White Paper

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# Analysis of the Groundwater Levels Around Park Rapids

Groundwater from the Pineland Sands area aquifers is critical in supporting a number of uses in the Park Rapids, Minnesota area. These uses are primarily for irrigation for agriculture, along with drinking water and other domestic use, industrial use, and recreation. The Pineland Sands area groundwater resource is made up of two major aquifer systems, the shallow surficial glacial outwash aquifer characterized by water table conditions, and a buried artesian sand and gravel aquifer at various depths below the shallow water table aquifer. The aquifers have seen increasing groundwater development over the last several decades, and the number of water appropriation permits issued by the Minnesota Department of Natural Resources (MDNR) has steadily increased from 100 permits in 1988 to 275 permits in 2014 to high volume users. This is in addition to non-permit users who may withdraw up to 10,000 gallons per day or 1 million gallons per year without needing a permit. Recognizing this, in 2017, the MDNR established the Straight River Groundwater Management Area (SRGWMA) and drafted a plan to ensure the sustainable development of groundwater resources while allowing for water use, as there were concerns on drawing down the aquifer water levels due to excessive groundwater withdrawals and overuse.

Foth Infrastructure & Environment, LLC (Foth) was asked to perform a review of the groundwater levels in the area and changes in water levels over time to determine the magnitude and significance of possible impacts of the increasing groundwater development to the aquifers. This review assessed the data of an area near Park Rapids over of a five-decade period, which is sufficiently long to ensure that trends related to the increase in groundwater appropriation would expect to be observed. The review focused on water levels as a measure of available water quantity and did not consider potential impacts to water quality from increased usage. While this review was done at a qualitative level, the results provide a screening level assessment of the overall groundwater quantity and availability to users of the aquifers in the Pineland Sands area around Park Rapids.

## Methods

Foth analyzed the publicly available groundwater data associated with the Pineland Sands area. The MDNR has a very robust data set through their Cooperative Groundwater Monitoring program, and Foth downloaded and reviewed data from this resource. To constrain the number of data records analyzed, Foth focused the analysis to wells located within a 10-mile radial distance of Park Rapids within the Pineland Sands as shown on Figure 1 and restricted the analysis to wells that had data before 1994 and are still actively monitored. Many of these wells have had continuous monitoring instrumentation installed in them and have been reporting hourly data during the last ~5 years.

Filtering of available data using the methods above led to a focused set of 31 wells with almost continuous coverage on all wells from the early 1990s until today. To identify the changes and trends in groundwater levels, Foth plotted the minimum, maximum, average water, standard deviation of water levels over the course of each year for the entire time period of well records. Figure 2 and Figure 3 show the maximum yearly water levels and average yearly water levels for the wells analyzed. To better look for any trends, trendlines were fitted to both maximum annual water level and the average annual water level data as shown on Figure 4 and Figure 5. The maximum water level would encompass the annual rebound and the annual average encompasses the seasonality. Foth also compared the data collected in 2022 against the first year water level measurements (or second/third years if there was less than one sample collected during the initial sampling year). The net change in water level over a three-to-five-decade time period are shown on Figure 6. About two-thirds of the wells have a net change resulting in water levels being higher in 2022 as compared to when monitoring started three-to-five decades ago, while only one-third of the wells have water levels that are lower than at the start of monitoring.

