October 25, 2023

One Strategic Step for Fort Worth Water, One Practical Leap for Asset Management

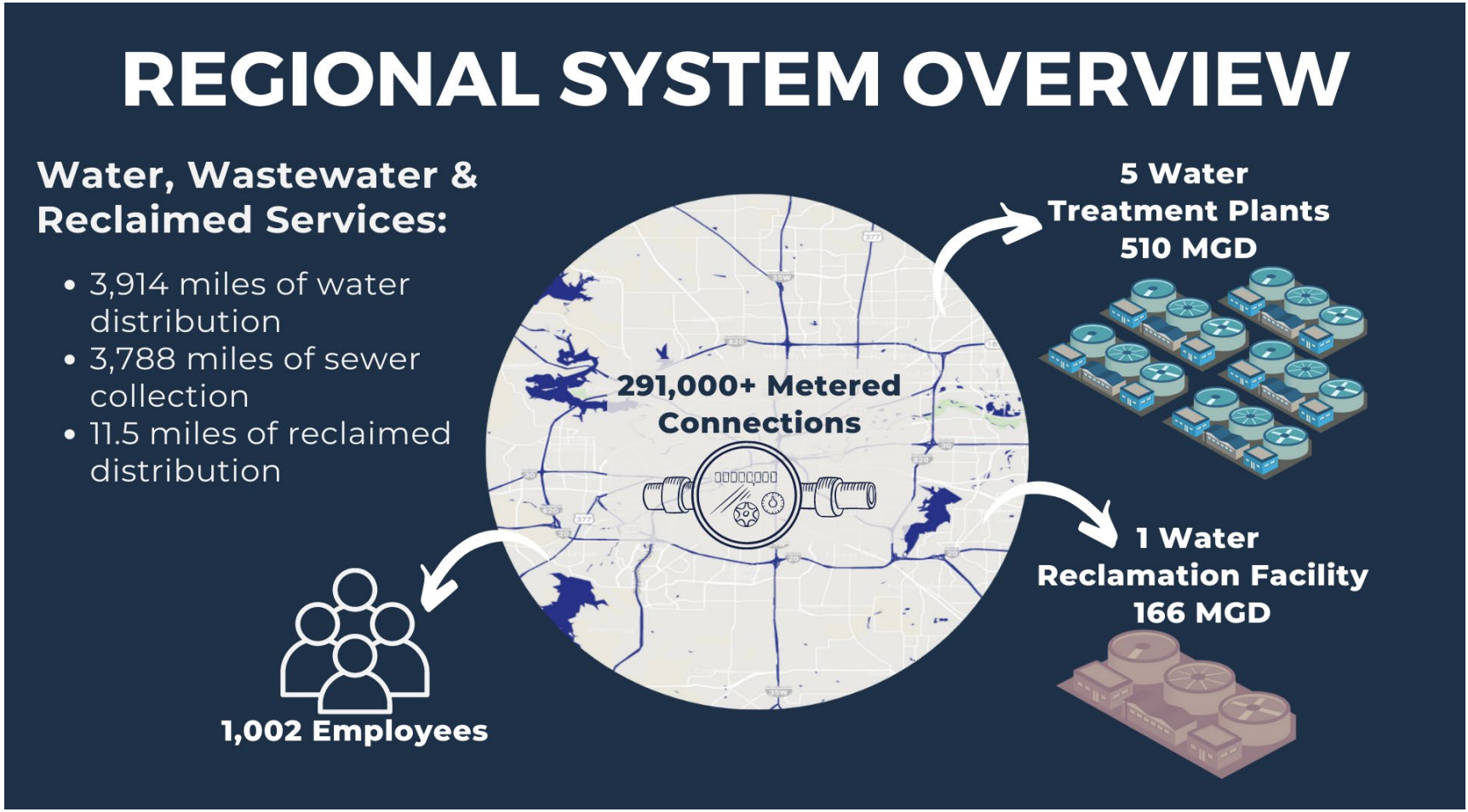
Agenda

- **Background on Fort Worth's Asset Management Journey**

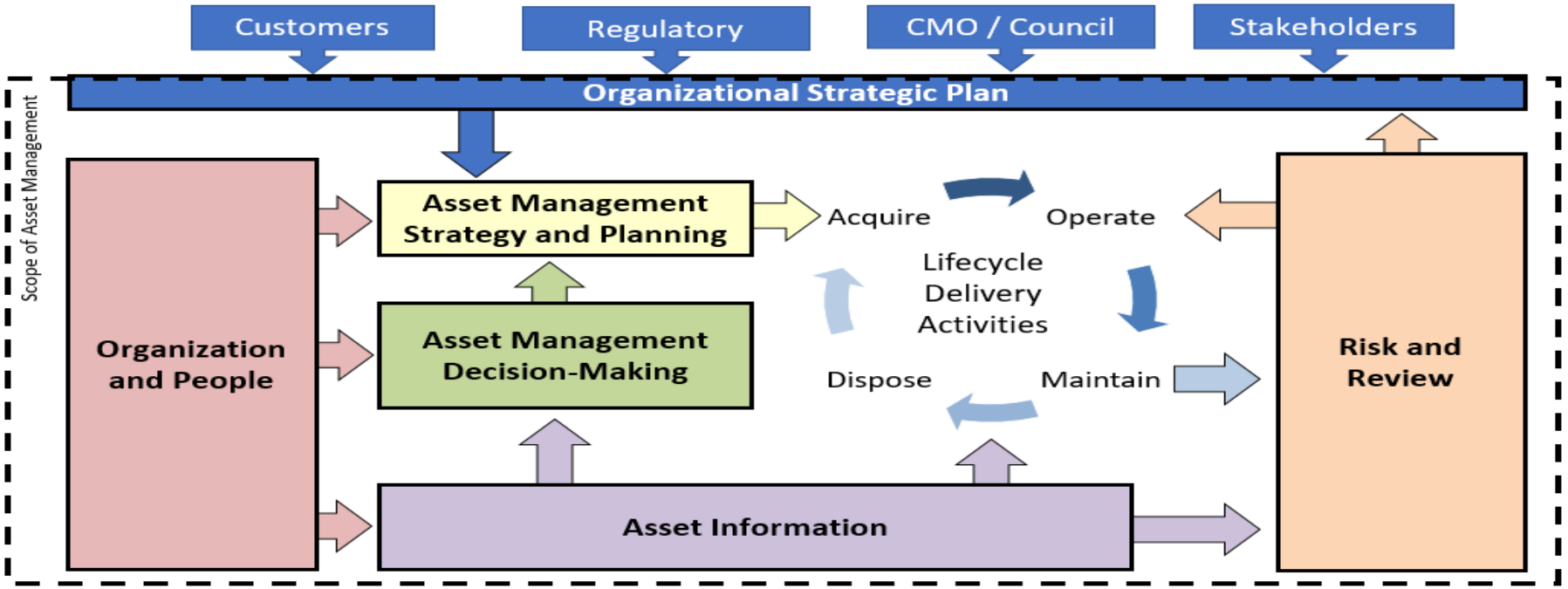
- Leveraging Technology
  - Pilot Tactical AM Plan (Vertical Assets)
  - WECAP/ICAP Program (Linear Assets)
  - MyH2O Program
  - Chemical, Electricity, and Natural Gas

- Lessons Learned and Best Practices

Fort Worth Water



IAM Asset Management Landscape Conceptual Model



Overall IAM Conceptual Model for the Asset Management Landscape

Asset Management Journey

Asset Mgmt. Subject Groups
- Group 1: Strategy & Planning
- Group 2: Asset Management Decision-Making
- Group 3: Life Cycle Delivery
- Group 4: Asset Information
- Group 5: Organization & People
- Group 6: Risk & Review

1900-1975

1946: Report on Water Distribution & Sanitary Sewer Systems
1960: Tarrant County - County Wide Sewage Study
1964: Metropolitan Fort Worth - Water System Study

1913: Ward Maps
1935: Vault Bluelines
1950: Vault Baker Books
1940: Telemetric Control System
1960: Vault ABC Maps
1960: Vault Intersection Maps
1971: Mainframe

1975-1995

1979: City of Fort Worth Distribution System Study
1984: Fort Worth 201 Facilities Plan (Village Creek)
1986: Water and Wastewater Master Plan

1986: Access Fee
1990: Impact Fee Ch. 395
1988: Water Faciliest
1990: AutoCAD and Microstation Map
1991: Water Facilities Upgrade
1989: Fixed Assets Tracking System

1991: City of Fort Worth Master Comprehensive Plan

1995-2005

1997: Static CIP Spreadsheet
2005: CPMS - Life Cycle Scenario

1990: CCTV
2004: GIS
2005: TMA Vertical

2000: City of Fort Worth Comprehensive Plan (New)

1999: Risk Management Plan
2002: Vulnerability Assessment
2004: Water Conservation & Drought Plan

2005-2015

2009: Dynamic CIP Spreadsheet
2009: Adoption of Effective Utility Management Principles Into Utility Business Plan

