

Mine Pool Early Warning System

Continuous Hydraulic Monitoring of Abandoned Mine Pools

Department of Environmental Protection
Bureau of Abandoned Mine Reclamation
May 6, 2026





Overview

Purpose of mine pool monitoring

Continuous monitoring of hydraulic head to identify threshold-controlled discharge risk within abandoned mine systems

- Public safety
- Environmental protection
- Integration with BAMR programs
- Early detection = safer communities + reduced emergency costs



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Mine Pool Blowouts

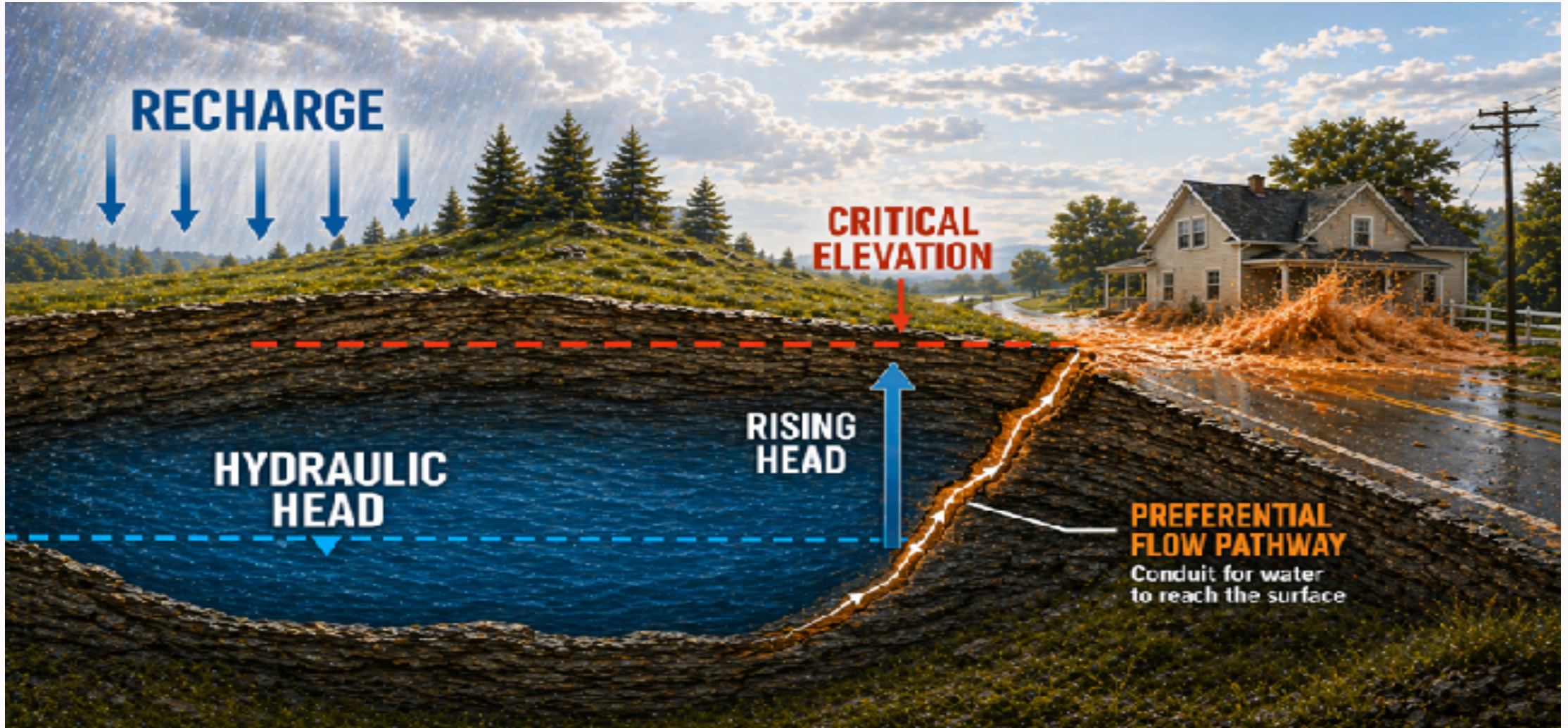


Uncontrolled mine pool discharges cause flooding, property damage, and AMD impacts



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Mine Pool Rise to Critical Discharge Elevation