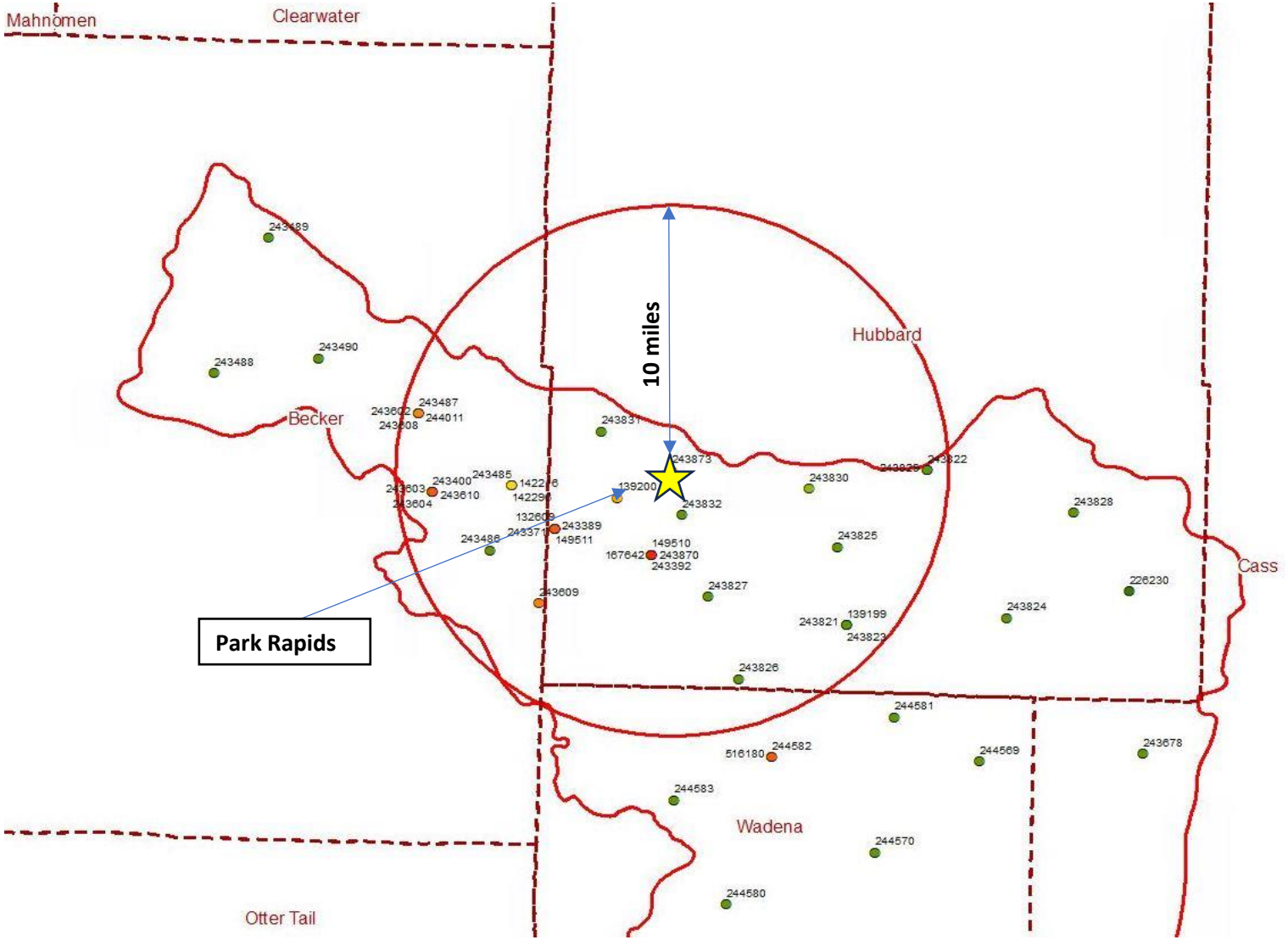
## Discussion

This analysis provides a review of publicly available data, and it should be caveated with the fact that some of the newer data is provisional and there are likely data issues with older data; the data was used as provided in public database. However, given the amount of data that was available within this area, it should be sufficient in providing a good picture of how the groundwater levels are acting in response to increased usage in the Pineland Sands aquifers around Park Rapids. The data shows that groundwater levels have generally remained stable in the five-decade record that was analyzed, even with increased permit appropriations and usage, demonstrating that the groundwater system is resilient and water withdrawals for use are apparently balanced by replenishment through recharge from precipitation and connected surface water resources. In fact, net change over time on an average for all of the wells analyzed shows stable water level (an increase of 0.01 foot, i.e., effectively no change) in the groundwater level from the first year of monitoring to 2022.

There are no obvious trends on a bigger picture basis indicating either increasing or decreasing water levels, and comparing the current groundwater levels against the old records show stable groundwater levels – even though groundwater usage and withdrawals have increased during this period. The data in 2022, a “key year” for groundwater levels in the region as it was following the 2021 drought, is broadly similar to the 1970s and 1980s. This area is highly monitored and given the robust nature of this dataset – decreasing groundwater levels should show up if they are occurring – but they don’t. If there are changes, they are on the order of inches over this period and are likely imperceptible based on the resolution of the data and the geology of the area.

This qualitative assessment shows that impacts related to groundwater withdrawals within the area of review are temporary, e.g., annual water levels rebound to average conditions following seasonal agricultural irrigation. The net loss from evapotranspiration, baseflow to streams and wetlands, and groundwater withdrawals is offset by recharge of the aquifers.

