



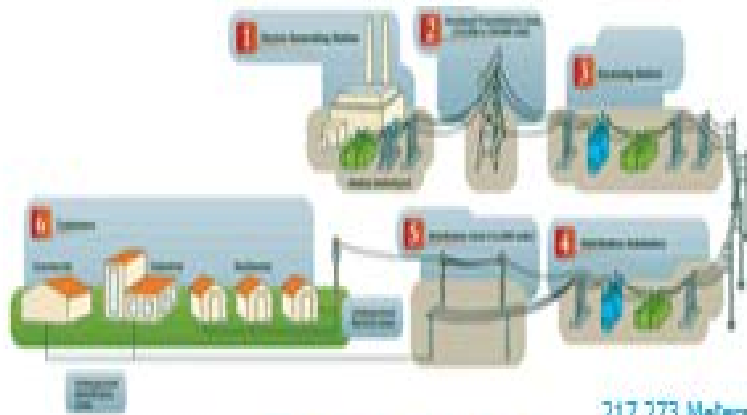
Colorado Springs Utilities

It's how we're all connected

PROVIDING VALUE IN REAL-TIME
FOR WATER TREATMENT
AND ACROSS THE ORGANIZATION

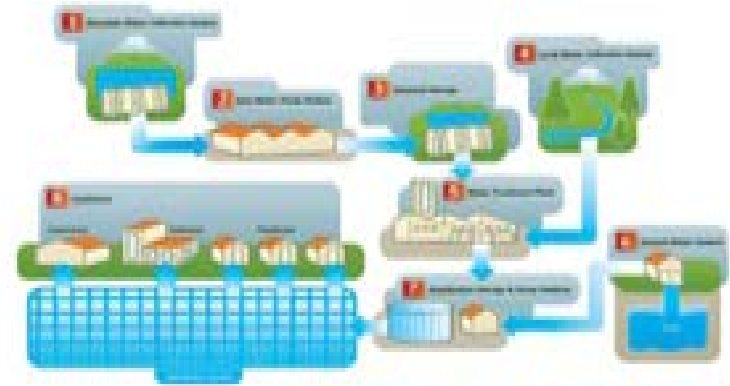


Colorado Springs Utilities – 4 Service Utility



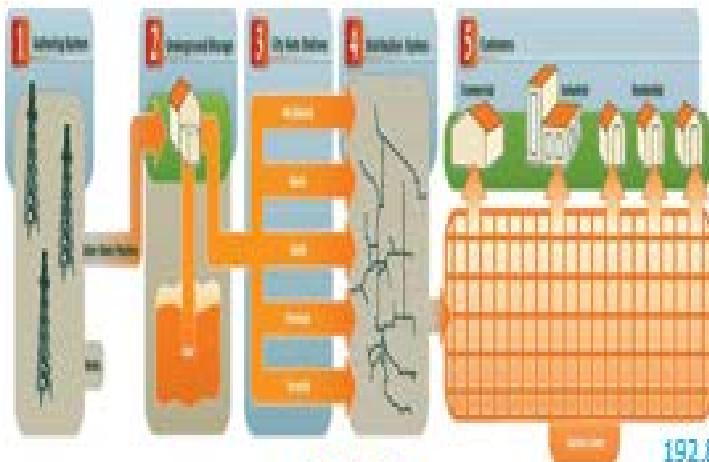
ELECTRIC

217,273 Meters
 4 Hydro Electric Plants
 2 Gas Plants
 2 Coal Plants
 Contracted Solar
 Generating Capacity 1164MW's



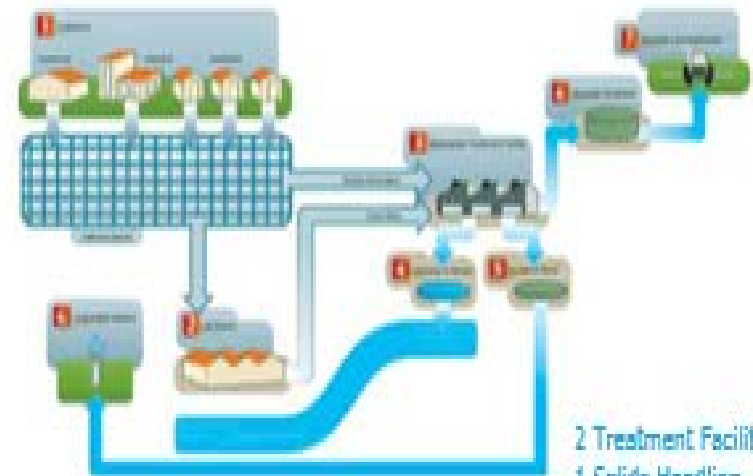
WATER

137,619 Meters
 6 Water Plants
 Treatment Capacity 286 MGD's



GAS

192,872 Meters
 7 Gate Stations
 Net Volume Throughput 269.8 MCF's



WASTEWATER

2 Treatment Facilities
 1 Solids Handling Facility
 19 Lift Stations
 Treatment Capacity 38 MGD's

The Challenge

- New Water Treatment Infrastructure
- Antiquated Reporting System
- But we did have:
 - Physical Infrastructure in Place
 - Technical Infrastructure in Place
- Now the business needs help...what do you do?