2007: Fixed Asset Spreadsheet
2010: Reclaimed Facilities
2013: Peoplesoft Financial Asset Management Module

2013: Water Privatization Study

2012: Emergency Response Plan

2015-2020

2019: Asset Management Maturity Assessment
2019: Update Design Criteria & Policy
2016: MAXIMO Phase 2 Vertical

2016: MAXIMO Phase 2 Horizontal
2019: SCADA Reassessment
2019: Risk Based Scoring of Horizontal Assets

2017: Water Department Reorganization

2019: Risk & Resiliency Assessment

2021-2025

2019-2022: AM Maturity Assessment
2022: CIP Framework Implementation
2022: Finalize Strategic Asset Management Plan

2022: Restructuring Asset Hierarchy in MAXIMO
2022: Condition Assessment Scoring Data Collection for Plants

2023: Implement Level of Service Framework

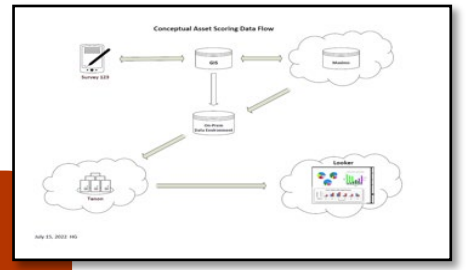
Recent Year Technology Implementation: Manual to Digital Evolution

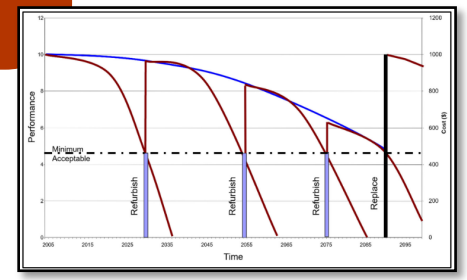
1900-1995

1995-2020

2020-2023

2023 and Beyond





AUTODESK AutoCAD

IBM maximo

ArcGIS

Innovyze

Looker

pipes

Utilizing Technology Guiding Principles

Data-driven decision making

Leveraging data analytics (e.g. data sciences, AI, ML)

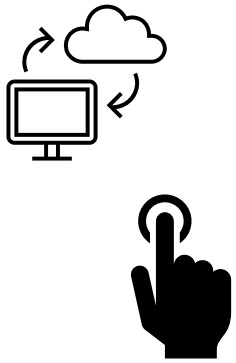
Streamlined communication and collaboration

Evaluating and implementing emerging technologies

Efficient data management

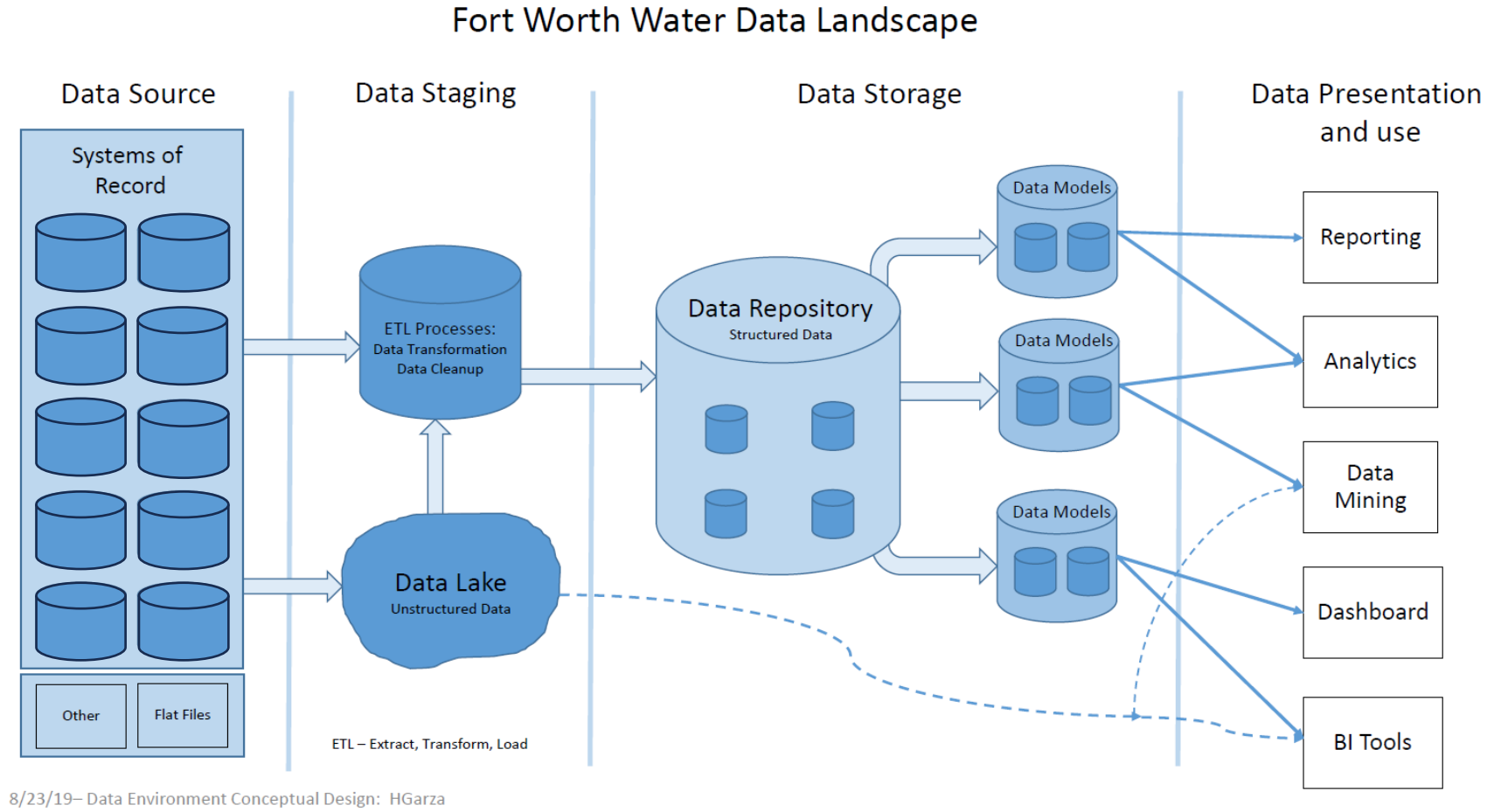
Automation/ optimization (e.g. Data collection)

Data visualization (e.g. dashboards)



NOTE: Overall goal is to enable people through technology

Fort Worth Water Data Landscape



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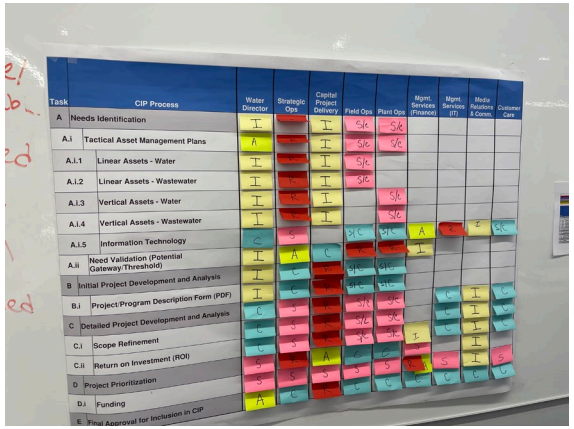
Strategic Asset Management Program

- Collaboration with Executive Leadership Team for a comprehensive asset management program
- Clear service value statements and asset life cycles
- Focus on risk-based decision-making and investment optimization
- Development of Implementation Plan that enables People through Technology



Dashboards help visualize strategies and target the most impactful projects/ actions

Home FORT WORTH WATER - Asset Cost Information for Village Creek Water Reclamation Facility

Location	Criticality	Asset Number	Description of Asset	Asset Location	Labor Cost ($)	Material and Service Cost ($)	Total Asset Maintenance Cost ($)
WVC		2623	Boiler, Heat Recovery Steam (HRSG) [NW of Turbine Room]	WVCERGHRSBOI	$3,784.18	$383,369.80	$387,153.98
WVC		750551	Valve, Turbine 1 Exhaust Diverter Damper, [N of Turbine Room, Below W Stack]	WVCERGGTB001		$184,802.03	$184,802.03
WVC		1737	Pump, Vertical Turbine, Worthington, Effluent, 60 KLD 54, 2nd from E (FE12)	WVCDSGFE1PMP012	$886.80	$180,654.54	$181,541.34
WVC		1234	Pump, Vertical Turbine, Byron Jackson, Effluent, 51VX1STGVCT, (PE23) [PE2 Pump Station, M]	WVCPRIPEP002PMP023	$991.78	$179,121.21	$180,113.04
WVC		5847	Gearbox, from FE12, REBUILT 11/1/19	WVCSUPSPA	$4,861.50	$173,135.32	$177,996.82
WVC		1236	Pump, Vertical Turbine, Byron Jackson, Effluent, 51VX1STGVCT, (PE25) [PE2 Pump Station, E]	WVCPRIPEP002PMP025	$3,286.59	$153,281.86	$156,568.45
WVC		4616	Motor, 800 HP, 2300 V, 197 AMP, 507 RPM, Variable Speed, 3 PH, 60 HZ, For Primary Effluent Pump 22 (PE22) [Sta. PE2, 2nd From W]	WVCPRIPEP002PMP022	$2,960.26	$144,235.07	$147,195.33
WVC		1127	Screen, Fine, Headworks Facility Middle, 2 from N Screen	WVCSCRHWKFSC004	$42,142.76	$98,513.02	$140,655.78
WVC		1122	Screen, Coarse, Headworks Facility W Side, S Screen	WVCSCRHWKCSC001	$17,116.62	$118,946.25	$136,062.87
WVC		1124	Screen, Fine, Headworks Facility Middle, S Screen	WVCSCRHWKFSC001	$26,454.74	$96,926.35	$123,381.09
Total					$2,175,638.55	$9,899,876.32	$12,075,514.87