Attachments




**NOTES:**

| R.D. OFFUTT COMPANY | | |
|---|---|---|
| **FIGURE 1**<br>GROUNDWATER WELL DATA AROUND PARK RAPIDS<br>2023 PINELAND SANDS ANALYSIS | | |
| Date: AUGUST 2023 | Revision Date: | |
| Drawn By: MMU | Checked By: JMW3 | Project: 20R016 |

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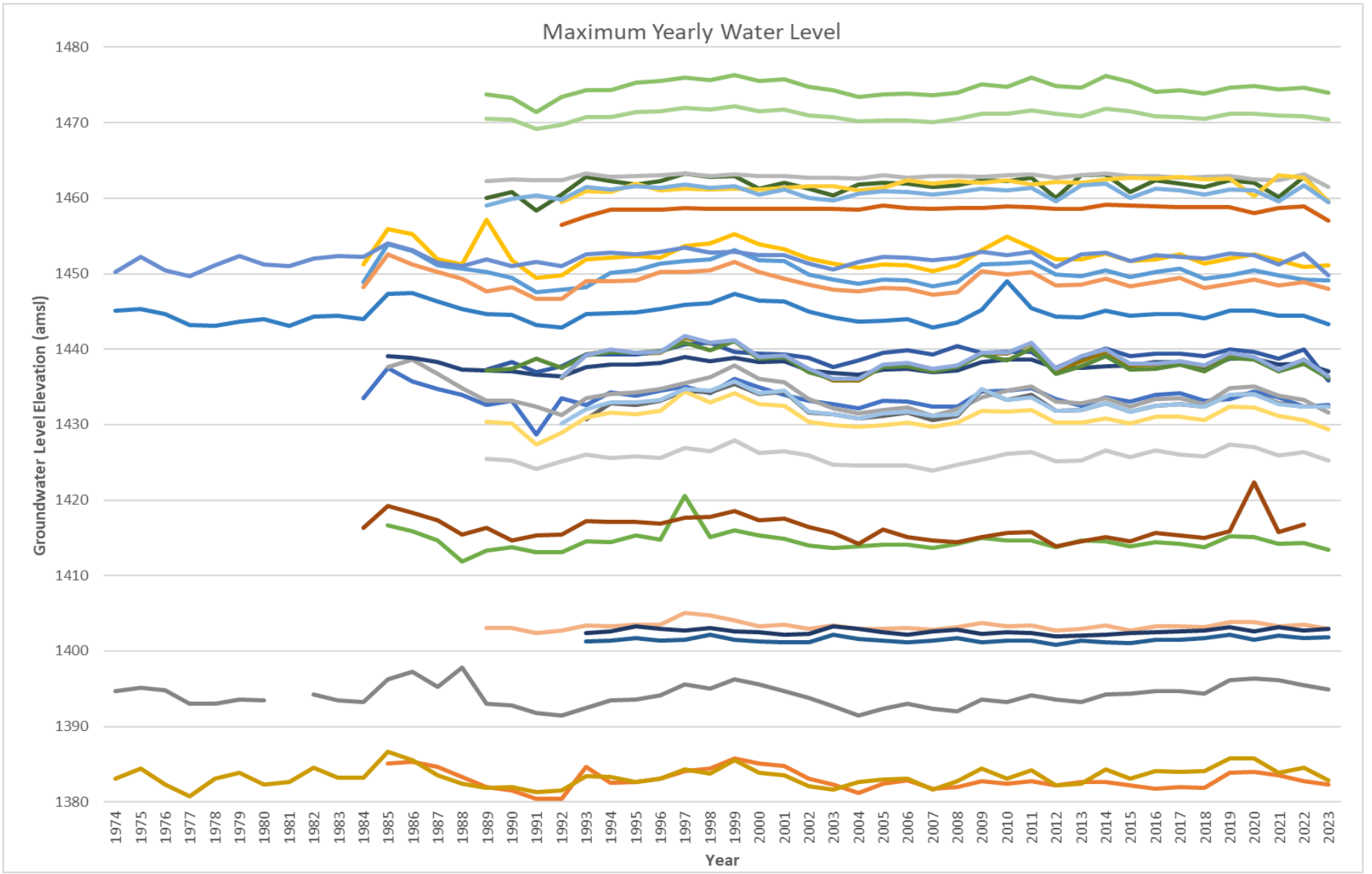
Date: 8/15/2023




