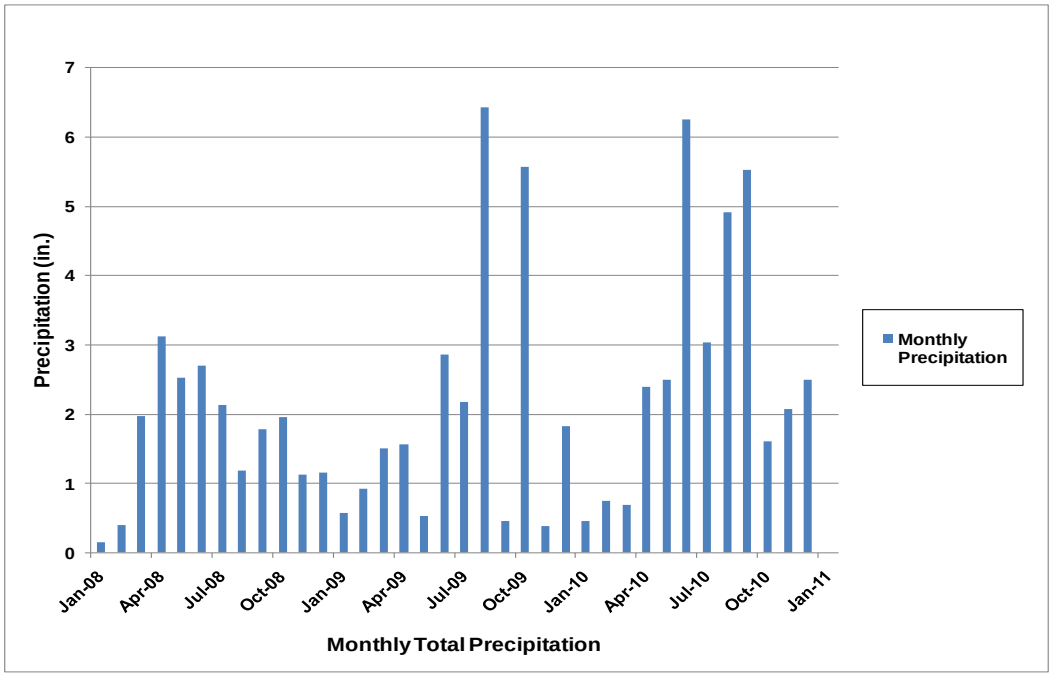

Figure 1. 2008-2010 Minneapolis/ St. Paul International Airport Monthly Precipitation Results

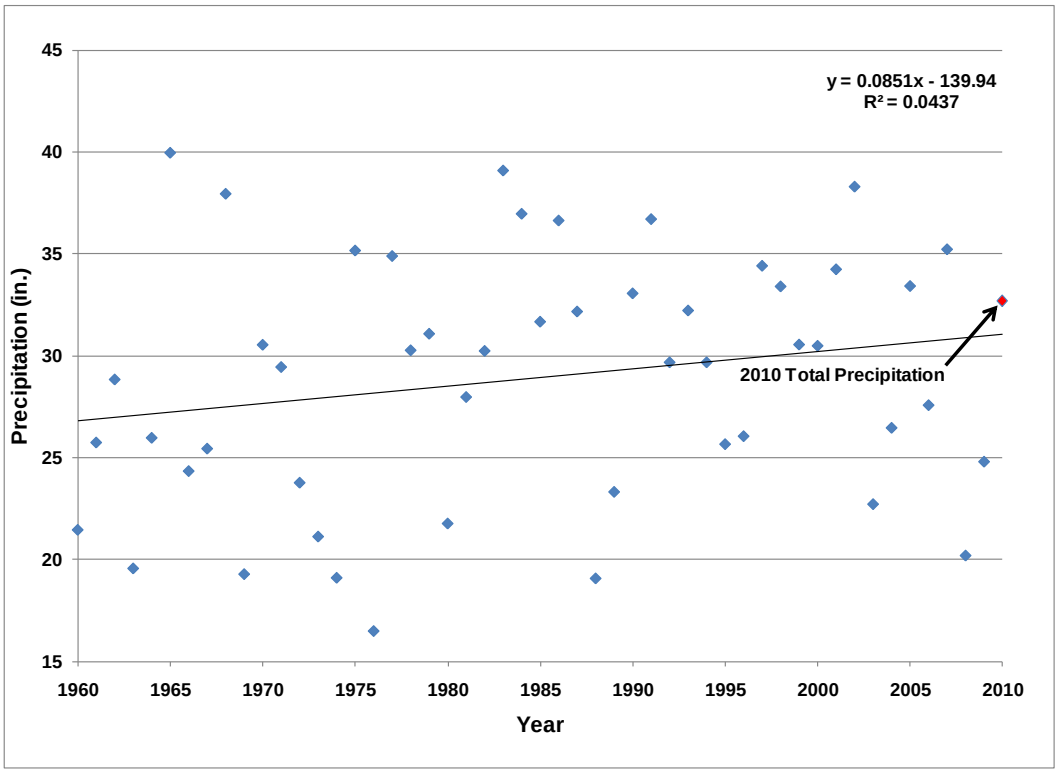

Figure 2. Minneapolis/St.Paul International Airport 50 Year (1960-2010) Annual Precipitation Record