Monitoring System Architecture

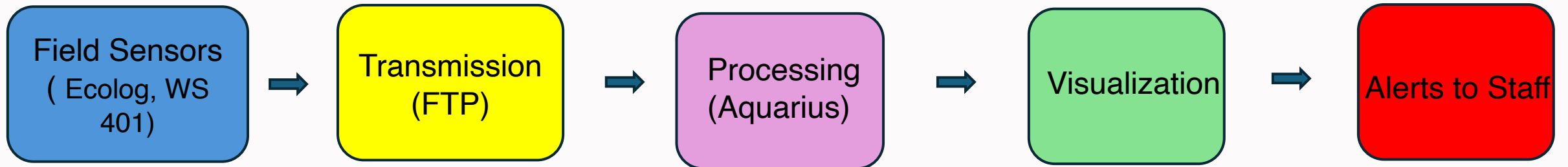
Integrated system for continuous hydraulic head monitoring and real-time data delivery

- OTT ecoLog 1000 pressure transducers
- WS401 weather station — *used at AMD treatment plants to monitor rainfall, alkaline additions and dilution rates (gravity-fed systems)*
- LinkComm + Aquarius Time Series for telemetry+ WebPortal for easy inspection





Data Workflow





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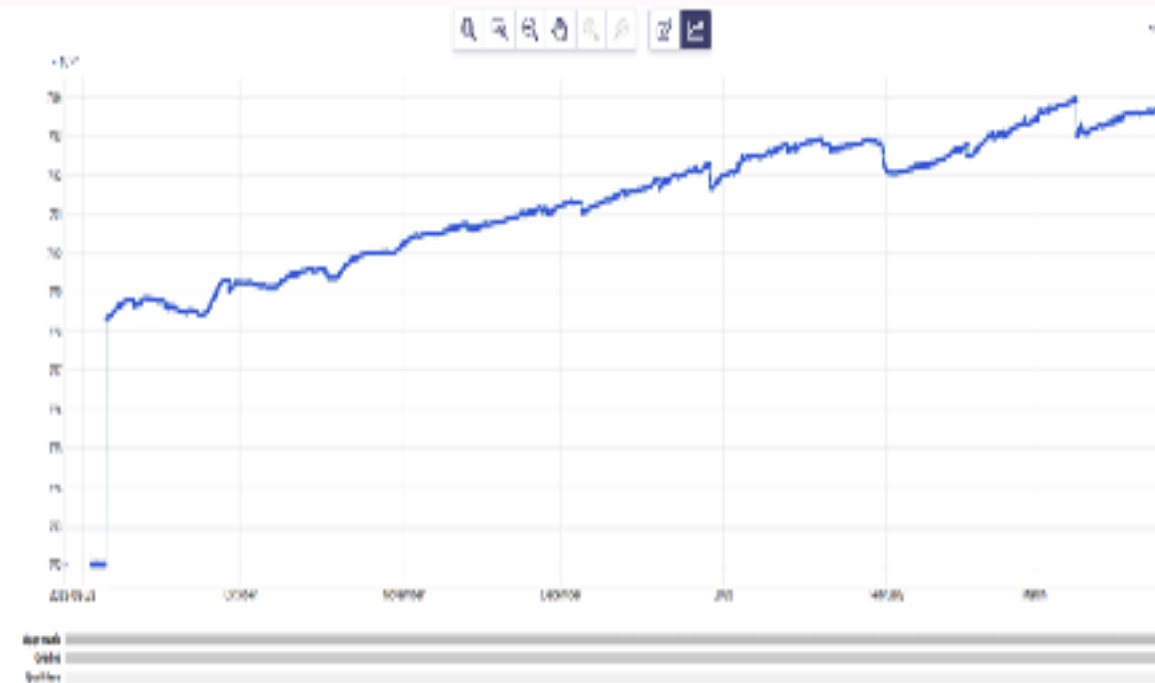
Deployment

- Well installation (steel guard, PVC casing)
- Data loggers (BLE setup, FTP transmission)
- Solar panels and battery backup

