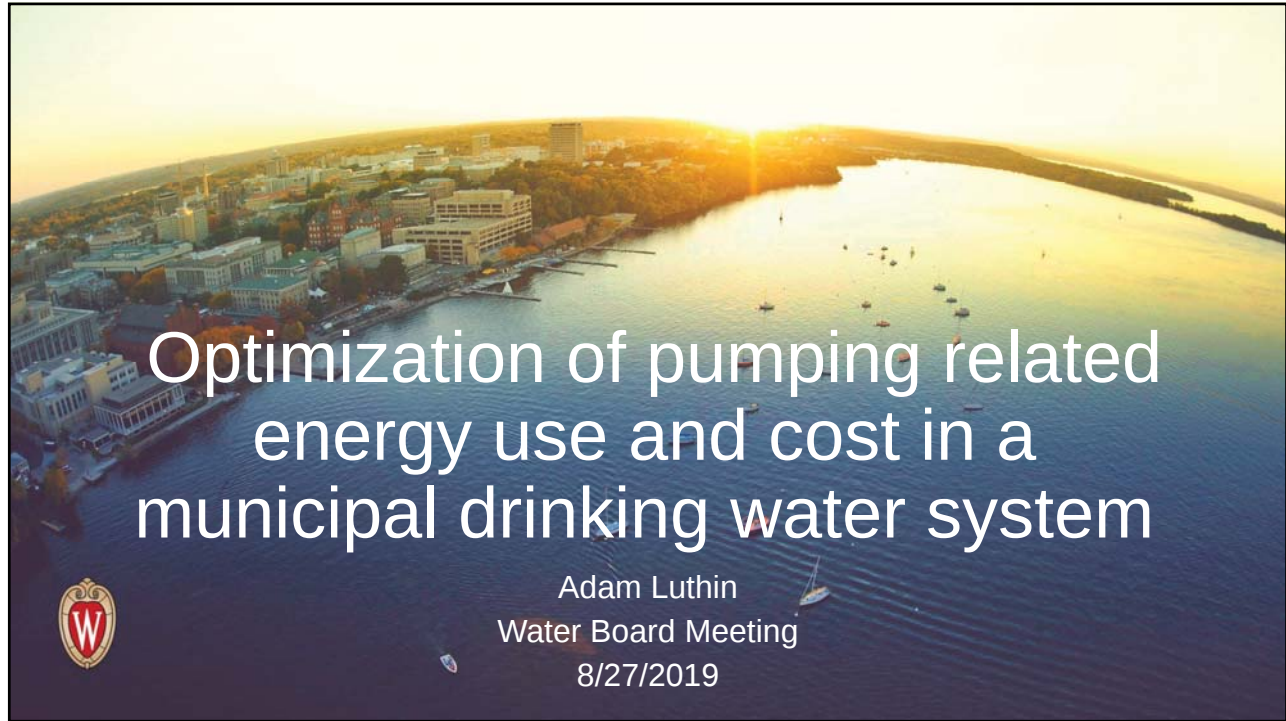
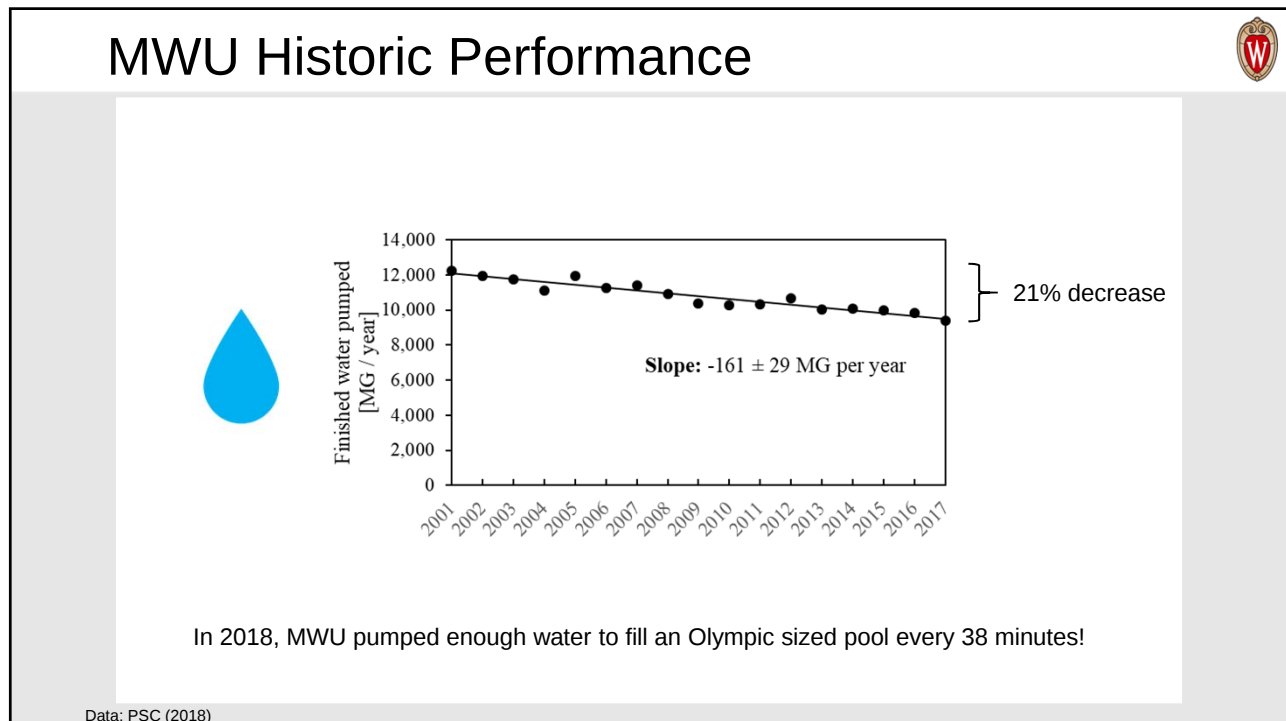