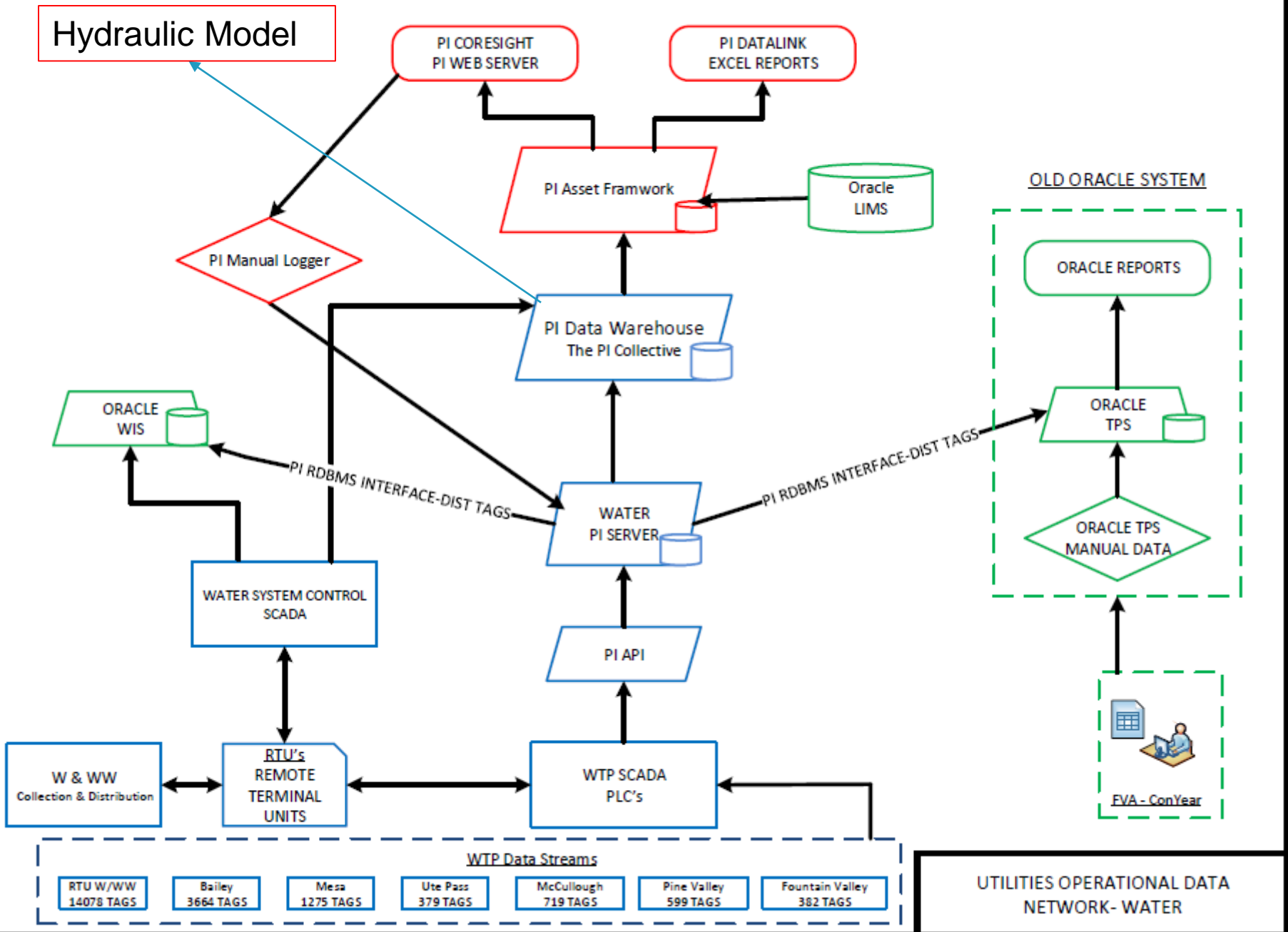
Providing Value in Real-Time

- What did it take?
- Each Plant needed 20 reports for
 - Conveyance
 - Compliance
 - Process
 - Management Analytics

Based on their individual permits, treatment capacity, specific treatment processes and existing instrumentation

