

Waipio Wastewater Pump Station Case Study

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BROWN AND
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Outline

- Project Background
- Project Purpose
- Collection System and Location
- Flow Projections
- Existing WWPS Issues
- Possible Causes of Reduced Capacity
- Field Investigation and Testing
- Alternatives
- Summary
- Lessons Learned



Project Background

- Previous reports consider the station to have “severe hydraulic deficiencies”
- Suspected cause is an underestimation of the system total dynamic head
- Recommendation to upgrade station capacity from 1.55 to 3.58 mgd
- Station upgrade a high priority since current peak wet weather flows approaching “official” station capacity



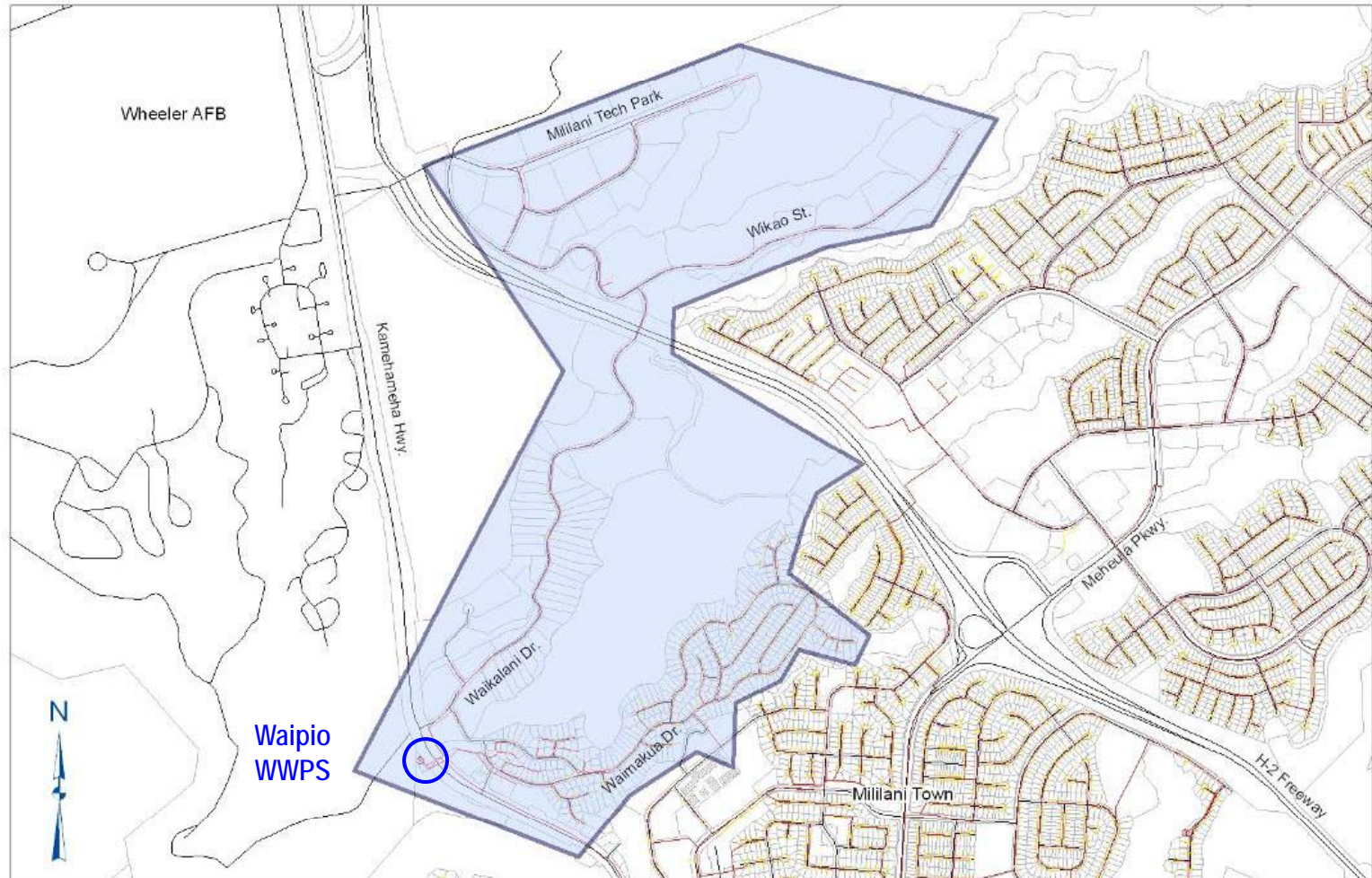
Project Purpose

- Identify and evaluate deficiencies
- Identify and evaluate alternatives to address deficiencies
- Prepare a recommendation





Collection System and Location





Flow Projections

- City's modeling program (called INFIX) used to model future flow
- Future (2020) peak wet weather flow is 3.55 mgd
- Flow model updated to account for future service area expansion
- Future (2030) peak wet weather flow based upon updated model is 4.3 mgd
- Current average dry weather flow is 0.54 mgd



Existing WWPS Issues

- Pumps not achieving design flow
 - 1.55 mgd actual vs. 2.4 mgd theoretical
- Clogging of pumps and check valves at low flow
- Pump shaft breakage
- Security issues
- Flooding of station during heavy rain



Possible Causes of Reduced Capacity

- Underestimation of system total dynamic head (TDH)
- Air binding of force main
 - Localized high points
 - Air relief valves (ARVs) not exercised
- Inaccurate flow meter
- Other unknown causes?
 - Pump control system issue is most probable