Optimization of pumping related energy use and cost in a municipal drinking water system

Adam Luthin
Water Board Meeting
8/27/2019

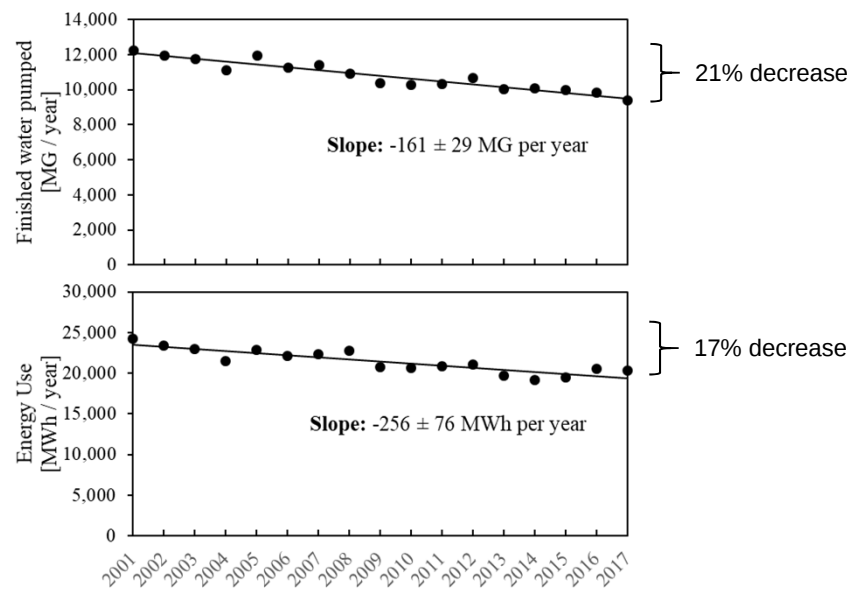
Water and Hippos and Energy



So MWU is basically lifting a hippo hundreds of feet every 1.4 seconds

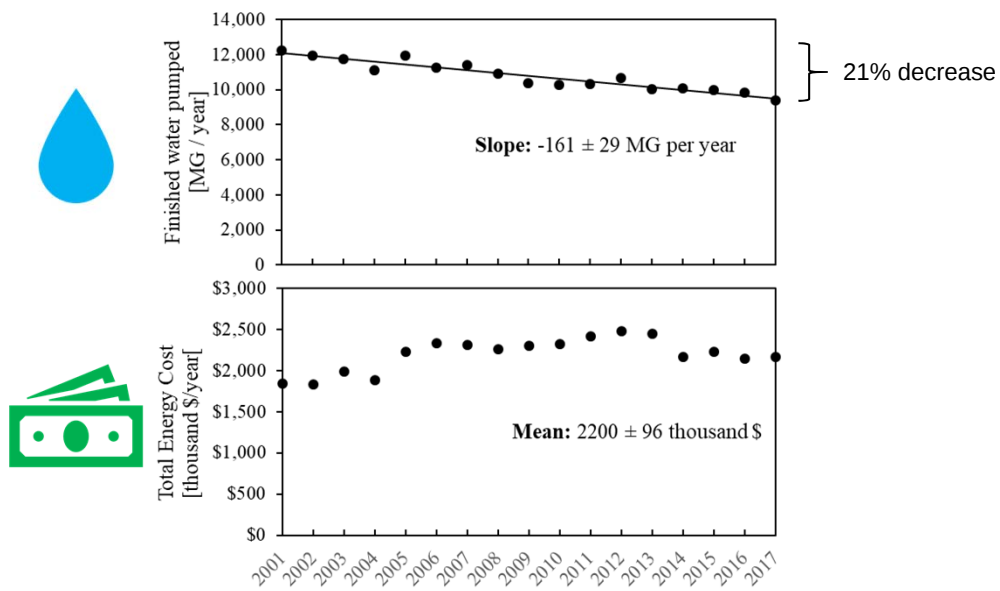


MWU Historic Performance



Data: PSC (2018)

MWU Historic Performance



Data: PSC (2018); BLS (2018)

Cost and Hippos