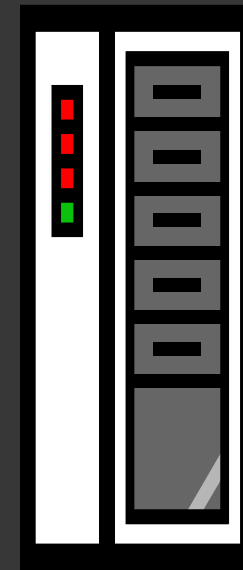
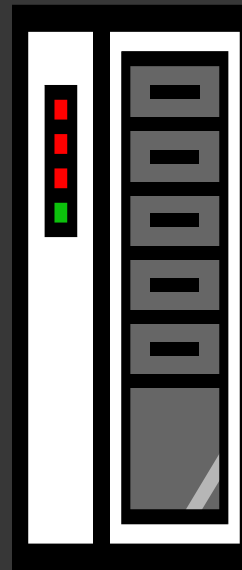
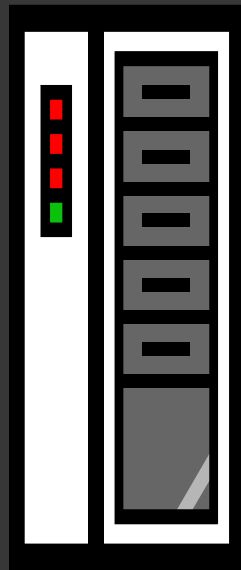
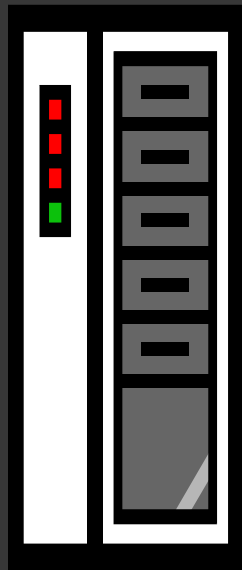
- Mobile Device Capability
- Adhoc Analytics & Excel Reporting Capabilities – what other CSU groups are doing
- Energy Monitoring and Management for WW

Hydraulic Model



Enterprise Information Infrastructure

The PI Collective



PI Data Warehouse
Primary

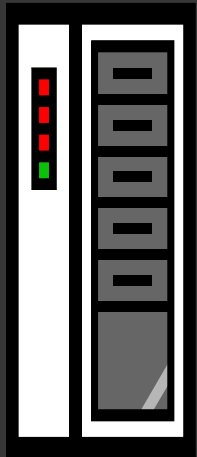
PI Data Warehouse
Secondary

PI Asset
Framework
PI Asset
Framework
PI Notifications
PI Abicus

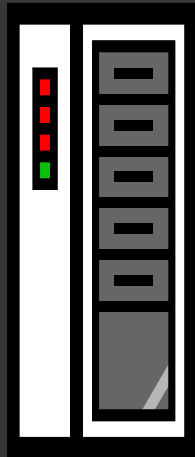
PI WebServer
PI Coresight
PI Manual Logger
PI Webparts Integrator
PI To GIS Integrator

PI SDK & PI System Management Tools for Discovery,
Failover, Failback and Load Distribution Services

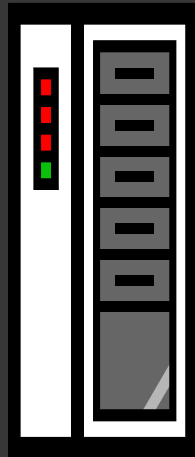
Source PI Servers



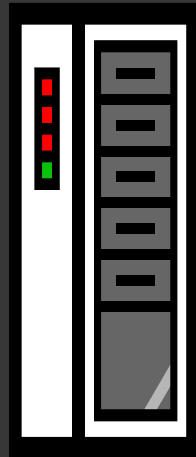
H2O PI
Server



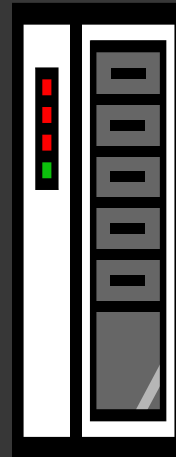
Remotes
Server



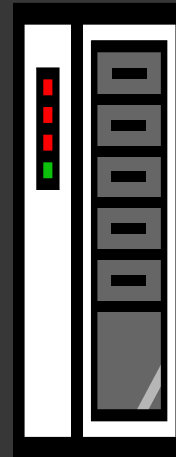
Drake PI
Server



Drake EP
PI Server



Nixon PI
Server



Front Range
PI Server

Data Flow from Water Treatment Plants – Mesa, UP & NG



PLC's at each Plant



RSLINX



RSVIEW

RSVIEW Data Logging



RW API – RSLINX and PI OPC Interface

MESA

[PAC_]