**NOTES:**

**LEGEND**

SITE

| | |
|---|---|
| 132609 | 139199 |
| 139200 | 142216 |
| 142296 | 149510 |
| 149511 | 167642 |
| 243371 | 243389 |
| 243392 | 243400 |
| 243486 | 243601 |
| 243603 | 243604 |
| 243605 | 243608 |
| 243609 | 243610 |

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**FIGURE 2**

MAXIMUM YEARLY WATER LEVEL
2023 PINELAND SANDS ANALYSIS

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|---|---|---|
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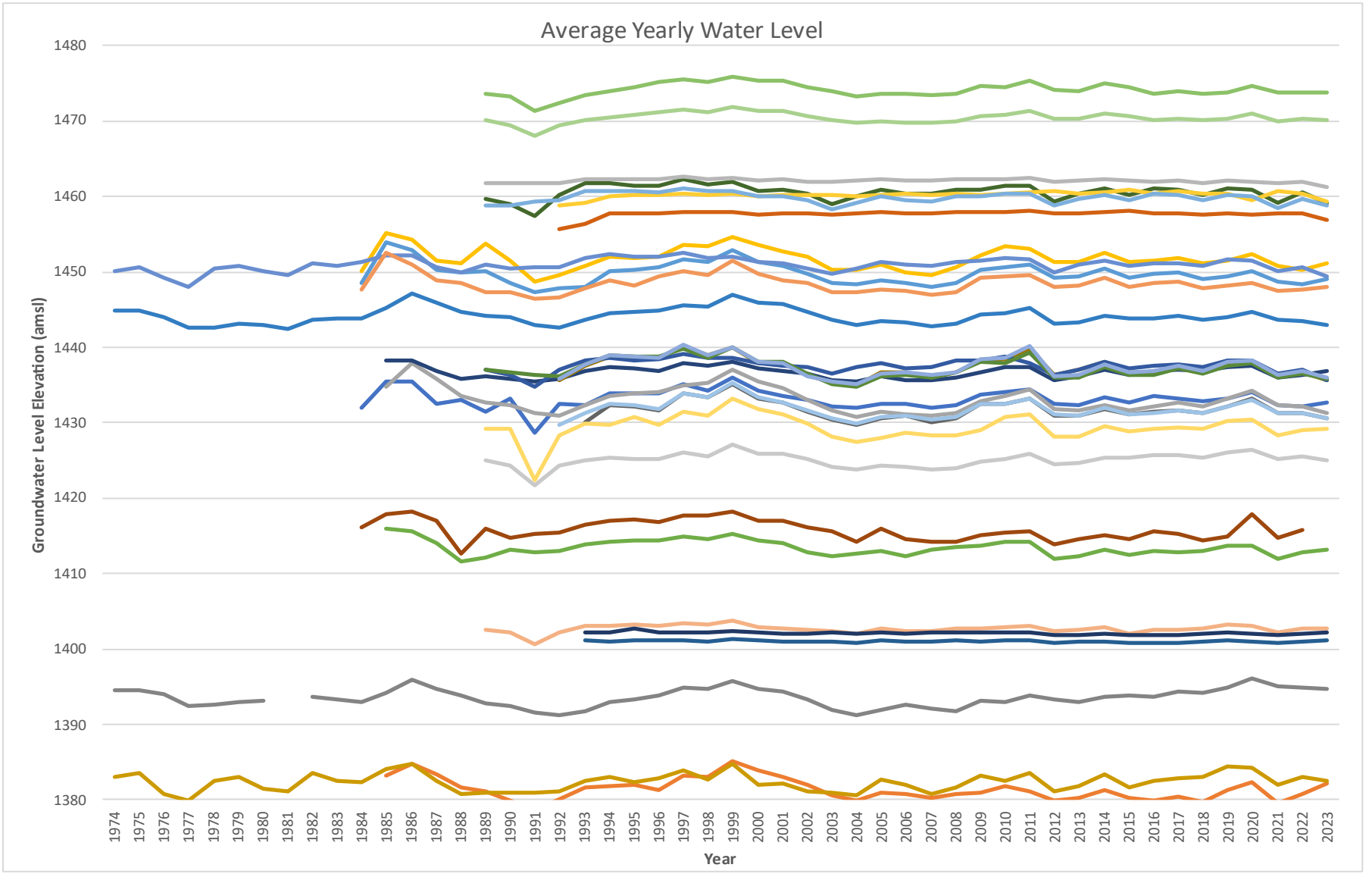