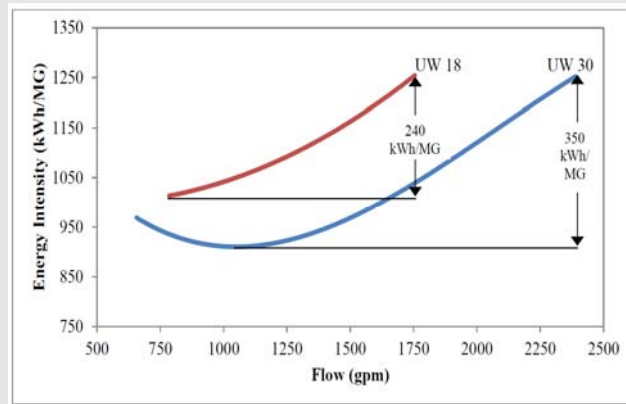
10¢ per hippo!
(Every 1.4 seconds)



Previous Work – Saving energy with VFDs



Energy intensity curves
VFD installation cost ~\$30,000



VFD installation at UW30 – projected to save 180,000 kWh/yr and \$20,000/yr

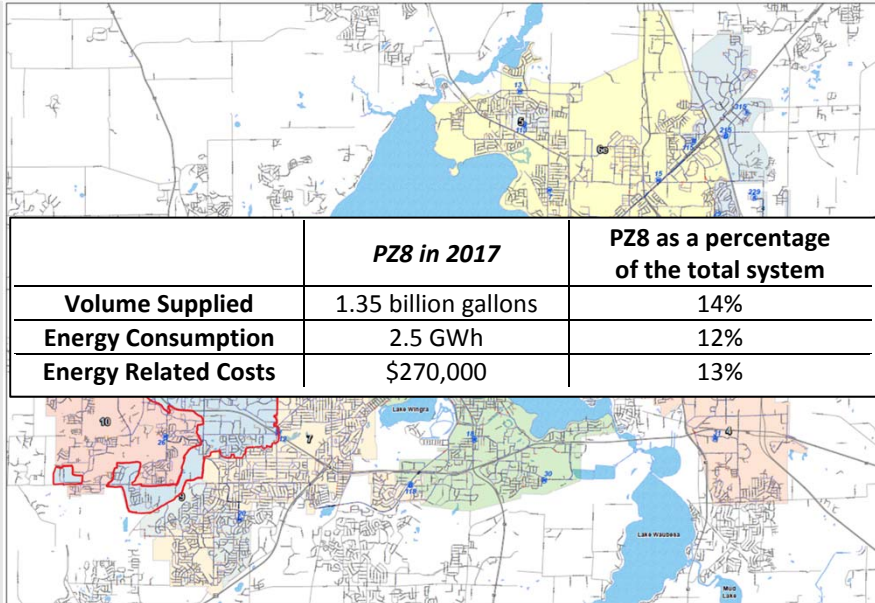
Mancosky 2017

Goal

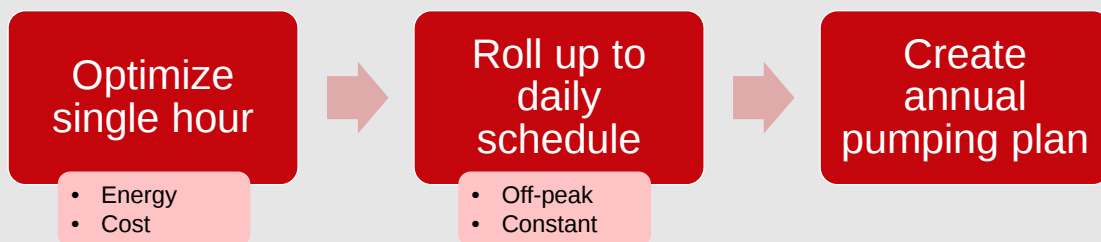


Develop methods to reduce energy consumption and energy related costs in a region of Madison Water Utility