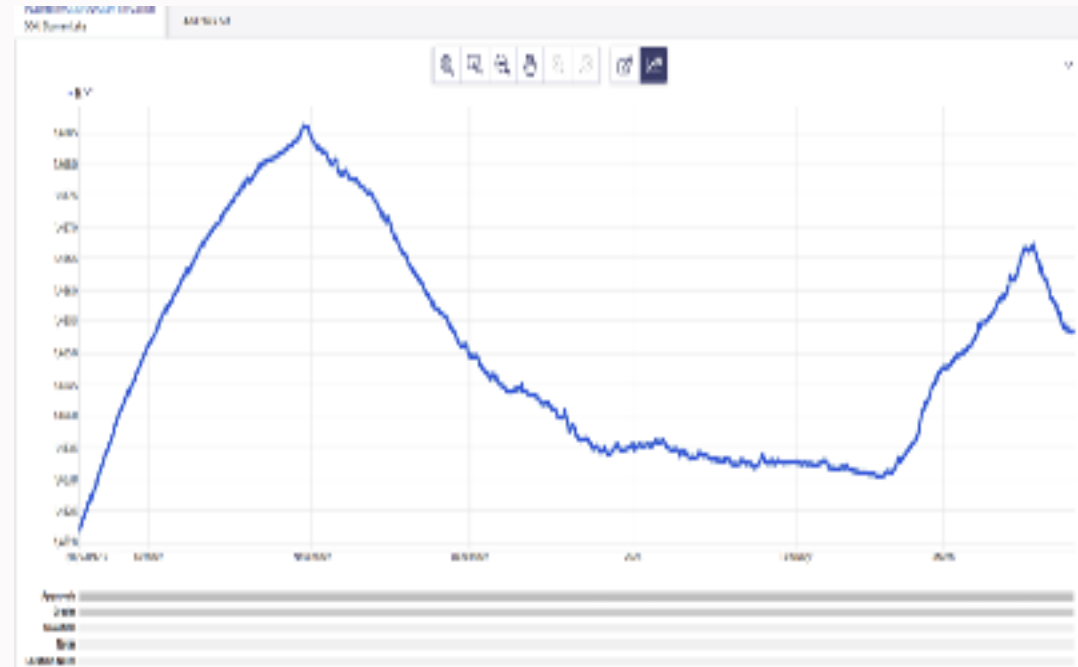
Installed to ensure long-term hydraulic head measurement stability and data continuity



Mine Pool Baseline Data



Steady rise → sustained recharge

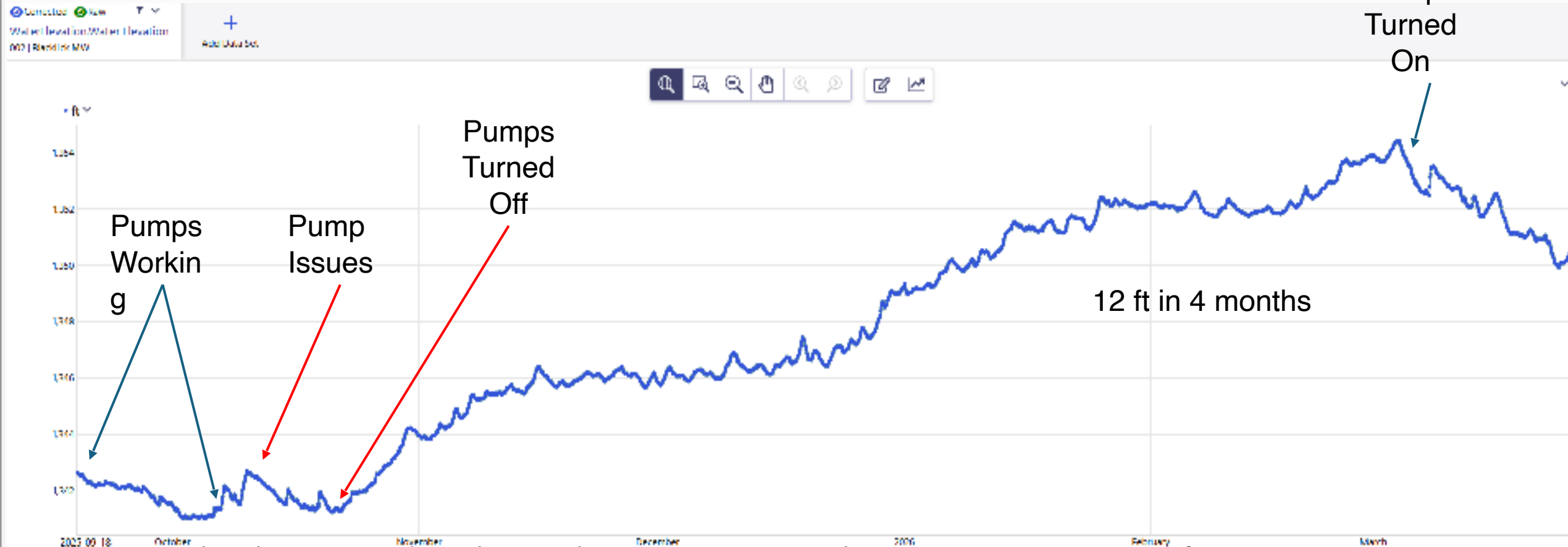


Seasonal variation → recharge/discharge balance



Proof of Life

Blacklick Treatment Plant





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Real-Time Decision: False Blowout