[PAC_]

[PAC]

[PAC]

[PAC]

[PAC]

[PAC]

[PAC]

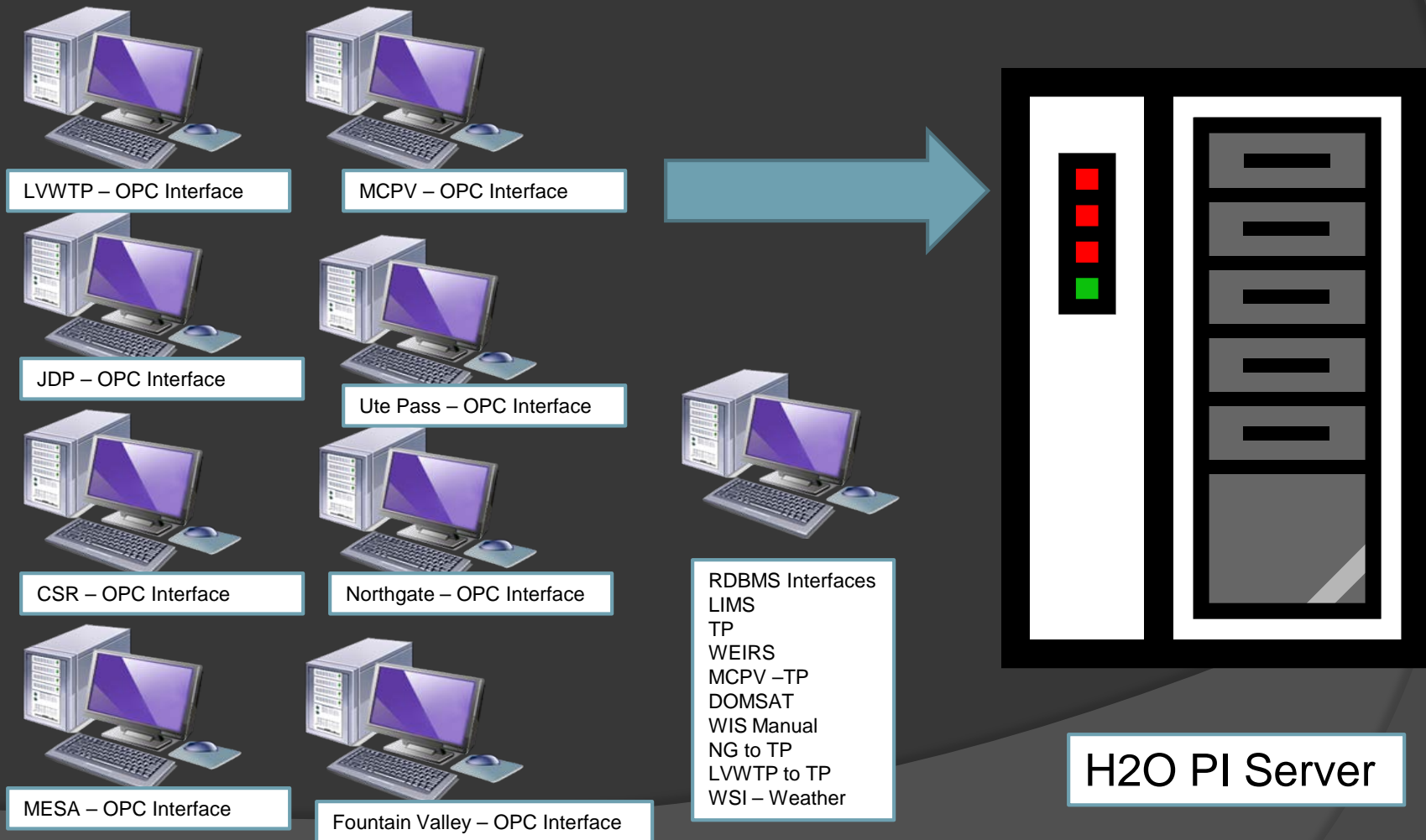
UP

[UP_CLX]