Asset Maintenance Cost Data from Maintenance Management System

Please Click on Asset Number to view Work Order Details

Work Type
- Select all
- CORRECTIVE
- CUSTOMER
- OVERHEAD
- PMREPAIR
- PREDICTIVE
- PREVENTIVE
- PROJECT
- SPECIAL

Plant Location	Report Date	MRC	Work Order #	Work Type	Description	
WVCSCR	12/13/2015 8:22:00 PM	WRRVCMM2	16-1001	CORRECTIVE	Hole in the compactor pipe (TMA# PC-1601269)	WVCSCRH\
WVCSUP	2/9/2016 11:46:00 AM	WRRVCMM2	16-1005	CORRECTIVE	Repair Conveyor (TMA# PC-1602390)	WVCSUPGI
WVCSLV	2/26/2016 9:12:00 AM	WRRVCMM2	16-1006	CORRECTIVE	Replace Bearings (TMA# PC-1602730)	WVCSLGTH
WVCSLV	3/31/2016 12:00:00 AM	WRRVCIE	16-1019	CORRECTIVE	Investigate Trouble Alarm for DAFT 1 Air Dissolution Tank (TMA# PC-1603385)	WVCSLGDA
Total						

CAN - Canceled; CLS - Closed ; CLS-SKP - Skipped PM; DEC - Work and Documentation Complete and Ready for QA; DEP - Work Complete but Documentation Pending HLD - In Progress
QAC-QA - QA Complete; RTA - Scheduled and Ready to Assign (Assignment Backlog); RTP - Screened and Ready to Plan (Planning Backlog); RTS - Planned and Ready to Schedule (Scheduling
SKP - PMs to be Skipped; WCC - Work Crew Complete (Ready for Supervisor Review); WCW - In Progress (Active Work)

Work Order Type (Corrective vs Preventative) Data and Stats

Home FORT WORTH WATER - Rolling Hills Water Treatement Plant

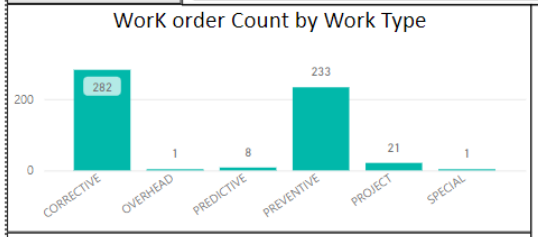
Select all | FY-2016 | FY-2017 | FY-2018 | FY-2019 | FY-2020 | FY-2021 | FY-2022 | FY-2023

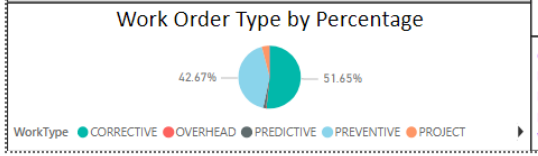
Total Labor Hours: 2,872.40

Total Cost ($): 315,405.93

MRC
- WPRRHIE
- WPRRHMM
- WPRRHOP

reportdate	MRC	wonum	description	Location	CAN	CLS	CLS-SKP	DEC	DEP	HLD	NEW	PHLD	QAC	RTA	RTP	RTS	RTW	SKP	WCC
10/3/2022 12:03:02 AM	WPRRHMM	22-103636	Chlorine Ejector Diaphragm Inspection, Quarterly	WPR-RH-DFNCHLEJE	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
10/3/2022 6:35:27 AM	WPRRHMM	22-103646	Annual cleaning basin 4	WPR-RH-SEDBSN004	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
10/4/2022 12:00:40 AM	WPRRHIE	22-103895	Ozone API Inspection I/E Monthly - P.M.	WPR-RH-DFNOZN	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
10/4/2022 7:54:08 AM	WPRRHMM	22-103953	ROLLING HILLS DESTRUCT BUILDINGS recharge control box ac unit	WPR-RH-DFNOZNDST	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
10/4/2022 8:01:44 AM	WPRRHMM	22-103954	ROLLING HILLS destruct buildings recharge ac units 1-4	WPR-RH-DFNOZNDST	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Total					13	0	9	79	4	15	1	0	355	5	0	5	5	1	50





Work Order Type by Work Order Status

Work Type	Number of Work Orders	Labor Hours	CAN	CLS	CLS-SKP	DEC	DEP	HLD	NEW	PHLD	QAC	RTA	RTP	RTS	RTW	SKP	WCC	WCW
CORRECTIVE	282	1,257.93	13	0	0	52	2	13	1	0	161	0	0	0	3	0	35	2
OVERHEAD	1	4.00	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
PREDICTIVE	8	99.00	0	0	0	3	0	0	0	0	0	0	0	0	0	0	5	0
PREVENTIVE	233	1,040.97	0	0	9	17	1	1	0	0	181	5	0	5	2	1	9	2
PROJECT	21	470.50	0	0	0	7	1	1	0	0	11	0	0	0	0	0	1	0
SPECIAL	1	0.00	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Total	546	2,872.40	13	0	9	79	4	15	1	0	355	5	0	5	5	1	50	4

CAN - Canceled; CLS - Closed ; CLS-SKP - Skipped PM; DEC - Work and Documentation Complete and Ready for QA; DEP - Work Complete but Documentation Pending
HLD - In Progress but on Hold NEW - New Request (Screening Backlog); PHLD - Planned but on Hold; QAC - QA Complete;
RTA - Scheduled and Ready to Assign (Assignment Backlog); RTP - Screened and Ready to Plan (Planning Backlog);
RTS - Planned and Ready to Schedule (Scheduling Backlog); RTW - Assigned and Ready to Work (Active Work) : SKP - PMs to be Skipped;
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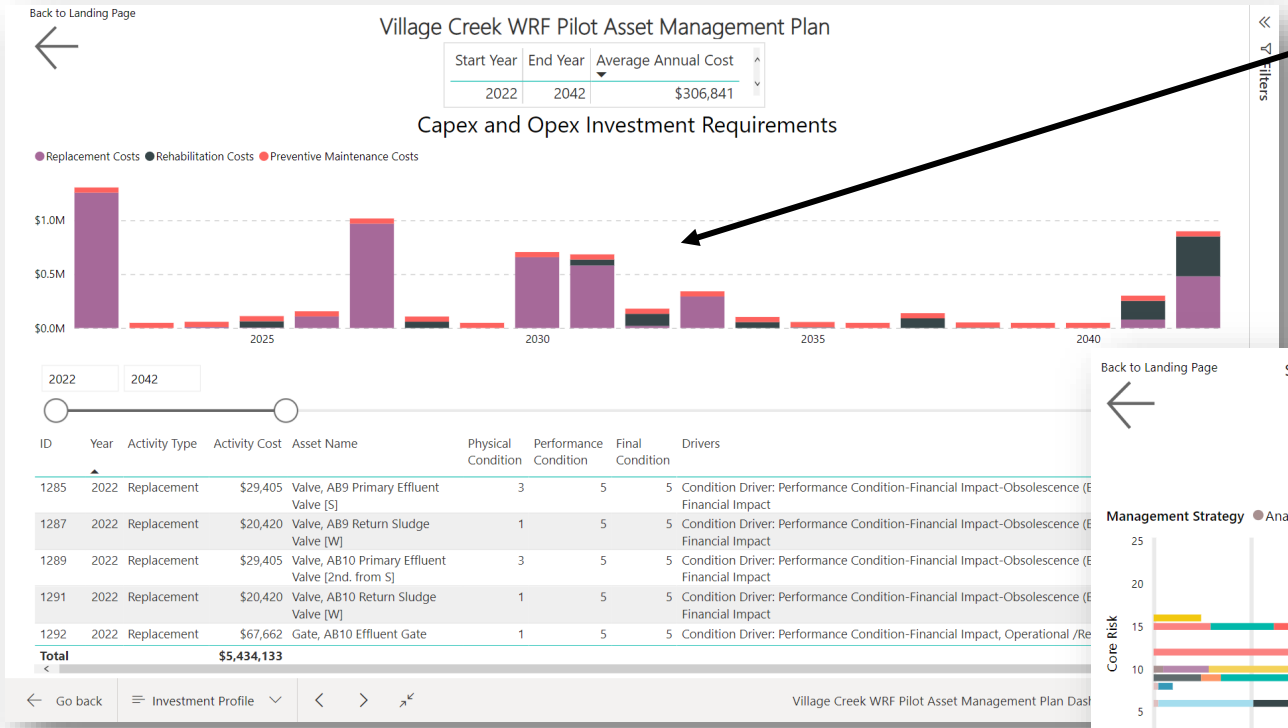
Vertical Asset – Pilot AMP