AQUARIUS
Time Series

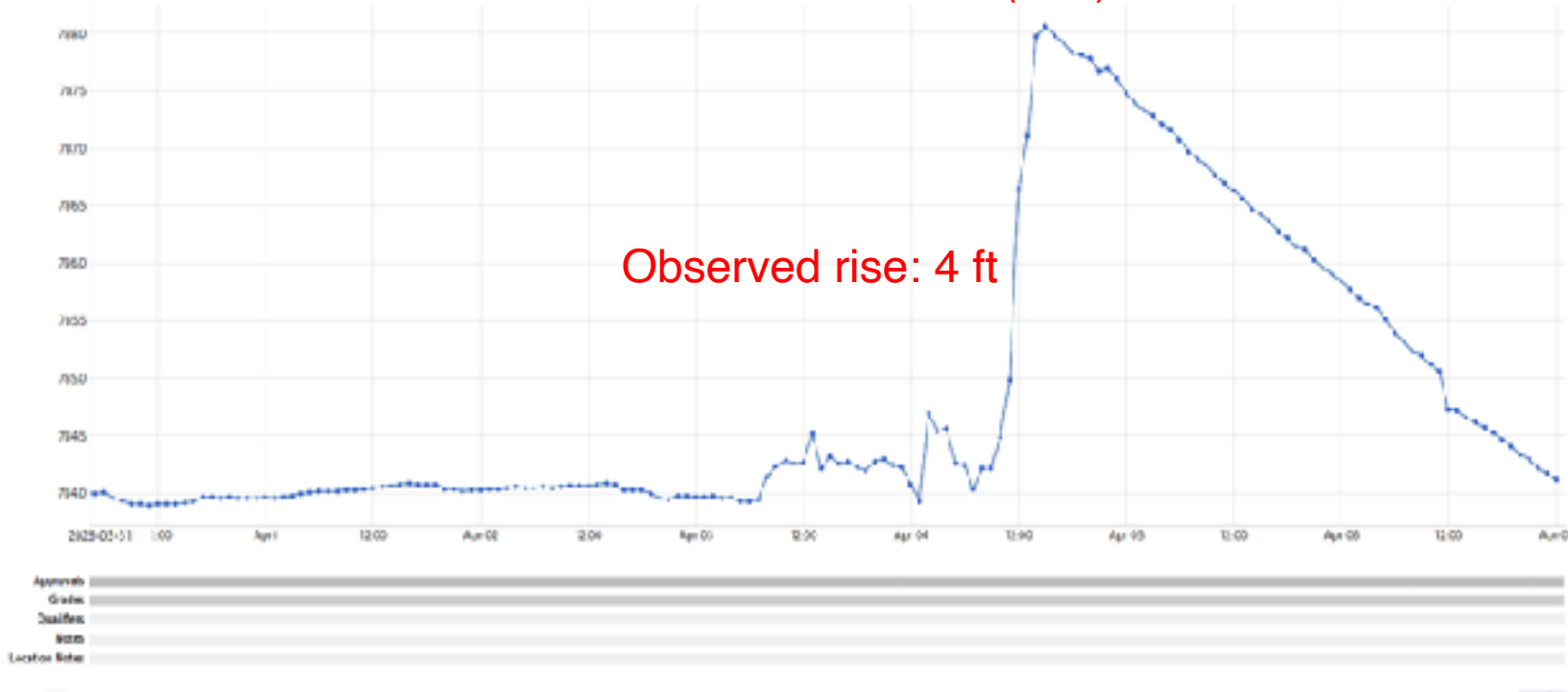
COBDES Raw
Water Elevation Water Elevation
201 RCF MW

+
Add Data Set



Alarm Threshold
(+5ft)

Observed rise: 4 ft



- Alarm threshold: +5 ft --not reached
- Rapid drawdown indicates non-rainfall-driven response
- Field response avoided — time and cost saved