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**FIGURE 3**

AVERAGE YEARLY WATER LEVEL
2023 PINELAND SANDS ANALYSIS

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|---|---|---|
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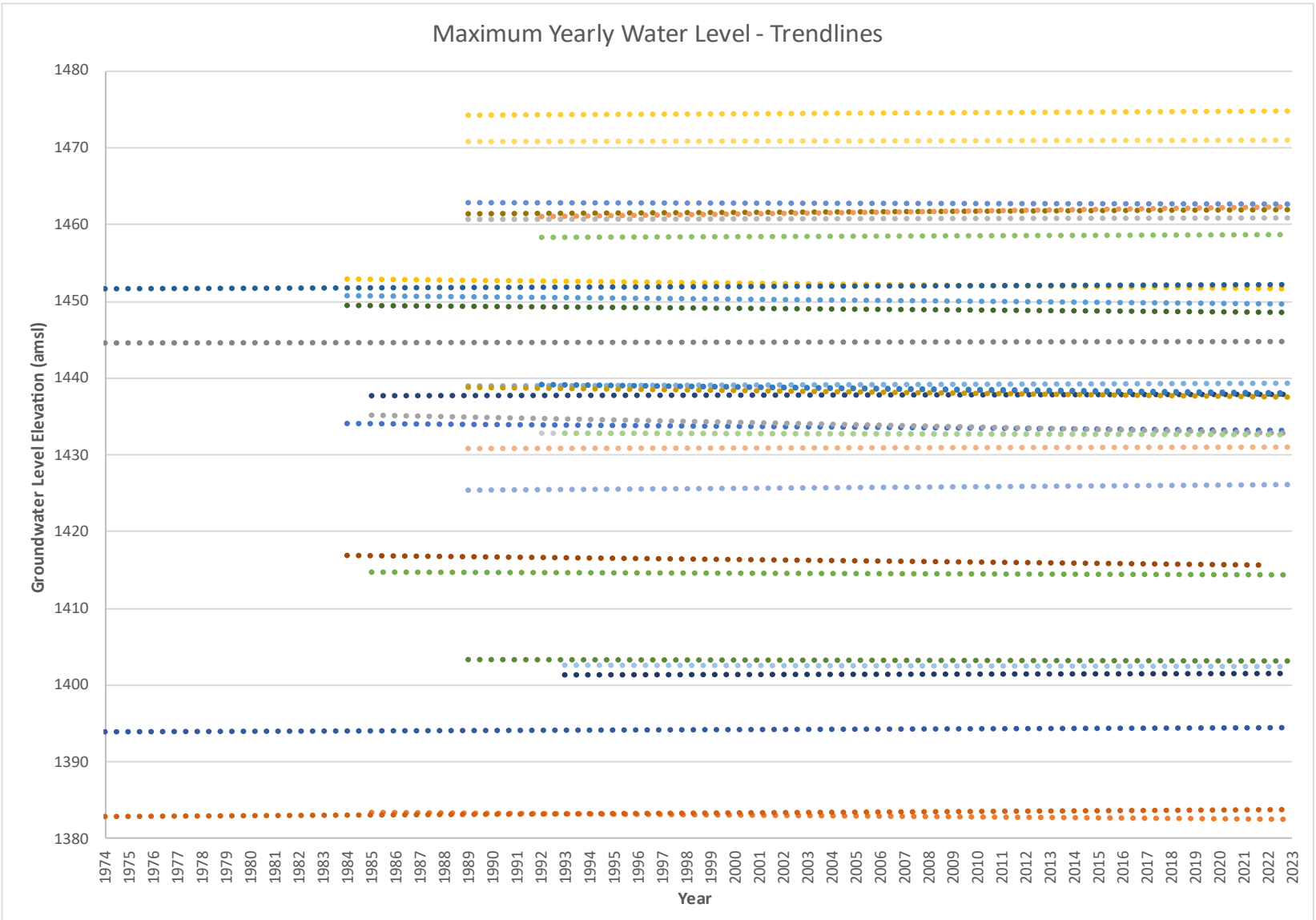