Quarry Island Fen Results

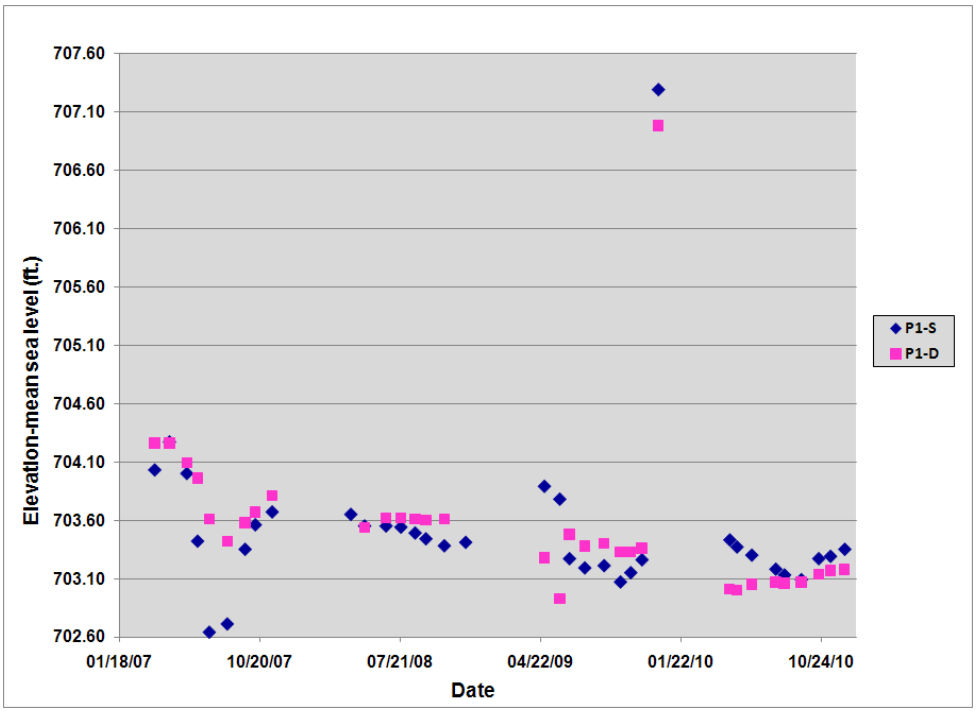

Figure 3. 2007-2010 Quarry Island Fen Well Monitoring Results

Snelling Fen Results

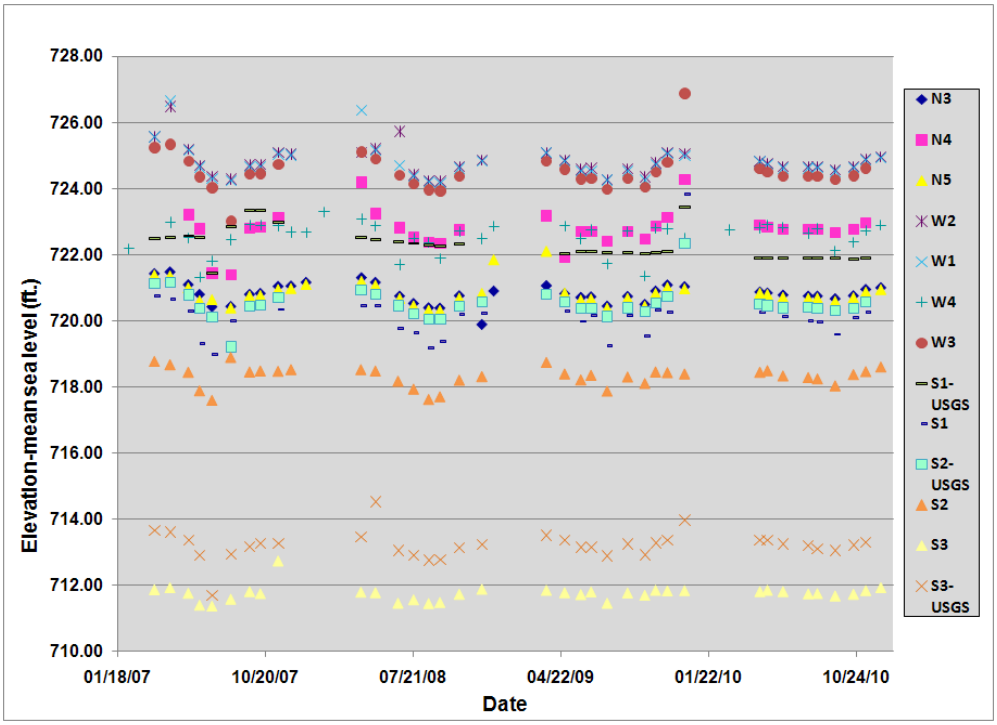

Figure 4. 2007-2010 Snelling Fen Well Monitoring Results

Nichols Fen Results

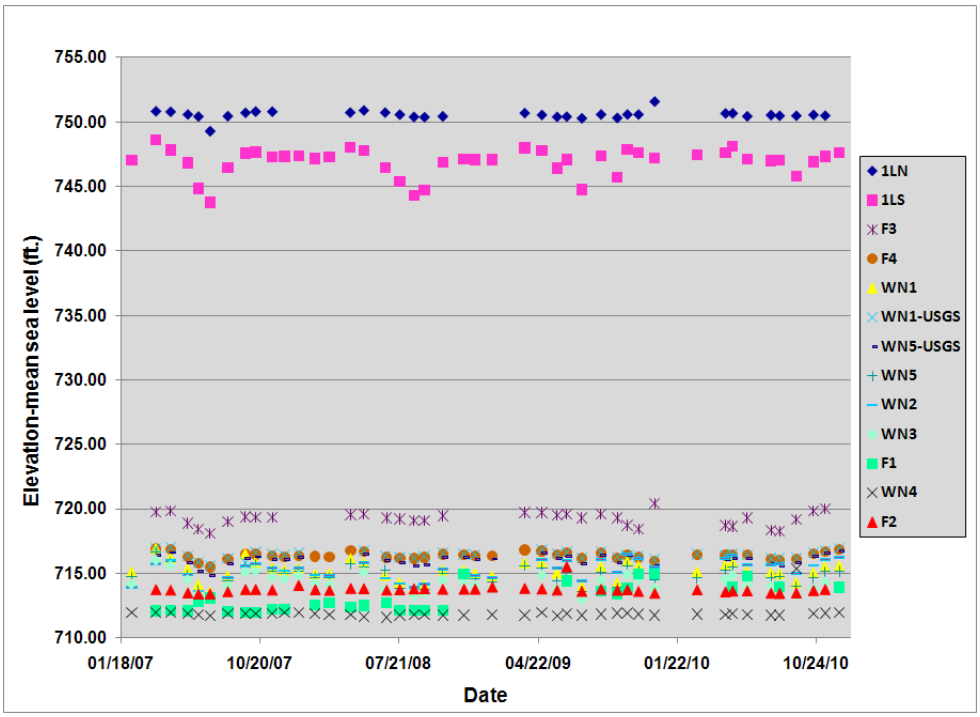

Figure 5. 2007-2010 Nichols Fen Well Monitoring Results

Discussion

Water elevations among the 2007-2010 monitoring years have been relatively consistent and follow similar annual patterns in the Snelling and Nichols fens (Figures 4-5). Water elevations in the shallow wells of the Quarry Island Fen appear to be less consistent and slightly decreasing (Figure 3). In general, water elevations have decreased during dry summer months, and rebounded as precipitation increased in the fall. Although monthly fen well measurements do not closely mirror recent precipitation patterns, measurements do reflect general precipitation trends, especially during summertime periods of low rainfall.

Due to the brief period of record for this monitoring effort, a limited regression analysis was performed on the datasets for each well. A trend line was fitted to monthly data from each well to determine if water levels are increasing or decreasing (Table 1). A "goodness of fit" test was completed for all trend lines, with R^2 values ranging from 0 to 0.6054. Due to these low R^2 values, all trends should be considered weak.

Based upon this analysis, water elevations in fen wells are mixed and do not demonstrate any obvious trends (low R^2 values). However, one of the Nichols fen wells (F1) is beginning to exhibit a slight increasing trend (R^2=0.6145). This trend may be due to increased precipitation amounts observed in recent years, reflecting higher groundwater levels (Figures 1-2). Additional monthly measurements are needed to expand upon existing baseline data and to provide for a stronger trend analysis in future reports.