Asset Management Plan - Dashboard

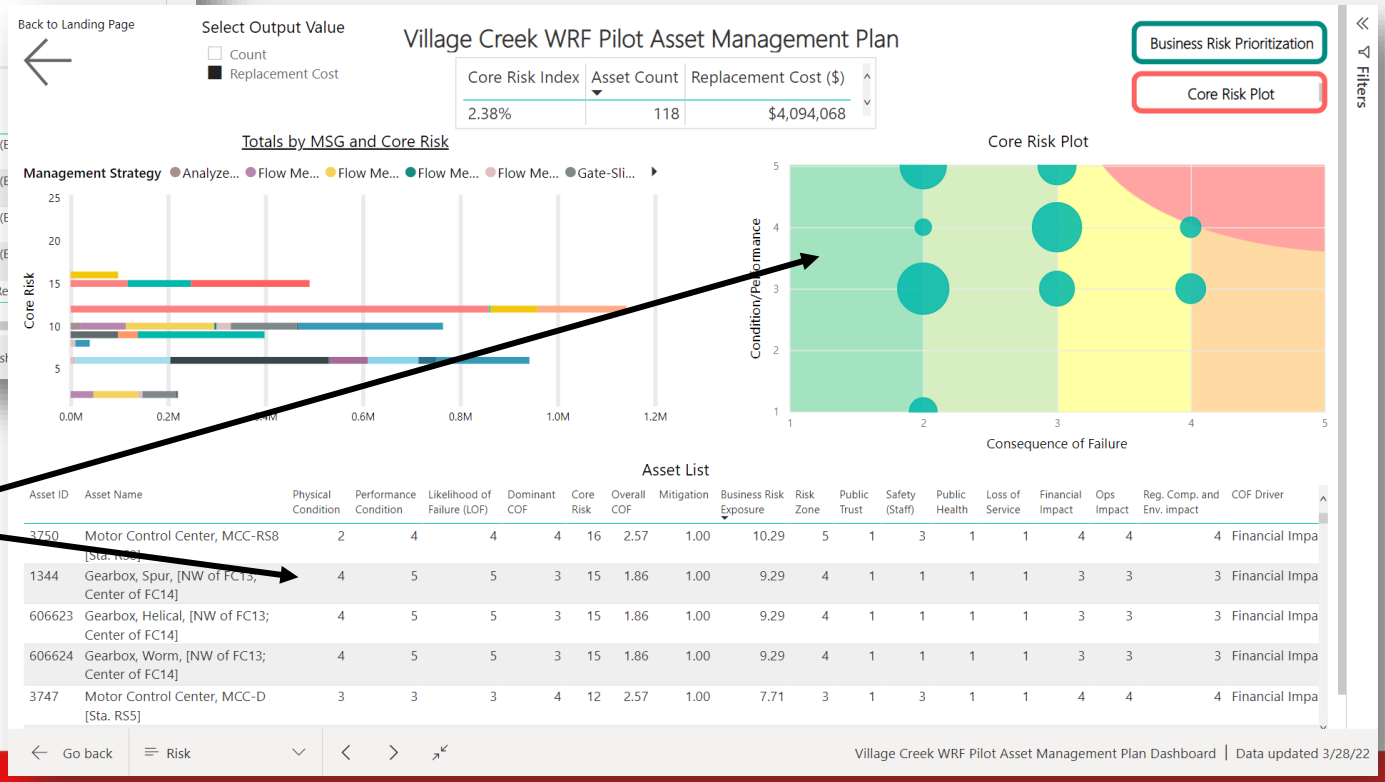
Pilot Assets include:

- Secondary Aeration Basins
- Secondary Clarifiers
- RAS/WAS Pumping Stations

Example Screenshots from AMP Dashboard



Capital (R&R) and O&M Investment Projections based on Management Strategies



Asset Risk Visualization and Risk Register

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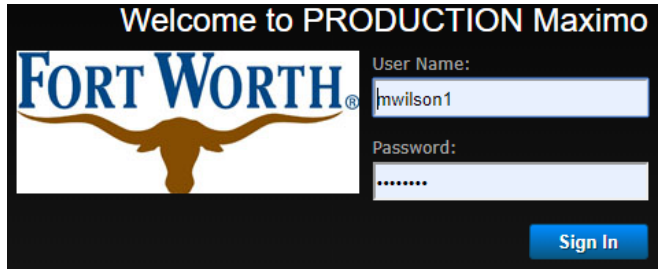
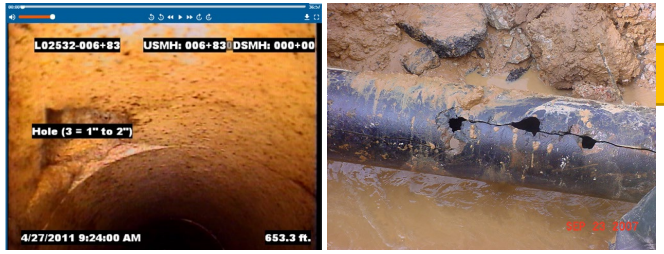
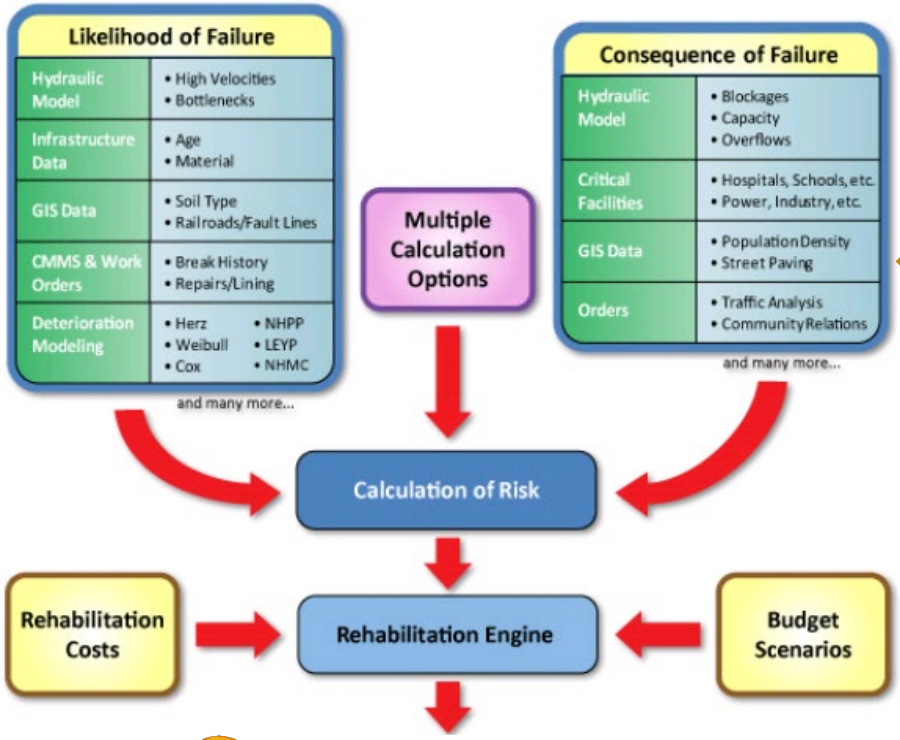
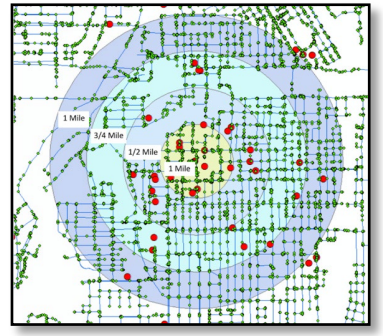
Linear Assets: Process-Flow





Likelihood of Failure (1-10)