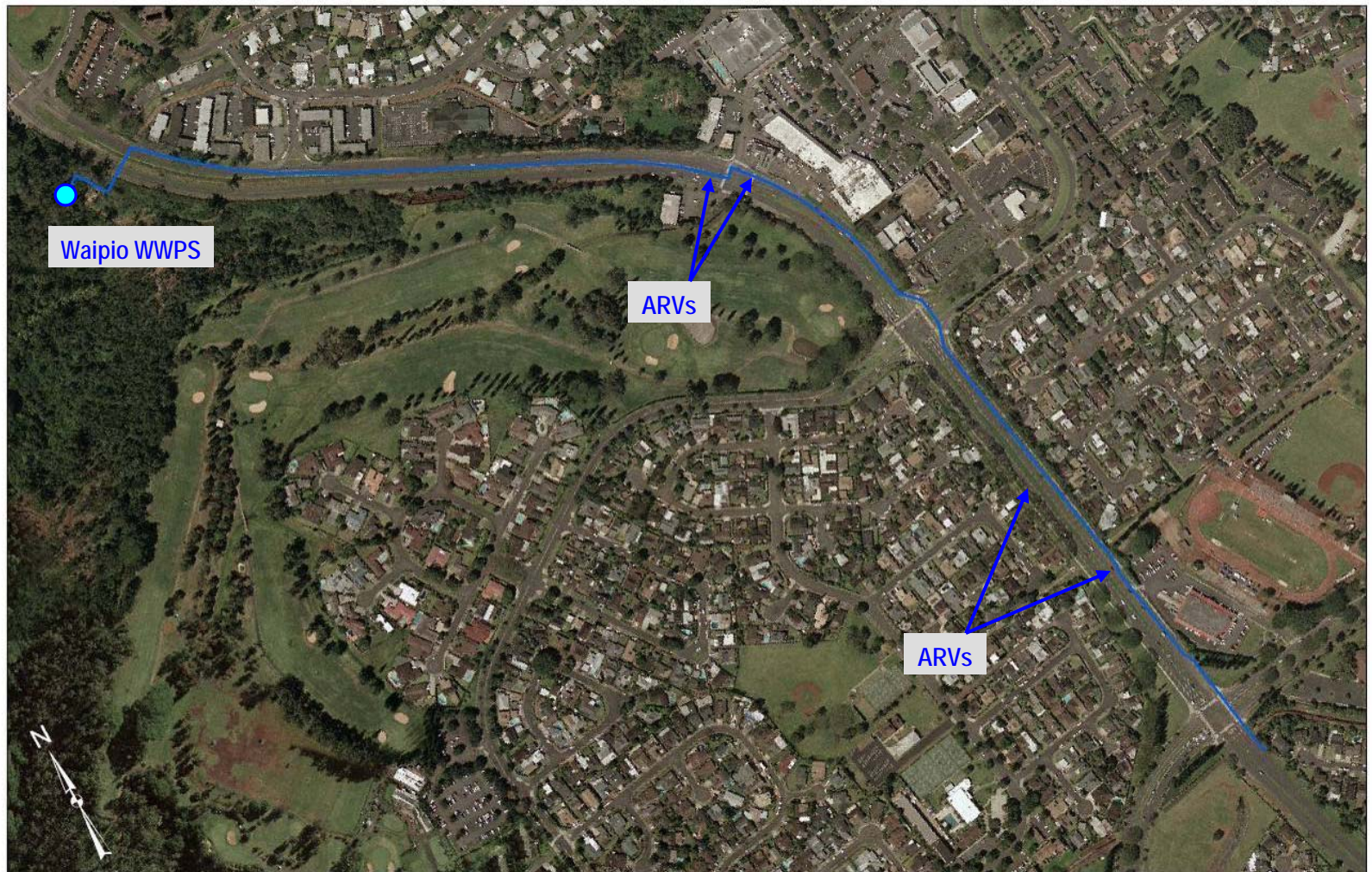


Underestimation of System TDH

- Issue: If system TDH is underestimated, reduced pump capacity could occur
- Verification Process:
 - Recalculated system TDH
 - Checked TDH against pump specifications
 - Verified force main capacity