Table 1. 2007-10 Fen Well Regression Analysis

Quarry Island Fen Trends		
Well	2007-10 Trend	R^2 (Trend Fit)
P1-S	-	0.0034
P1-D	-	0.1067
Fort Snelling Fen Trends		
Well	2007-10 Trend	R^2 (Trend Fit)
N3	-	0.0287
N4	+	0.0251
N5	-	0.0209
W2	-	0.0782
W1	-	0.0768
W4	+	0.0122
W3	+	0.0002
S1-USGS	-	0.3038
S1	+	0.0068
S2-USGS	+	0.0001
S2	-	0.0006
S3	-	0.0056
S3-USGS	+	0.0088
Nichols Fen Trends		
Well	2007-10 Trend	R^2 (Trend Fit)
1LN	+	0.0017
1LS	+	0.0113
F3		0
F4	+	0.0144
WN1	-	0.0035
WN1-USGS	+	0.0144
WN5-USGS	+	0.0428
WN5	-	0.0056
WN2	+	0.2498
WN3	-	0.0654
F1	+	0.6054
WN4	+	0.0428
F2	-	0.0005

Suggestions for future monitoring:

- Continue collecting monthly measurements to help identify annual and long term trends in fen water table elevations.
- Install fire guards on wells P1-S, P1-D.
- Replace weathered marking flags with painted stakes in each well nest.

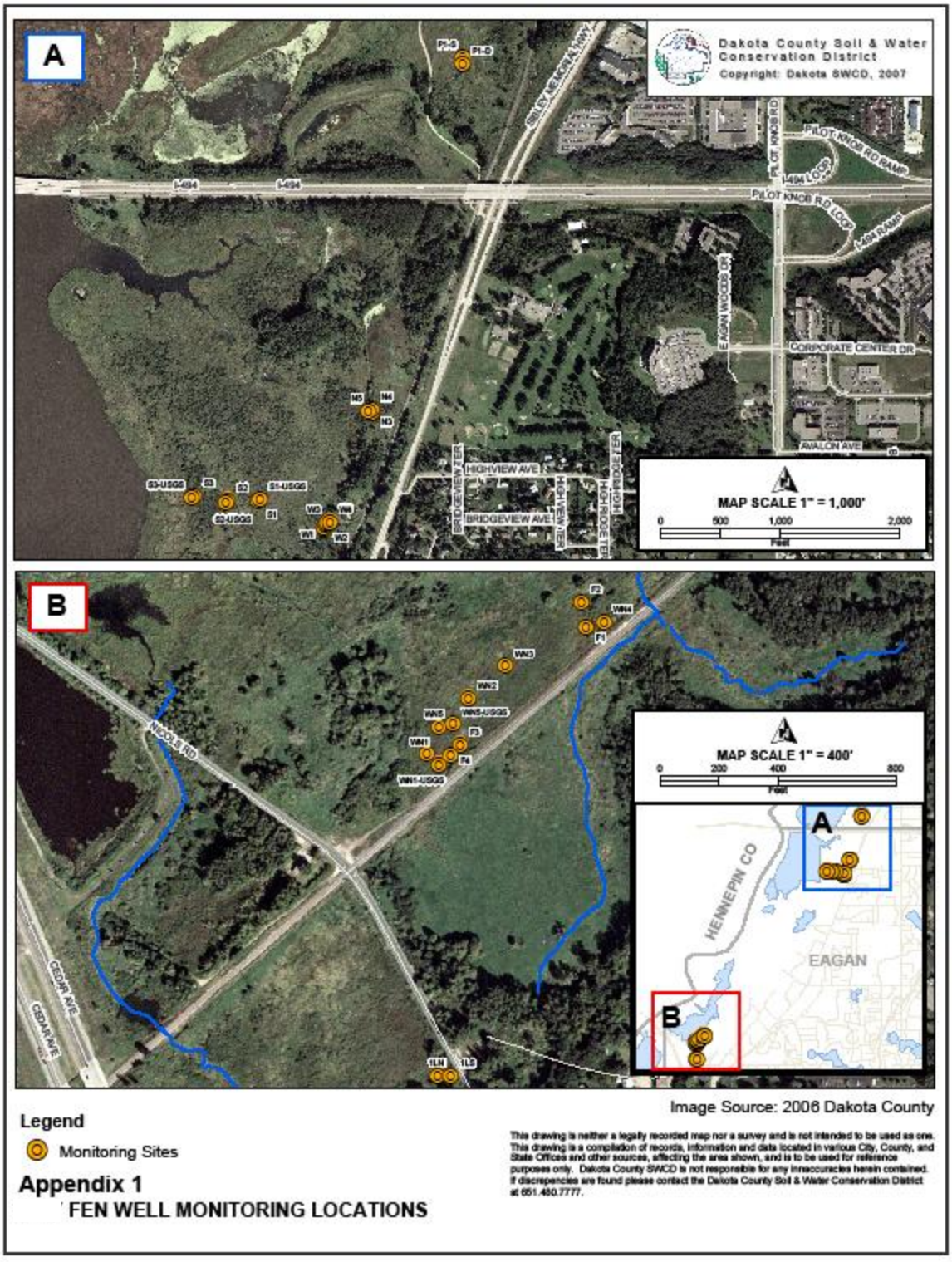

Image Source: 2006 Dakota County

Legend

Monitoring Sites

Appendix 1

FEN WELL MONITORING LOCATIONS