ICR Well 1 Health Report 2024 Analysis

Prepared by: Katie Geyer

Date: October 2024

Introduction

This report outlines the findings from three separate pumping tests conducted on ICR Well 1 in 2016, 2020, and 2024. The objective is to evaluate the overall health and performance of the well over time, identify any areas of concern, and recommend measures to ensure the continued productivity and reliability of the well.

Data Summary

The data for Well 1 over the three pumping tests is summarized below:

Test Year	Static Water Level (ft)	Total Drawdown (ft)	Pumping Rate (gpm)	Pumping Duration (minutes)
2016	56.1	109.29	376	300
2020	39.9	119.0	383	75
2024	64.1	120.8	310	500

Key Findings

1. **Static Water Level Decline**:

   Over the period from 2016 to 2024, the static water level has fluctuated but overall decreased:

   - **2016**: 56.1 ft below land surface.
   - **2020**: 39.9 ft below land surface (increase).
   - **2024**: 64.1 ft below land surface (decrease).

2. The significant drop from 39.9 ft in 2020 to 64.1 ft in 2024 suggests that the aquifer is experiencing a lower recharge rate or that pumping stress has increased. It can be influenced by broader environmental factors beyond just well infrastructure. The **2023-24 winter season had below-average precipitation**, and the **2024 monsoon season was one of the weakest on record** in the Prescott area. These climatic factors likely contributed to lower groundwater recharge rates during that period, causing the static water level to drop more than in previous years.
   The annual report reviewing the ICR well field's long-term water levels will integrate these seasonal variations into the analysis, distinguishing between normal fluctuations and more concerning trends caused by low precipitation conditions.
3. **Stable Drawdown with Reduced Yield**:
   Despite the drop in the static water level, the total drawdown has remained relatively stable, increasing by only 10 ft since 2016. This stability in drawdown, despite the declining static level, is unusual. Normally, a lower static level would result in a more significant drawdown. However, a key factor contributing to this stability may be the **reduction in pumping rate**:
   - **2016**: 376 gpm
   - **2020**: 383 gpm
   - **2024**: 310 gpm (19% drop since 2020).
4. The reduced yield indicates that the well's pumping efficiency has decreased, even though the aquifer's capacity to maintain drawdown remains unchanged. However, the **dry 2023-24 winter season and even drier 2024 monsoon season** may be contributing to lower water availability, amplifying the appearance of declining well performance. In future reports, it may be helpful to assess well performance during both drought and non-drought periods to determine the extent to which seasonal and climatic variations impact yield independently of equipment health.
   Comparing the well's yield during wet seasons versus dry seasons can provide a clearer picture of both equipment performance and aquifer health.
5. **Equipment Age**:
   ICR 1's pump and associated well equipment are old and may require replacement. This aligns with the observed reduction in yield, suggesting that the equipment may no longer be functioning at optimal capacity, contributing to the decline in water yield.
6. **Rebound After Pumping**:
   After testing, water level rebounded to 65.2 feet within 100 minutes of stopping the pump, indicating that the aquifer retains its ability to recharge effectively after pumping has ceased. This suggests that the aquifer is not experiencing significant long-term depletion, though the decreasing static level warrants further monitoring.

Analysis & Implications

- **Drawdown Stability vs. Yield Decline**: The stability of drawdown combined with the declining yield suggests that the problem may lie in well infrastructure rather than aquifer depletion. The consistent reduction in gallons per minute points to mechanical or structural issues within the well itself, likely related to aging equipment. As a result, ICR Well 1 may require rehabilitation to restore its performance to prior levels.
- **Static Water Level Decline**: The lower static water level in 2024 compared to previous years warrants attention and continued monitoring. However, the aquifer's ability to maintain relatively consistent drawdown during pumping suggests that the aquifer is not under immediate stress and maximum drawdown observed is well above the maximum pumping depth required for long-term viability of the well.

Recommendations

1. **Pump and Equipment Replacement**:
   The significant drop in yield from 2020 to 2024 indicates that the pump is no longer operating efficiently. Recommendations include replacing the pump and inspecting the well casing and other equipment for wear, corrosion, or blockages that may be reducing water flow.
2. **Well Rehabilitation**:
   In addition to equipment replacement, a well rehabilitation process may be necessary to remove sediment, biofouling, or scaling from the well screen and casing. This could improve water flow and restore yield closer to its 2016/2020 levels.
3. **Continued Monitoring of Static Water Levels**:
   Given the decline in static water levels, ongoing monitoring of the water levels in ICR Well 1 is recommended during both pumping and non-pumping periods.
4. **Annual Pumping Tests**:
   To ensure early detection of any potential declines in well performance, it is also recommended to conduct annual pumping tests. These tests will enable us to monitor changes in yield, drawdown, and static water levels, while also providing data for future analyses and informed decision-making.

Conclusion

The data from 2016, 2020, and 2024 shows that while drawdown has remained stable, the decrease in pumping efficiency and yield is a sign that ICR Well 1 requires attention. Aging equipment and potential well obstruction are potential causes for reduced yield, and addressing these issues now will restore the well's performance and help prevent further degradation.