NG

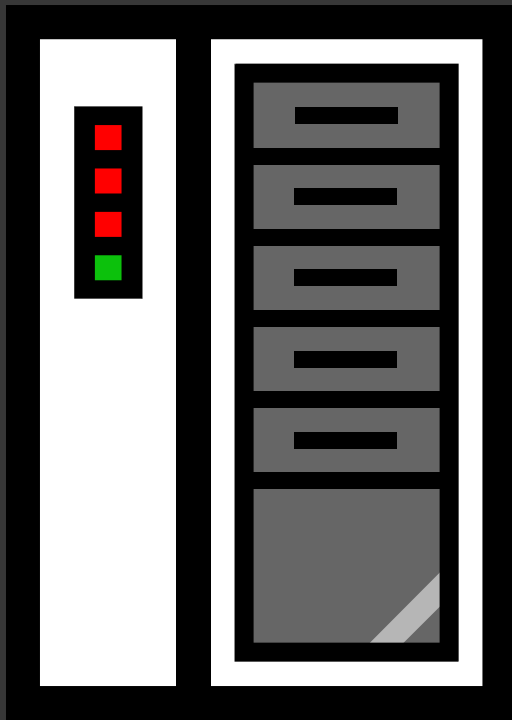
[Northgate Gate]

H2O PI Server & 17 Interfaces

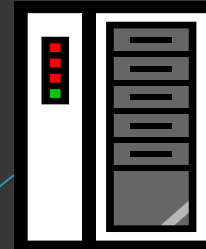
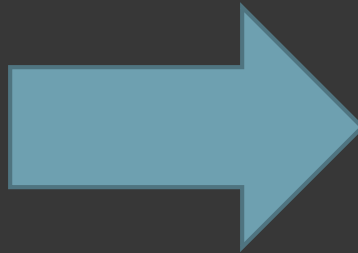


Pi Servers

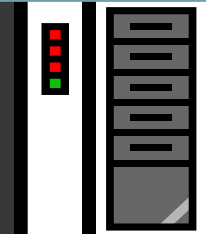
PI Collective



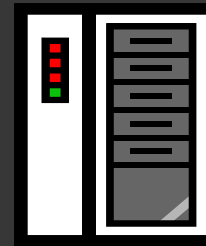
MSH2OPI – Water PI Server



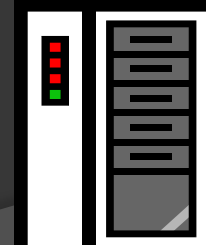
PI Data Warehouse - Primary



PI Data Warehouse - Secondary



PI Asset Framework & PI Notifications



PI Web Apps - PI Coresight

Water Treatment Real-Time Assets

- Mesa Data Streams = 1275
 - McCullough Data Streams = 719
 - Pine Valley Data Streams = 599
 - Ute Pass - Data Streams = 379
 - Bailey Data Streams = 3664
 - Fountain Valley – PI Tags = 382
 - RTU's/SCADA Data Streams = 14078
- Total Water Treatment Data Streams = 20,714

Wastewater PI Assets

- LVWTP PI Tags = 1866

- JDP PI Tags = 2908

- CSR- PI Tags = 854

Total Waste Water Treatment PI Tags = 5,628

SDS Reporting

5 Compliance Reports, 1 Water Conveyance Report and 14 Process & Performance Reports

State Compliance Reports:

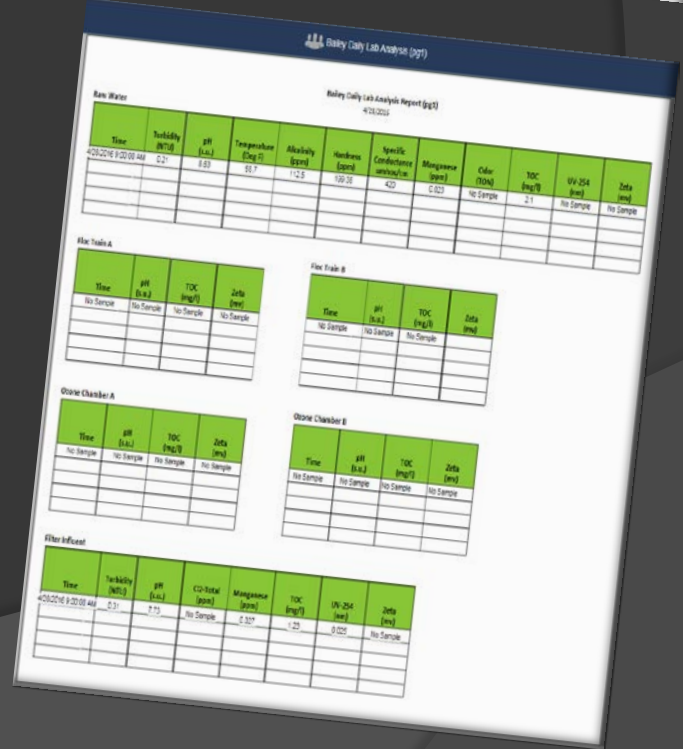
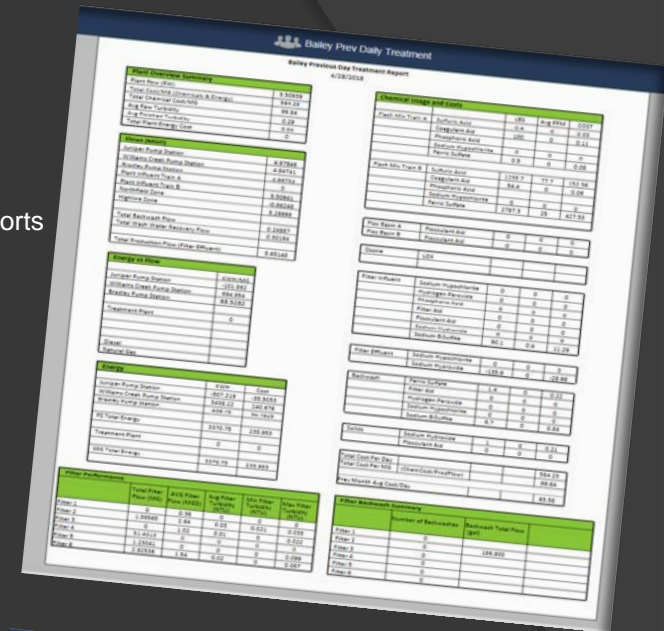
- State MOR
- Disinfection Profile Benchmark Calculator
- 15 Minute Turbidity Report
- Filter Backwash Recycling Rule Recordkeeping Form
- Monthly Percent Backwash Report