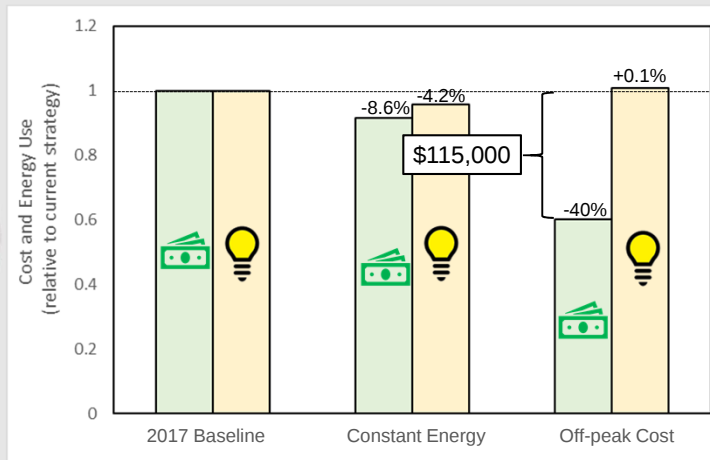
Pressure Zone 8



Annual optimized operational strategy

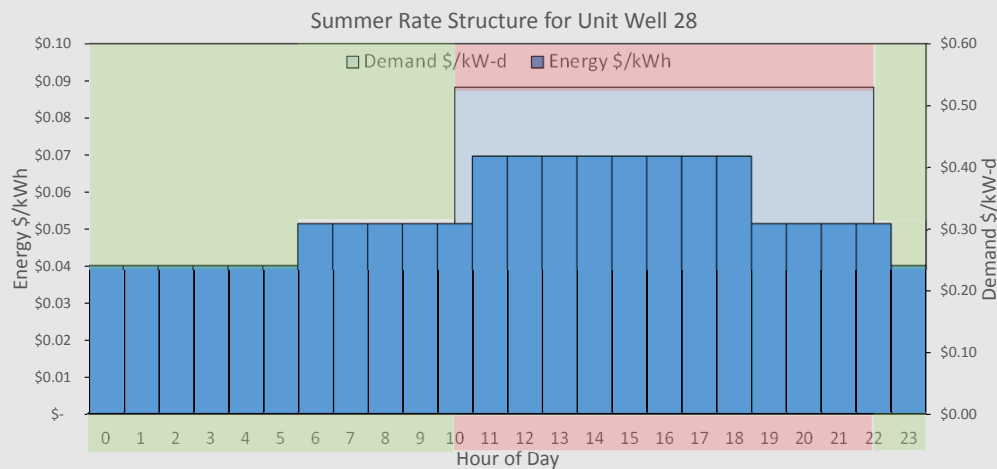


Comparing optimization results



Strategy	2017 Baseline	Constant Energy	Off-peak Cost
Energy [MWh/yr]	2650	2540	2670
Cost [\$ /yr]	\$ 291,000	\$ 266,000	\$ 175,000

Basics of Electric Rate Structures

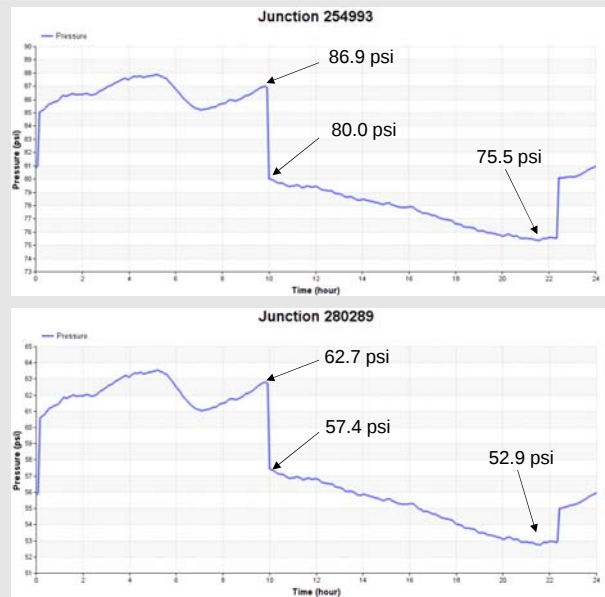
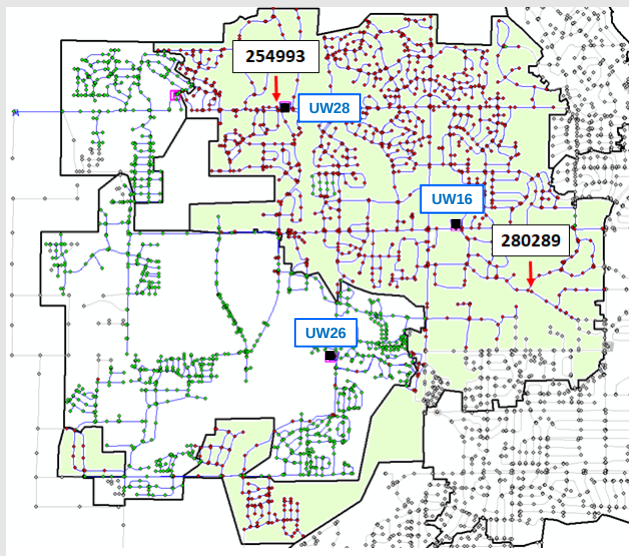