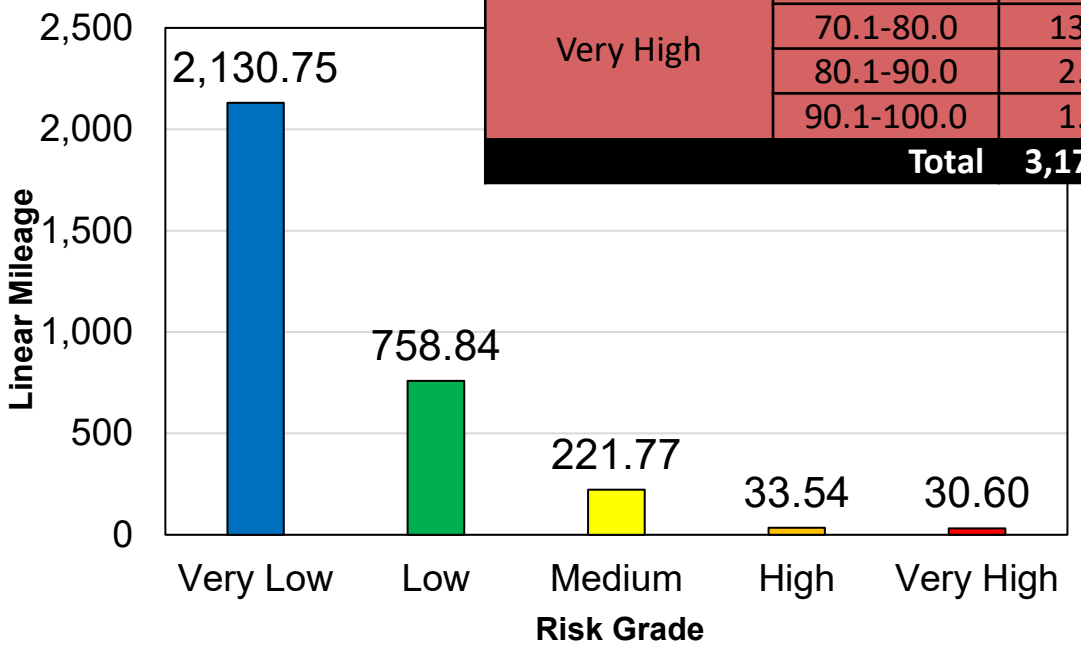


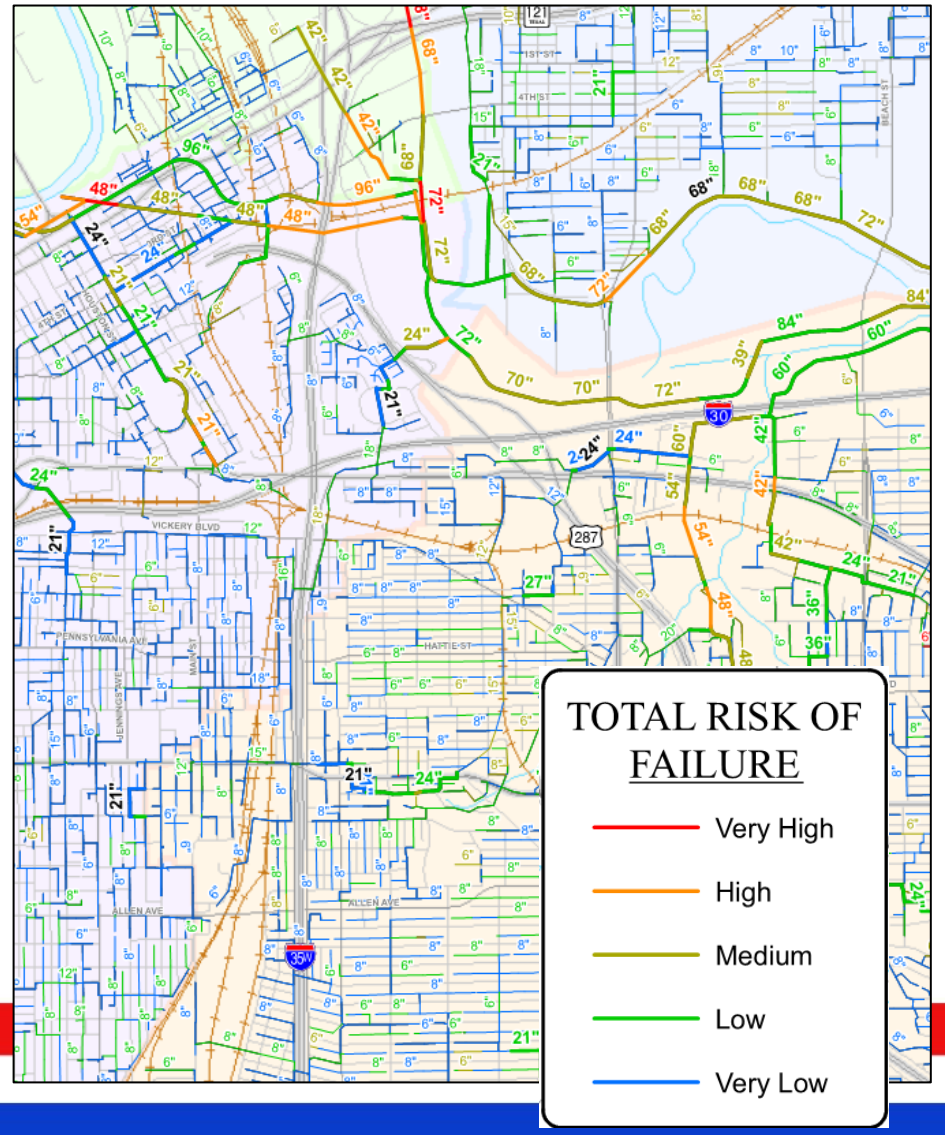
CRITICALITY (1 – 10)

ENGINEERING JUDGEMENT

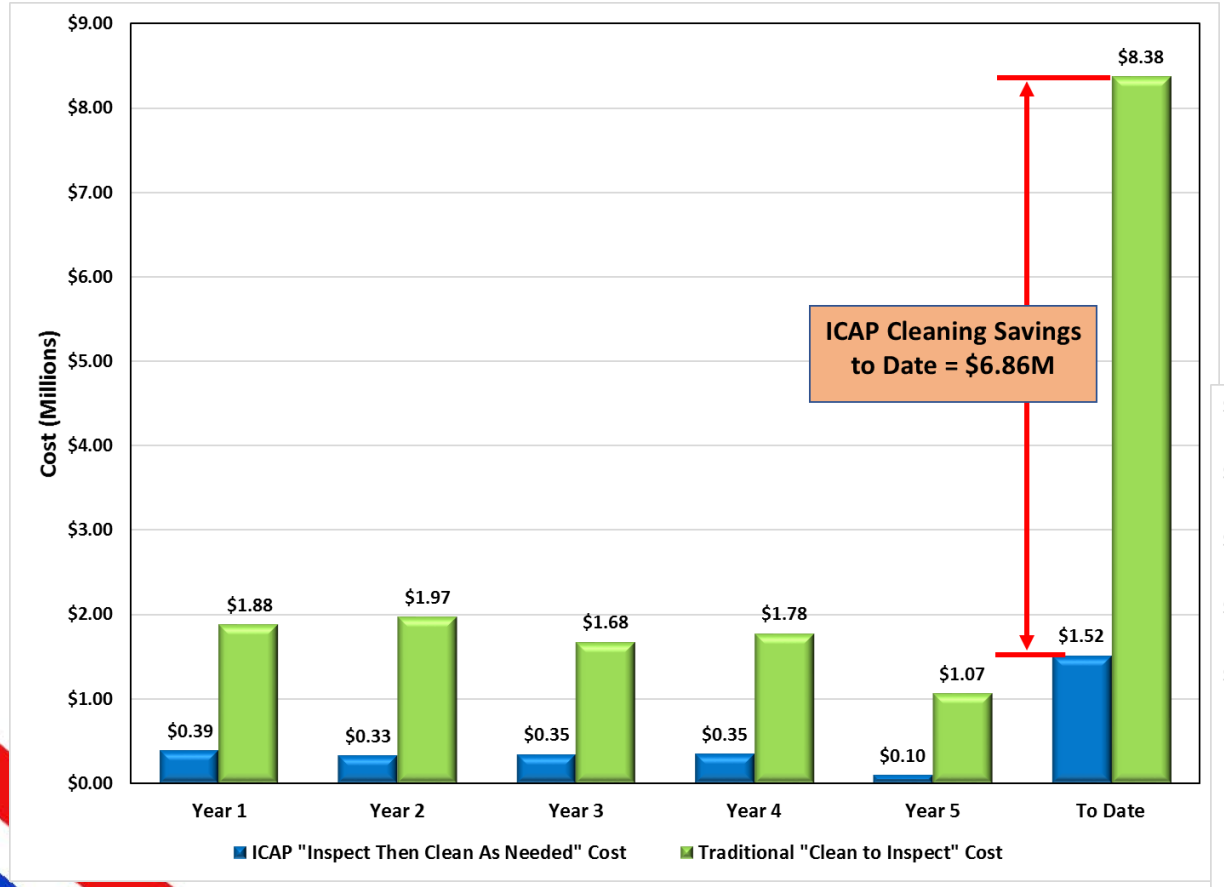
Pipe Risk Scoring for CIP Consideration

Risk Grade	Risk Range	Length (mi)	% of System
Very Low	0.0-10.0	2,130.75	67.1 %
Low	10.1-20.0	536.52	23.8 %
	20.1-30.0	222.32	
Medium	30.1-40.0	152.49	7.0 %
	40.1-50.0	69.28	
High	50.1-60.0	33.54	1.1 %
Very High	60.1-70.0	12.93	1.0 %
	70.1-80.0	13.47	
	80.1-90.0	2.57	
	90.1-100.0	1.62	
	Total	3,175.49	100.0 %