- Findings:
 - Determined that pumps were designed for the proper TDH
 - Force main capacity is sufficient



Air Binding of Force Main





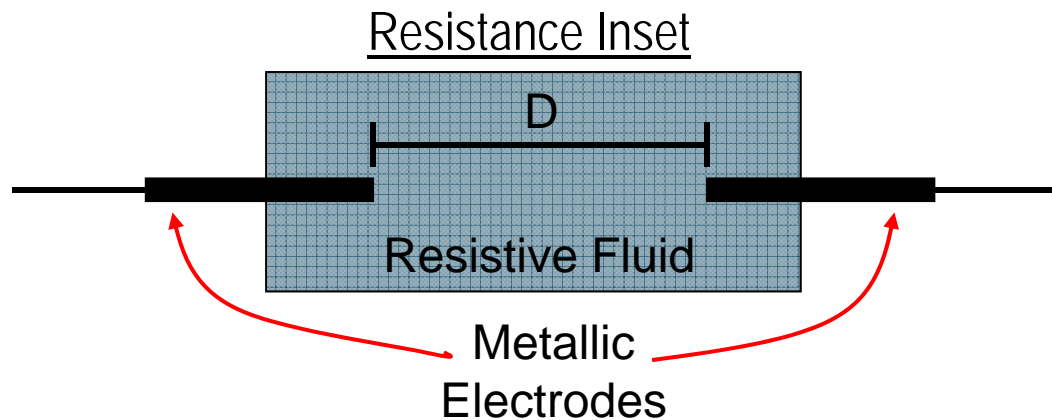
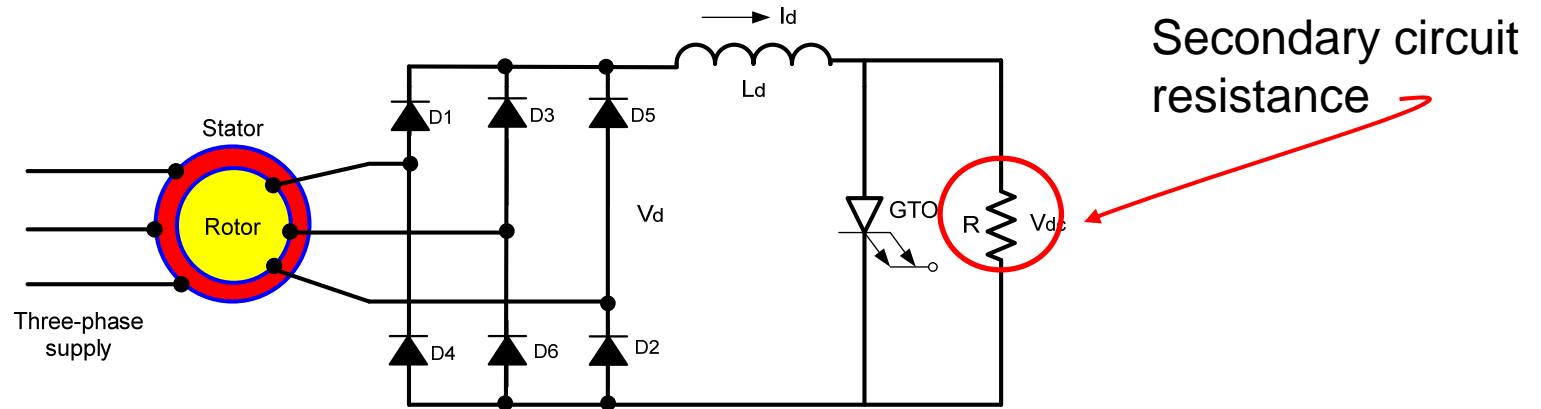
Inaccurate Flow Meter