Water Conveyance Reports:

- SDS Daily Flows

Process & Performance Reports:

- Daily Treatment Report which includes :
 - Plant Overview Summary
 - Flow Summary
 - Energy Summary
 - Filter Performance
 - Chemical Usage for 9 areas
 - Filter Backwash
 - Monthly Chemical Usage Report
 - Monthly Treatment Report
 - Lab Analysis Report
 - Lab Analysis for 9 areas
 - Lab/Online Comparison Report
 - Lab analysis online vs manual reads with % variance
 - Raw Water Report
 - Daily, Weekly, Monthly and YTD production with Avg and Max values.
 - Daily Filter Summary Report



Colorado Springs Utilities

TPS Reports

Plant Reports

- [Ed Bailey WTP](#)
- [Fountain Valley WTP](#)
- [Mesa WTP](#)
- [McCullough WTP](#)
- [Pine Valley WTP](#)
- [Ute Pass WTP](#)

Management Reports

- [Monthly Plant Reports](#)
- [Water Accounting Reports](#)



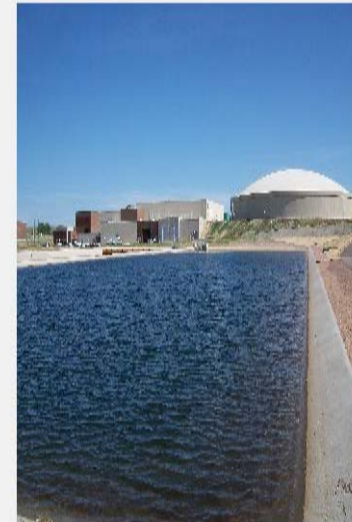
Coresight Reports

- [1. Daily Treatment](#)
- [2. Filter Summary](#)
- [3. Daily Raw Water](#)
- [4. Daily Lab Analysis \(PS1\)](#)
- [5. Daily Lab Analysis \(PS2\)](#)
- [6. Monthly Chem Cost](#)
- [7. Critical Lab Comparison](#)
- [8. SDS Partner Flows](#)

Excel Reports

- [Run Report](#)
- [Report History](#)

- [1. MGB](#)
- [2. Backwash Disinfection Report](#)
- [3. Monthly Lab Analysis](#)
- [4. Monthly Turbidity](#)
- [5. Monthly Chemical Usage](#)
- [6. Monthly Treatment Report](#)
- [7. TPS Report](#)
- [8. Daily Chemical Usage](#)