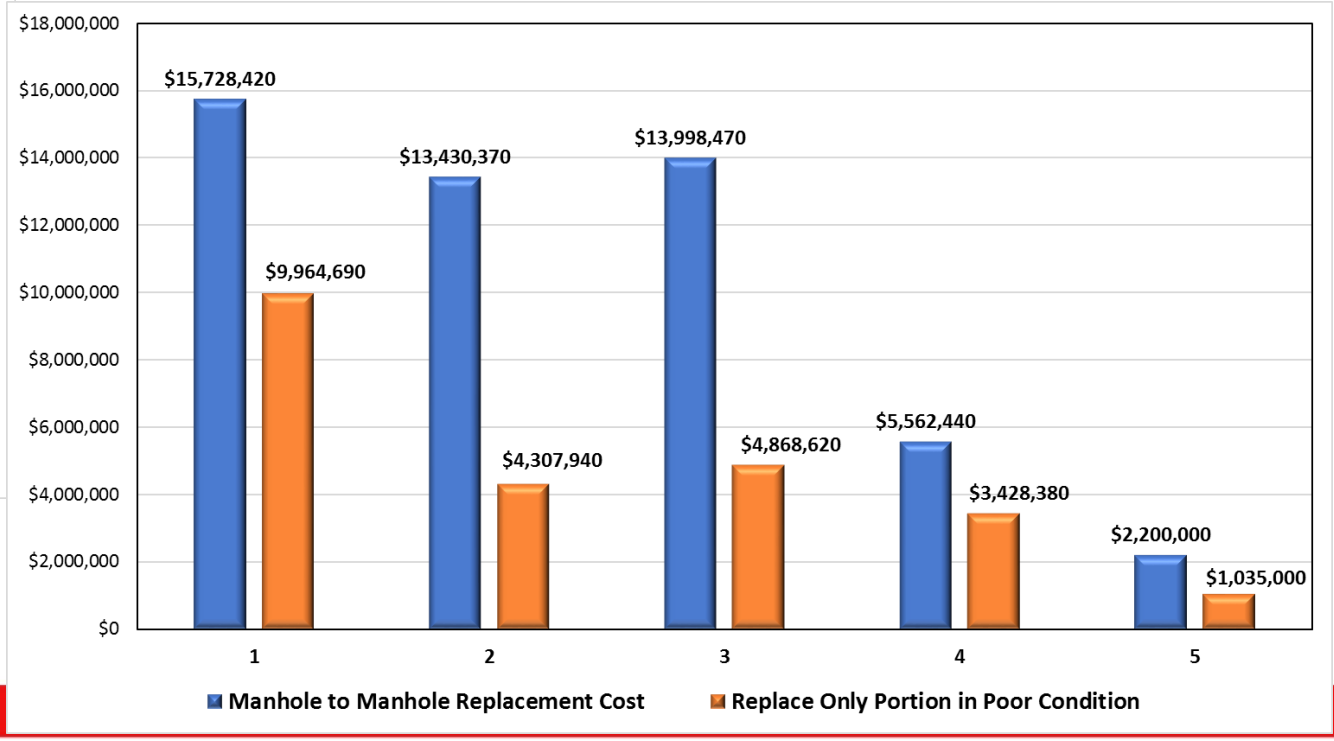




Success with Linear Asset Programs



Identified savings of $27M in wastewater CIP and $7M in operations budget (Years 1-5)



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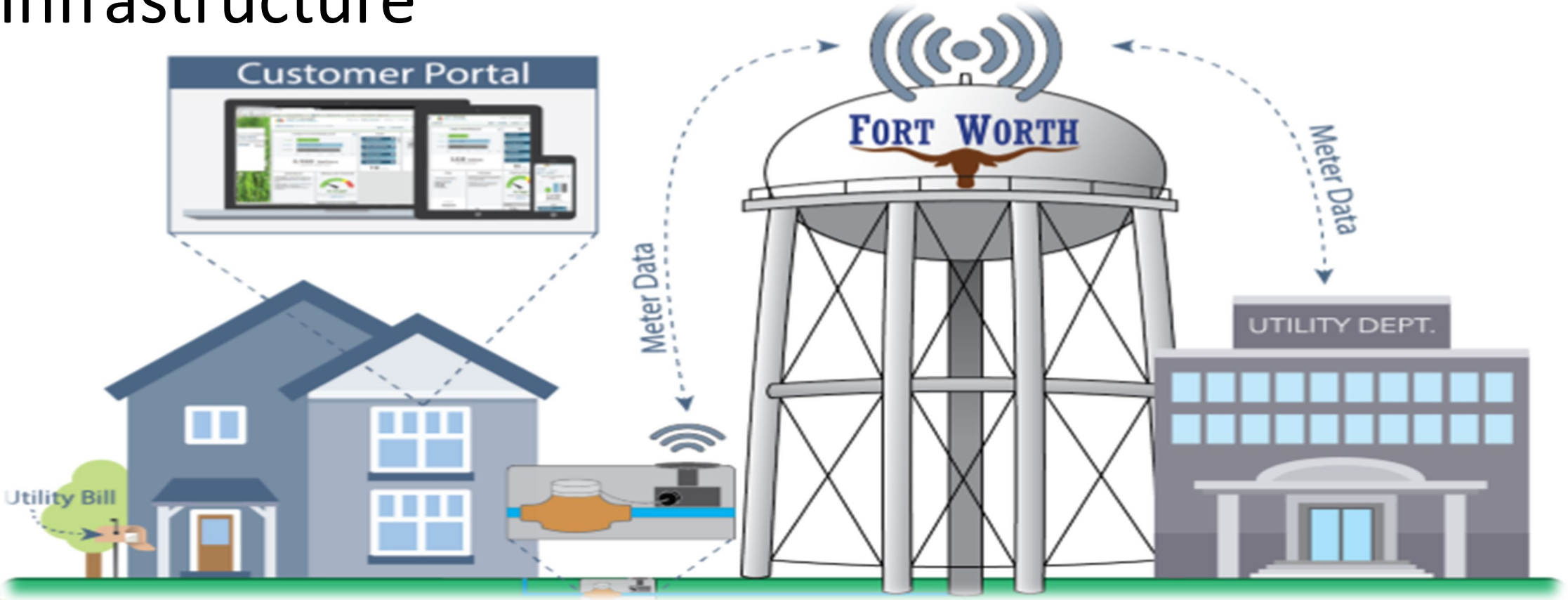
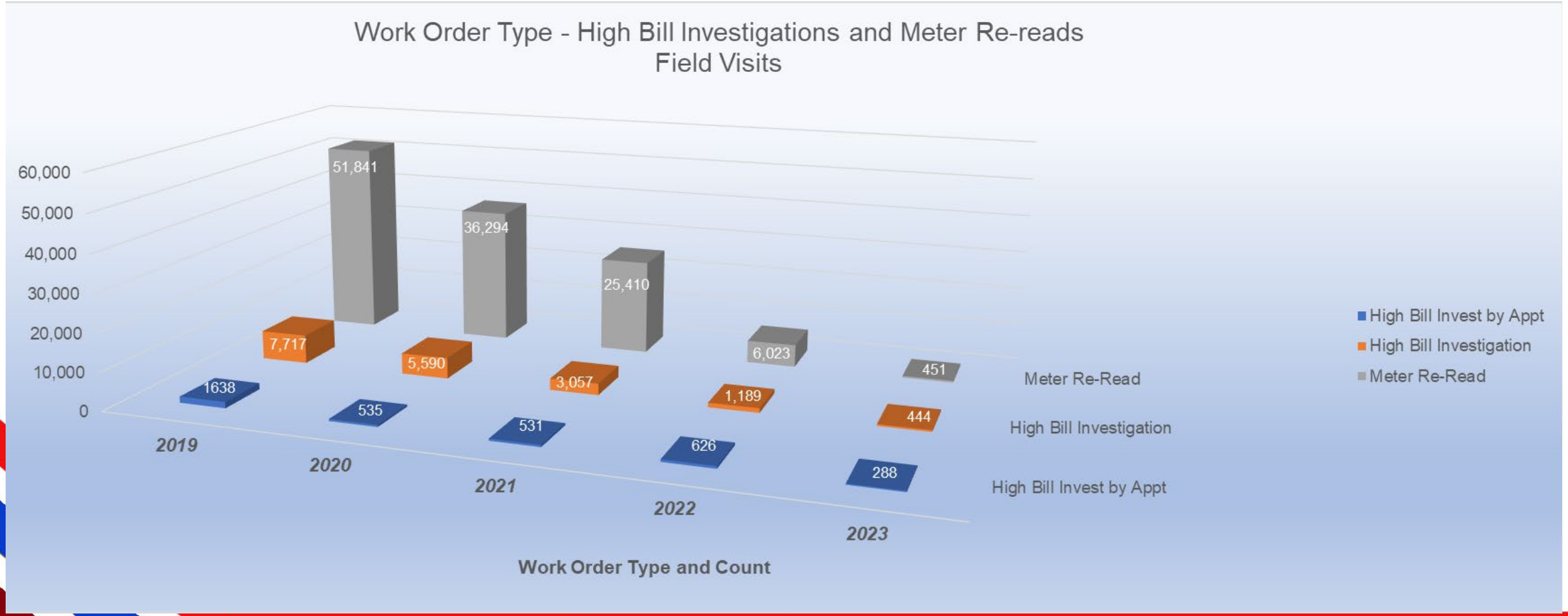
MyH2O Program - Automated Metering Infrastructure