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Deployment Configurations



Logger on reinforced
injection pad



Low-profile flush
mount installation



Standard steel guard
setup w/ antenna extender



Weather station



Weather station co-
located with
monitoring well



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Deployment Configurations



MacDonald, PA



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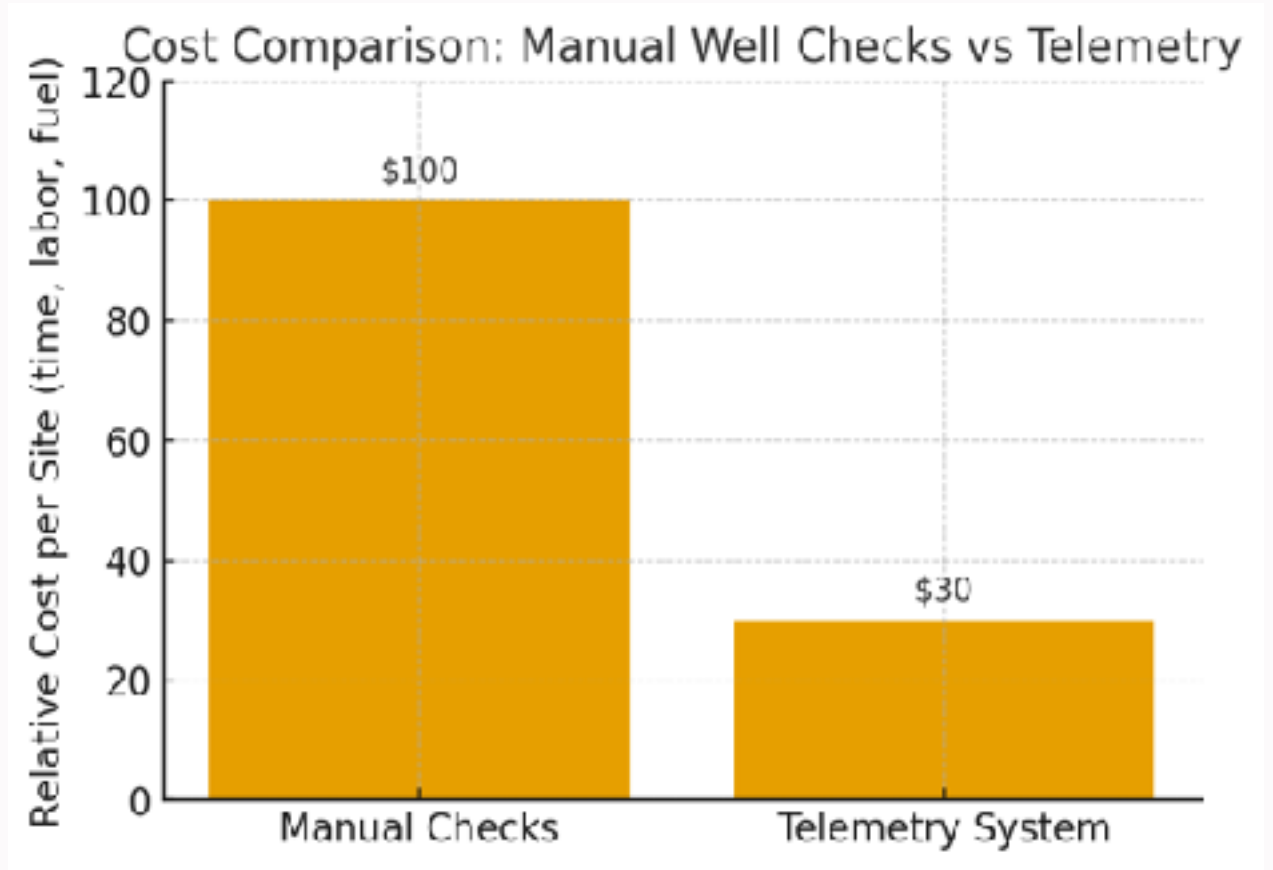
Live Demo: Aquarius Web Portal and Time Series

- [Webportal](#)
- [Time Series](#)



Benefits

- Early warning of rapid mine pool rise — hours matter
- ~70% reduction in field visits — direct operational cost savings
- Long-term datasets support data-driven treatment design
- Rainfall correlation improves alkaline dosing efficiency





Network Status

Real-time hydraulic head monitoring across multiple mine pool systems

- 12 monitoring wells instrumented and actively transmitting
- 2 weather stations deployed, 2 more to go
- Sites established during winter recharge — baseline conditions documented
- All loggers online and reporting to Aquarius Time Series
- Network spans 5 counties / 9 mine pools in the bituminous district
- 13 additional sites pending — criteria-based prioritization underway

Next Steps & Network Expansion

Transitioning toward predictive, threshold-based mine pool management

- Priority pool selection based on risk, discharge history, and design needs
- Area-wide drilling contract enables rapid deployment of monitoring wells
- Integration of rainfall and hydraulic head data to define system response and seasonal behavior
- Development of threshold-based alert criteria tied to observed hydraulic response



Key Findings

- Continuous monitoring defines mine pool behavior in real time
- System detects hydraulic changes prior to surface discharge
- Data supports predictive, rather than reactive, management



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Questions?



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The Department of Environmental Protection's mission is to protect Pennsylvania's air, land and water resources and to provide for the health and safety of its residents and visitors, consistent with the rights and duties established under the Environmental Rights Amendment (Article 1, Section 27 of the Pennsylvania Constitution).