Monthly Operating Report (MOR) Summary Form				Revision: 6/18/2015	
Submit Online at www.wqed.compliance.com/login					
Guidance available at www.colorado.gov/cdp/ps/wtr					
Calculate					
Yellow Background - PWS Input Values		Blue Background - Public Water System Information Section		Red Background - MOR Data	
PWS ID:	CO8124458	PWS Name:	Colorado Springs	MOR Type:	Conventional/Periodic
Facility ID:	183	Facility Name:	Southern Bellcore Station WTP	Month:	Jan 18
Facility Process:		Facility:		Year:	2017
Generate:					
Turbidity Compliance Filter Effluent (CFE) Summary Section					
*If at ANY time the turbidity rises above 1 NTU the PWS must contact the department within 24 hours.					
Facility ID:	189	Required Number of Sampler Per Day:	6		
Number of Sampler Required:	186	Number of Sampler Taken:	186	Number of Plant Offs:	0
Number of Dayr Sampling Required:	31	Number of Dayr Sampling Met:	31	M&R Complied:	Yes
Number of Sampler Exceeding 1 NTU:	0	Highest Sample:	0	Max TT Complied:	Yes
Number of Sampler Exceeding 0.3 NTU:	0	% Sampler Exceeding:	0	95% TT Complied:	Yes
Microbial Treatment - Log Inactivation Summary Section					
*If at ANY time the log ratio falls below 1 the PWS must contact the department within 48 hours.					
Facility ID:	111	Required Number of Sampler Per Day:	6		
Number of Sampler Required:	186	Number of Sampler Taken:	186	Number of Plant Offs:	0
Number of Dayr Sampling Required:	31	Number of Dayr Sampling Met:	31	M&R Complied:	Yes
Number of Sampler Below 1 Ratio:	0	Lowest Ratio:	7.3	Min TT Complied:	Yes
Logport Duration Below Minimum:	N/A (No Values Below Minimum)				
EPRD - Water Treatment Disinfection Byproduct Monitoring (WTD) Summary Section					
*If at ANY time the residual falls below 0.2 mg/L for more than four (4) hours the PWS must contact the department by the end of the shift.					
Facility ID:	111	Number of Sampler Taken:	186	M&R Complied:	Yes
Did the residual disinfectant ever drop below 0.2 mg/L for more than four (4) hours:	No	EPRD TT Complied:	Yes		
*If the error is question 4, 5, 6, or 7 is Yes then please visit www.compliance.com/form on the website for more information.					
Facility ID:	111				
1. Was each filter monitored continuously?	Yes				
2. Were measurements recorded every 15 minutes?	Yes				
3. Was there a failure of the continuously monitoring equipment?	No				
4. Was individual filter level greater than 1.0 NTU in two (2) consecutive measurements?	No				
5. Was individual filter level greater than 0.5 NTU in two (2) consecutive measurements after an on-line for more than four (4) hours?	No				
6. Was individual filter level greater than 1.0 NTU in two (2) consecutive measurements in three (3) consecutive measurements?	No				

Display: Bailey TOCS
Asset: Plant Effluent+
Ad Hoc Display

Bailey Water Treatment Plant

Total Organic Carbon Summary

Name	Description	Time	Value	Units	Trend	Minimum	Maximum	Average
Lab (Plant) Filter Effluent TOC	Plant Lab - Filter Combined Effluent TOC - Manual Entry	7/3/2017 12:00:00 PM	0.017	mg/l		0.017	0.017	0.017
Lab (Plant) Filter Influent TOC	Plant Lab - Filter Influent Total Organic Carbon - Manual Entry	4/29/2017 9:00:00 AM	1.6	mg/l		1.6	1.6	1.6
Lab (Plant) Raw Water TOC	Plant Lab - Raw Water Total Organic Carbon (mg/l) - Manual Entry	4/29/2017 9:00:00 AM	2.01	mg/l		2.01	2.01	2.01
Plant Effluent Organic Carbon (Total)	WQ Lab Bailey Effluent TOC	2/7/2018 7:57:00 AM	1.03			0.8614	1.03	0.9627
Plant Influent Organic Carbon (Total)	WQ Lab Bailey Influent TOC	1/10/2018 9:15:00 AM	2.08	mg/l		2.08	2.08	2.08
Plant Reservoir Influent Organic Carbon (Total)	WQ Lab Bailey Res Influent TOC	2/7/2018 7:50:00 AM	0.00			0.00	1.0074	0.9323

In Plant Lab - Bailey Raw Water

In Plant Lab - Filter Influent

In Plant Lab - Filter Effluent

WQ Lab - Plant Influent

WQ Lab - Plant Reservoir Influent

WQ Lab - Plant Effluent

Bailey Previous Day Treatment Report
2/12/2018

Plant Overview Summary	
Plant Flow (MG)	5.002
Total Cost/MG (Chemicals & Energy)	183.631
Total Chemical Cost/MG	85.11
Avg Raw Turbidity	1.57
Avg Finished Turbidity	0.02
Total Plant Energy Cost	492.78

Flows (MGD)	
Juniper Pump Station	4.88014
Williams Creek Pump Station	4.84329
Bradley Pump Station	4.87964
Plant Influent Train A	5.90205
Plant Influent Train B	0
Northfield Zone	-1.45314
Highline Zone	6.10288
Total Backwash Flow	0.24903
Total Wash Water Recovery Flow	0.23525
Total FW Production Flow (Fib. Eff)	5.10399

Energy vs Flow	
	KWh/157MG
Juniper Pump Station	185.758
Williams Creek Pump Station	274.885
Bradley Pump Station	184.691
Treatment Plant	1975.53
Diesel	
Natural Gas	