Truck Roll Reduction from AMI Installation



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Chemical Utilization Predictive

ROLLING HILLS											123 MGD	
Daily Inventory Monitoring												
Chemical	Tank #	Level to Overflow		Current Level		Available Capacity to Order (h)			Current Inventory	% Full	How many Truck Loads can we accept?	Daily Usage	Days Supply
Liquid Oxygen	1	100.0 in.	8.3 ft.	65.3 in.	5.4 ft.	34.7 in.	2.9 ft.	7404 Gallons.	16596 Gallons.	55%	1	37,682	13
	2	100.0 in.	8.3 ft.	76.0 in.	6.3 ft.	24.0 in.	2.0 ft.	4436 Gallons.	19564 Gallons.	65%	0	lbs./day	days
	3	100.0 in.	8.3 ft.	62.8 in.	5.2 ft.	37.2 in.	3.1 ft.	8137 Gallons.	15863 Gallons.	53%	1		
	4	100.0 in.	8.3 ft.	48.4 in.	4.0 ft.	51.6 in.	4.3 ft.	12493 Gallons.	11507 Gallons.	38%	2		

Truck Load Capacity	
4,733	Gallons

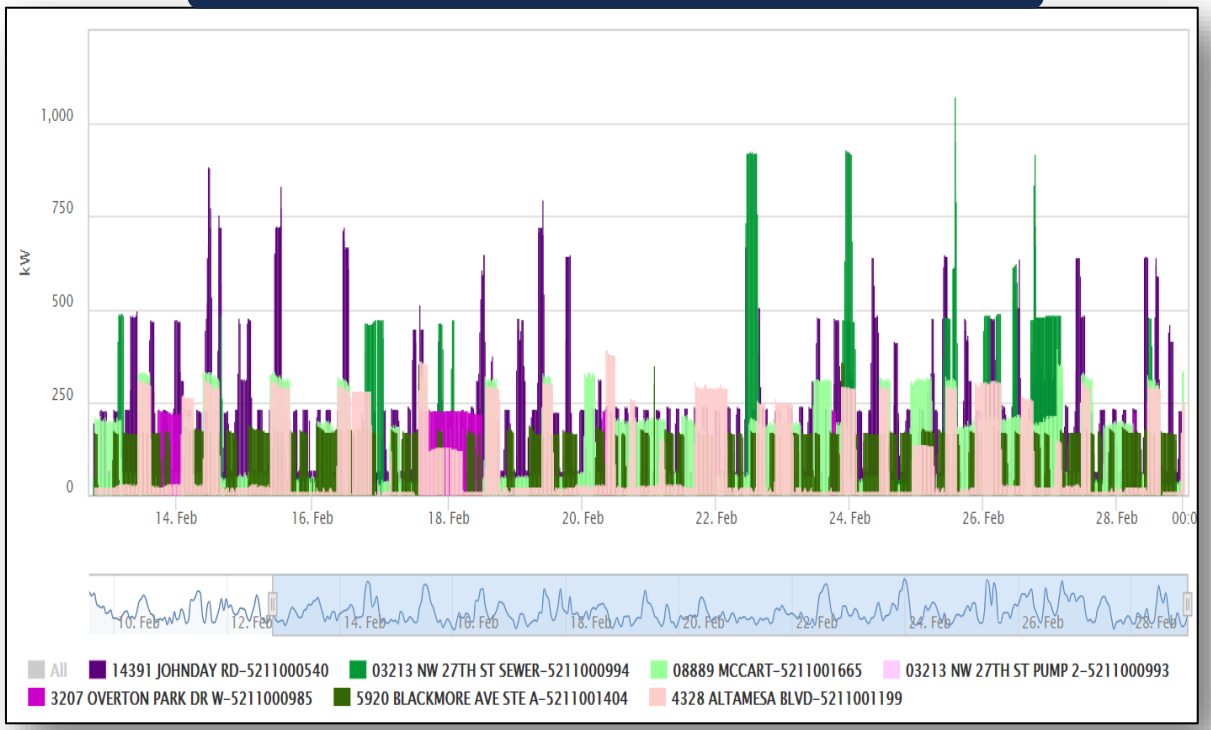
Electricity: Breakdown of Electricity Costs

Goal

- Reduce Power Consumption and Cost ($) through Physical and Operational Changes without compromising water quality

- Understand energy consumption
- Research penalties from ONCOR
- Develop Energy Models to pinpoint energy intensive processes
- Identify/Implement measures that can be taken to utilize energy more efficiently

Water/Wastewater – Pumping Facility Energy Usage



Electricity: Breakdown of Electricity Costs

Two primary components of electricity costs:

- **Commodity Charges**
  - Costs to ***purchase*** the power
  - Fixed contract – stays consistent @ ~$.041/kWh (usage)
- **Delivery Charges**
  - Pass-through charges from Utility (Oncor)
  - Costs to ***deliver*** power (transmission & distribution)
  - ~90% of these charges come from customer demand (kW) rather than usage (kWh)
  - Demand = maximum amount of electricity consumed at a given time

CITY OF FORT WORTH
56001 0605004
900 Monroe Street, Suite 400
Fort Worth, Texas 76102-6319

Service at ESI ID #: 10443720006999507
03213 NW 27TH ST SEWER
FORT WORTH,TX 76106
samuel.steele@fortworthtexas.gov

Bill Date: 06/25/20 **Bill Period - 05/14/20 thru 06/14/20**

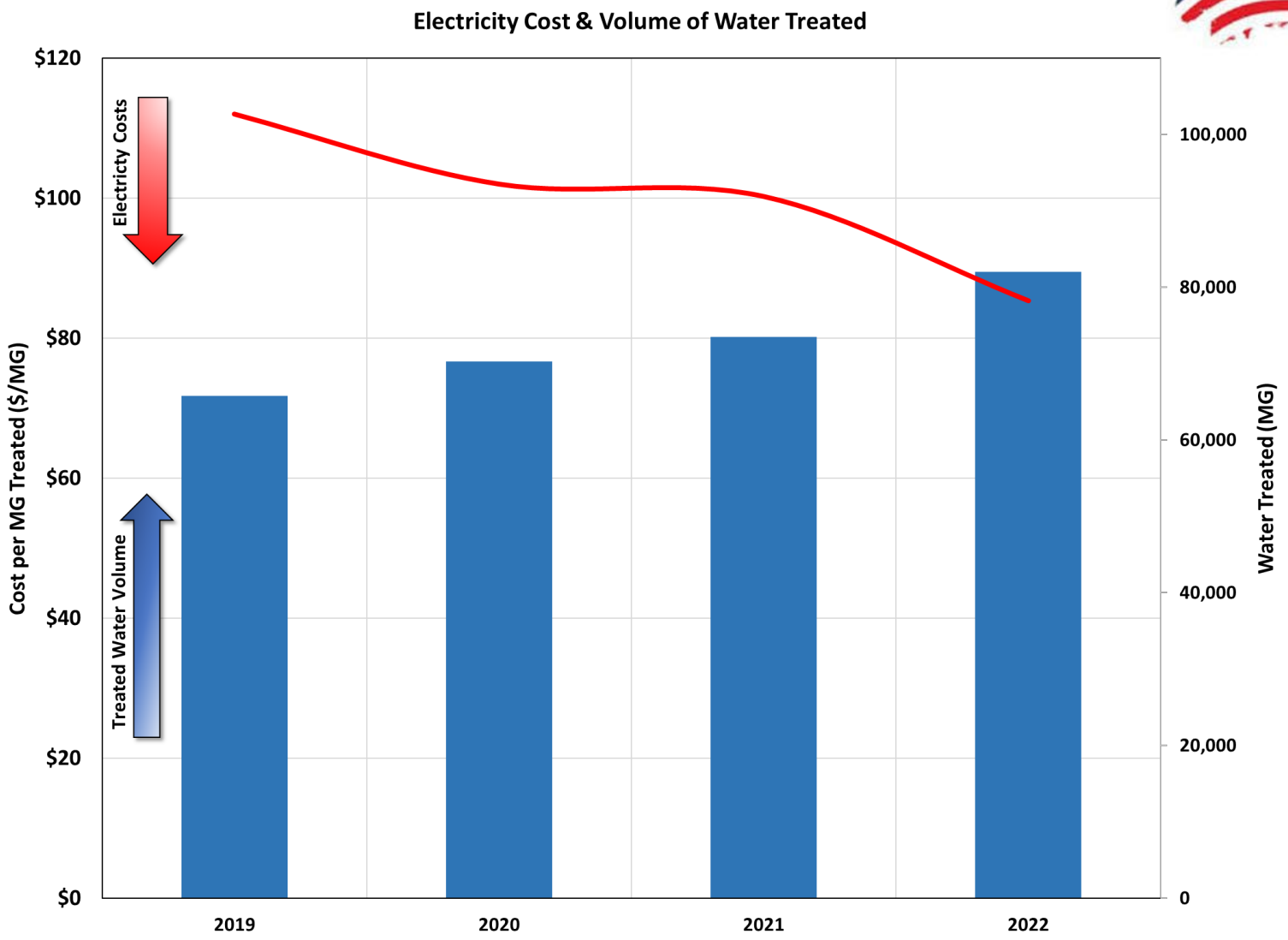
Previous Balance	Current Charges	Payments/Adj.	Amount Due	Due Date
$13,246.09	$18,077.22	-$13,246.09	$18,077.22	07/27/20