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| Linear (142216) | Linear (142296) | Linear (149510) |
| Linear (149511) | Linear (167642) | Linear (243389) |
| Linear (243400) | Linear (243486) | Linear (243601) |
| Linear (243603) | Linear (243604) | Linear (243605) |
| Linear (243608) | Linear (243609) | Linear (243610) |
| Linear (243825) | Linear (243827) | Linear (243831) |
| Linear (243867) | Linear (243868) | Linear (243870) |
| Linear (243873) | Linear (243874) | Linear (243875) |
| Linear (244011) | Linear (272084) | Linear (243371) |
| Linear (243392) | | |

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**FIGURE 4**

MAXIMUM YEARLY WATER LEVEL
2023 PINELAND SANDS ANALYSIS

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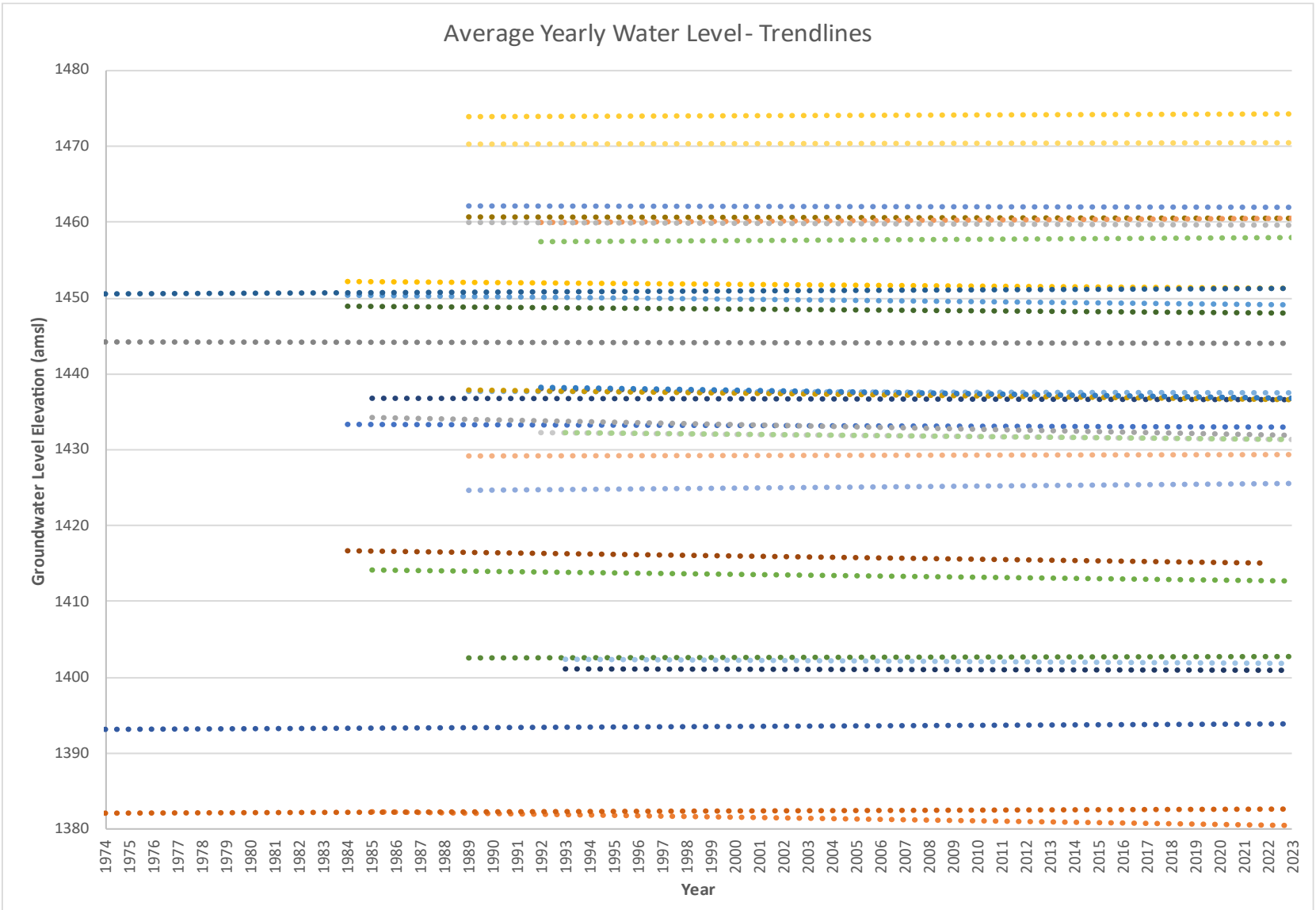
Date: 8/15/2023