On Peak Demand Charge

Charge	% of Electric Bill
Consumptive	50%
Demand	46%
Other	4%

\$4,205.90

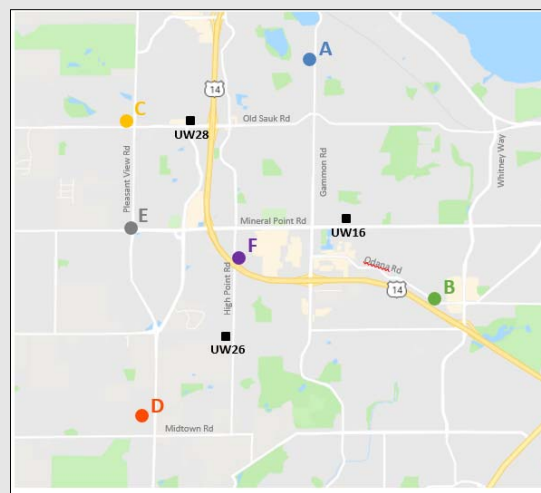
Ran hydraulic models using new operational strategy



Pilot study!



- Running the system in the optimized method

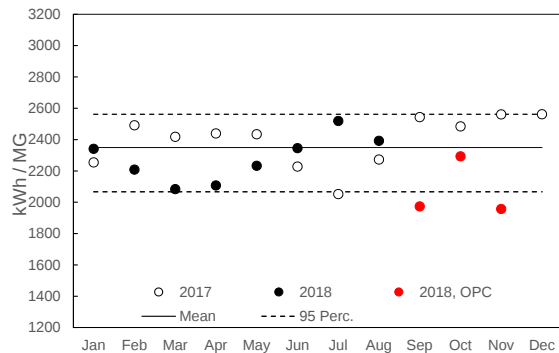


Google Maps (2018)

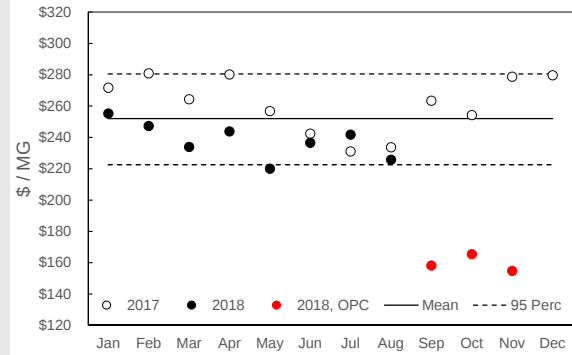
Billing data – UW26, UW28, UW16



Energy Intensity



Cost Intensity



	Savings*
September	\$10,300
October	\$9,500
November	\$10,500
TOTAL	\$30,300

*Savings with respect to average cost from Sep 2017 - Aug 2018 (\$248.34/MG)

Conclusions



- Operational strategy management has the opportunity for significant cost savings!
 - Estimated up to 40% (or \$115,000 annually) in Pressure Zone 8 alone
 - In Pressure Zone 8, this was possible without additional capital investment
- Reductions in energy use are possible (up to about 5%)
- Optimized operational strategy effectiveness is highly dependent on many variables specific to the system

Other work... completed and future.



COMPLETED

- How can infrastructure investments impact savings opportunities?
- Can this be done in other pressure zones?
- How can operators use this information?

FUTURE

- Continue to explore implementation into other pressure zones
- Better understand the implications of water storage
- Develop better usability of schedule generator or interface directly with SCADA system

Thank you!



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Dan Rodefeld
Doug Van Horn