Meter	Type	Dates	Current Meter Read	Previous Meter Read	Multiplier	kWh Usage	kW Demand	Power Factor
134289797LG	ACT	06/02 - 06/14	99.6591	0	1600	**159,454.56**	1,498.00	0.891
134289797LG	ACT	05/14 - 06/02	6763.56	6724.24	1600	**62,920.96**	1,498.00	0.891

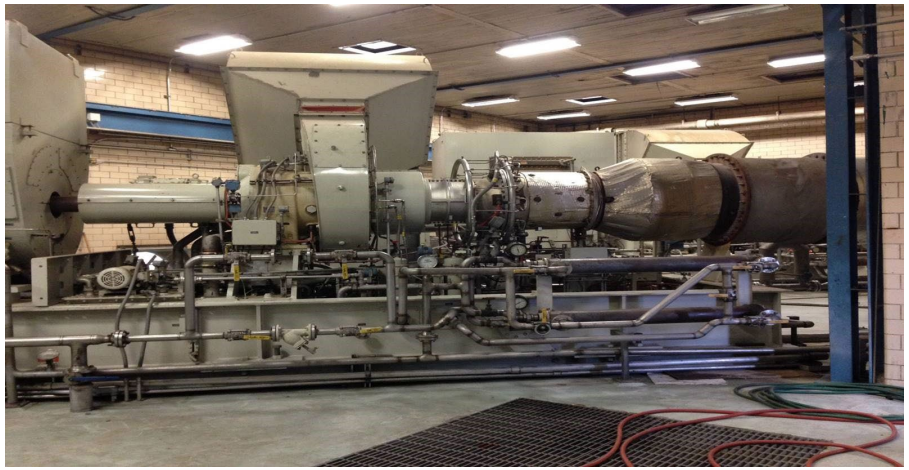
Current Charges	Qty	Rate	Amount
Electric Service			
CKWH : Commercial Energy	222,375.53	0.04113	$9,146.31
HUB-LZ Basis Charge	222,375.53	0.00021	$46.71
TDSP : TDSP Pass-Through Charges			$8,791.46
TRN002:Firm Point to Point Transmission Service Charge for long term or short term firm	*260.00*	*5.12579*	*$1,332.71*
BAS003:Delivery Point Charge	*1.00*	*30.82000*	*$30.82*
MSC041:Energy Efficiency Cost Recovery Factor (EECRF)	*222,376.00*	*0.00035*	*$77.39*
DIS001:Distribution Charge	*1,597.00*	*4.49733*	*$7,182.24*
MSC042:Distribution Cost Recovery Factor	*1,597.00*	*0.09959*	*$159.05*
BAS001:Basic Customer Charge	*1.00*	*9.25000*	*$9.25*
TDSP discretionary service charges			-$65.28
RRR008:Merger Savings Credit	*1,597.00*	*-0.04087*	*-$65.28*
Not Taxable TDSP discretionary service charges			$73.38
MSC024:Public Purpose Program	*222,376.00*	*0.00033*	*$73.38*
Non Taxable TDSP service charges			$84.64
MSC025:Nuclear Decommissioning	*1,597.00*	*0.05300*	*$84.64*
Total Current Charges			$18,077.22
Payments and Adjustments			
Previous Balance			$13,246.09
Payments and Adjustments			
Payment on 06/02/20			-$13,246.09
Total Payments/Adjustments			-$13,246.09
Total Amount Due			**$18,077.22**

Electricity Savings Achieved

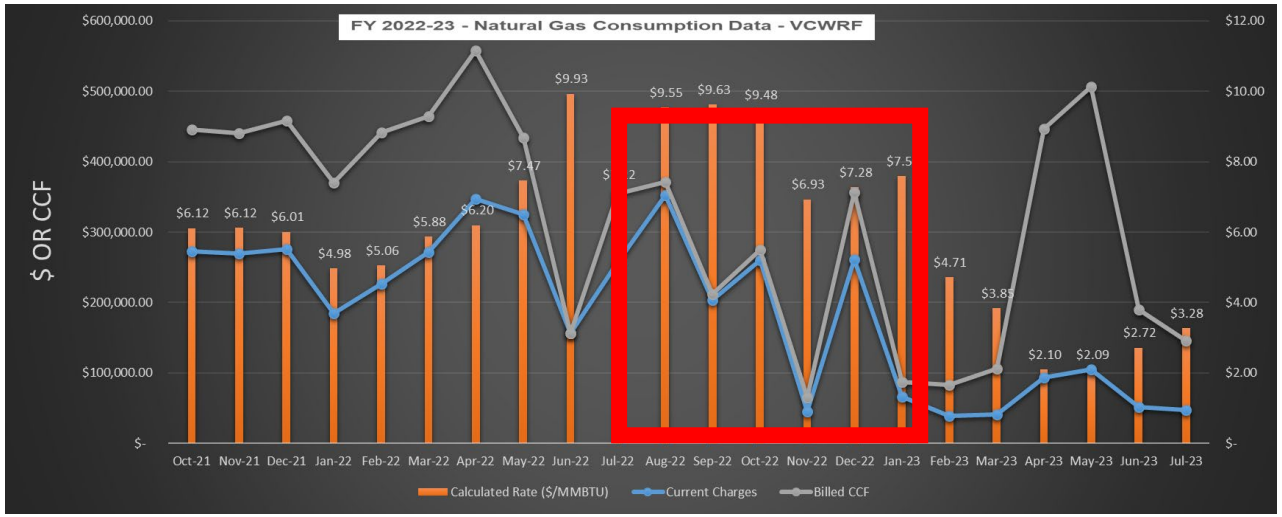
24% savings in $/MG treated water since 2019



Natural Gas - Efficiency Analysis: When to Power Our Turbine?



Description	Unit	Value
Natural Gas Usage for the Month of May - 2022	MMBTU	43,414
Daily Average MMBTU Used (May 2022/31 days)	MMBTU	1,400
Average KWh Produced by Turbine using Natural Gas	KWh	108,890
1 MMBTU of Natural Gas produce KWh (108,890 Kwh/1400 MMBTU)	KWh	77.75
Electricity Rate from Utility ($/KWh)	$/KWh	0.05
Cost-Efficiency Threshold		**$ 3.89**



"If the natural gas price is below $3.89, it is cost-effective to run the turbine to generate electricity; otherwise, it is more economical to purchase electricity from the grid."

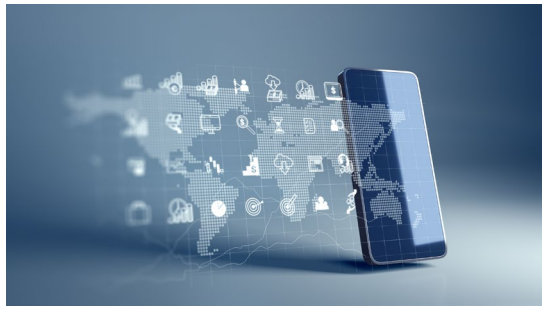
Agenda

- Background on Fort Worth's Asset Management Journey

- Leveraging Technology
  - Pilot Tactical AM Plan (Vertical Assets)
  - WECAP/ICAP Program (Linear Assets)
  - MyH2O System
  - Chemical, Electricity, and Natural Gas

- **Lessons Learned and Best Practices**

Key Takeaways from FWWU's Technology Implementations



- Maximize IoT (Internet of Things)
- Leverage centralized AM system – improve visibility
- Effective change management strategies
- Improve data analytics capabilities

Best Practices for Successful Integration of Technology in SAM Programs

- Assess/build upon existing processes
- Define clear objectives
- Engage stakeholders at all levels
- Establish robust data management practices
- Provide comprehensive training
- Continuous improvement

For Additional Questions

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Opportunities