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Linear (243392)

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**FIGURE 5**

AVERAGE YEARLY WATER LEVEL
2023 PINELAND SANDS ANALYSIS

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|---|---|---|
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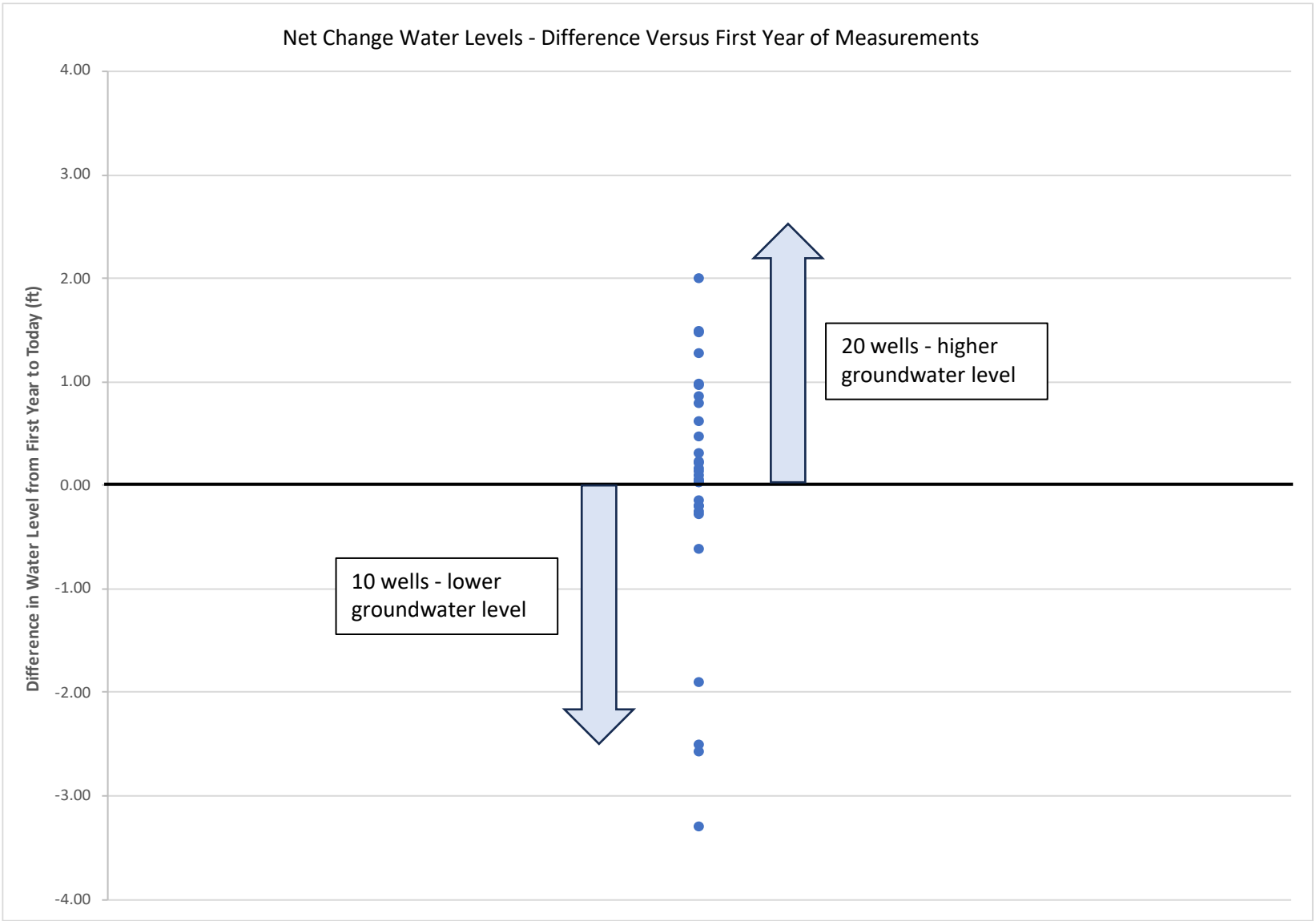


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|---|---|---|
| **FIGURE 6**<br>NET CHANGE WATER LEVEL<br>2023 PINELAND SANDS ANALYSIS | | |
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