- Issue: Discrepancy between actual and theoretical capacities could be caused by an inaccurate flow meter reading
- Verification Process:
 - Obtained portable strap-on ultrasonic flow meter for comparison purposes
- Findings:
 - Flow readings from ultrasonic flow meter matched station flow meter
 - Existing flow meter is functioning properly



Issue with FloMatcher Control System

- Issue: Operators indicated that FloMatcher Control System could be affecting capacity





Issue with FloMatcher Control System

- Verification Process:
 - “Bypassed” the FloMatcher during testing
- Findings: FloMatcher settings are restricting pump capacity
 - 1.55 mgd reported vs. 2.5 mgd actual (1 pump)
 - 2.5 mgd reported vs. 3.8 mgd actual (2 pumps)
 - Pumps consistent with their curves
 - “Official” station capacity was underestimated



Alternative Evaluation

- Alternative 1 – WWPS Rehabilitation
 - Cost ~ \$2.2 million
- Alternative 2 – WWPS Replacement
 - Cost ~ \$4.5 million
- Comparison analysis conducted to select preferred alternative
- Evaluation Criteria
 - Capital Cost
 - O&M Cost
 - Sunk Cost
 - Permit Requirements
 - Constructability
 - Construction Impacts
 - Community Acceptance



Selected Alternative - WWPS Rehabilitation

- Improvements to be implemented:
 - New dry-pit submersible pumps
 - New spring-loaded check valves
 - New motor control center and VFDs
 - New SCADA instrumentation
 - Emergency generator upgrade
 - Site drainage improvements
 - Ventilation system upgrade
 - Security improvements
- Report submitted to the City
- Design and construction to follow report



Summary

- Project to address "severe hydraulic deficiencies"
- Design flow is 4.3 mgd
- Purpose to identify/assess deficiencies and prepare a recommendation
- FloMatcher settings causing pumps to have a reduced capacity
- WWPS not as deficient as initially thought
 - Actual station capacity is 3.8 mgd
- Selected WWPS rehabilitation as preferred option
- Urgency of station upgrade has been reduced
- Significant cost savings actualized



Lessons Learned

- Ask questions!
 - Not all useful information comes in writing
- Follow your intuition and instincts
 - Do a “gut check”
- Extra upfront effort can yield significant savings



Questions?