Energy		
	KWH	Cost
Juniper Pump Station	873.469	61.14
Williams Creek Pump Station	1282.88	89.8
Bradley Pump Station	871	60.97
PS Total Energy	3027.34	211.91
Treatment Plant	7039.77	492.78
SOS Total Energy	10067.1	704.69

Filter Performance					
	Total Filter Flow (MG)	AVG Filter Flow (MGD)	Avg Filter Turbidity (NTU)	Min Filter Turbidity (NTU)	Max Filter Turbidity (NTU)
Filter 1	1.70961	1.71	0.02	0.024	0.026
Filter 2	0	0	0	0	0
Filter 3	1.71112	1.71	0.02	0.022	0.023
Filter 4	0	0	0	0	0
Filter 5	0.55111	0.55	0.01	0	0.019

Chemical Usage and Costs (Daily)			
Flash Mix Train A	Sulfuric Acid	185	Avg PPM COST
	Coagulant Aid	0	0 0 0
	Phosphoric Acid	0	0 0 0
	Sodium Hypochlorite	0	0 0 0
	Ferric Sulfate	1387.49	14 232.82
Flash Mix Train B	Sulfuric Acid	0	0 0 0
	Coagulant Aid	0	0 0 0
	Phosphoric Acid	0	0 0 0
	Sodium Hypochlorite	0	0 0 0
	Ferric Sulfate	0	0 0 0

Flur Basin A	Fluoculant Aid	3932.65	0.1	7.56
Flur Basin B	Fluoculant Aid	0	0	0

Settled Water	Sodium Hydroxide	220.96	2.7	46.71
	Sodium Hypochlorite	0	0	0

Filter Influent	Sodium Hypochlorite	0	0	0
	Hydrogen Peroxide	0	0	0
	Phosphoric Acid	0	0	0
	Filter Aid	0	0	0
	Fluoculant Aid	0	0	0
	Sodium Hydroxide	0	0	0
	Sodium Bisulfite	124.68	0.6	15.62
	LOX	446.63		29.32

Filter Effluent	Sodium Hypochlorite	0	0	0
	Sodium Hydroxide	0	0	0

CCT	Sodium Hypochlorite	733.42	1	113.71
-----	---------------------	--------	---	--------

Backwash	Ferric Sulfate	0	0	0
	Filter Aid	0	0	0
	Hydrogen Peroxide	0	0	0
	Sodium Hypochlorite	0	0	0
	Sodium Bisulfite	0	0	0

Solids	Sodium Hydroxide	0	0	0
	Fluoculant Aid	0	0	0

Total Cost Per Day		425.74
Total Cost Per MG (ChemCost/ProdFlow)		85.11
Prev Month Avg Cost/Day		416.06

Bailey Previous Day Filter

Bailey Daily Filter Summary Report
2/11/2018

Filter Statistics						
Filter	1	2	3	4	5	6
Total Filter Flow	1.70961	0	1.71112	0	0.55111	1.13212
Total Hours Online	24	0	24	0	24	0
Total Hours Offline	0	24	0	24	0	24
Number of Backwashes	0	0	0	0	0	0
BackWash Total Flow	187014	186807	191954	187320	0	0
Avg Turbidity (NTU)	0.02	0	0.02	0	0.01	0.03
Max Turbidity (NTU)	0.026	0	0.023	0	0.019	0.061
Min Turbidity (NTU)	0.024	0	0.022	0	0	0
Avg Head Loss	7.4	0	8.9	0	16.1	0
Max Head Loss	8.5	0	11.5	0	20.3	0
Min Head Loss	6.1	0	6.6	0	12.8	0
Avg Valve Position	14.0404	0	10.3447	0	10.6667	10.7851
Avg Filter Rate	1.71	0	1.71	0	0.55	1.13
Avg Hours Run						
Avg Minutes Washed						
Avg Wash Volume (kgal)						

Filter BackWash Details

Date/Time at Start of BackWash	Filter	BackWash Mode	BackWash Reason	Total Hours Run at Start of BackWash	HeadLoss at Start of BackWash	Valve Pos. at Start of BackWash	Turbidity at Start of BackWash	Turbidity at End of BackWash	Total Minutes Washed	Total BackWash Flow	Total Rinse to Waste Flow	Filter To Waste Volume
2/9/2018 9:21:10.430008 AM	1	In BackWash	Time Online	0.67317	0.46136	0	0.0703	0.0277	43	187014	60192.5	0
1/29/2018 5:56:46.054001 AM	2	In BackWash	Time Online	527.494	0	0	0.03496	0.02968	66	186807	59653.3	0
2/7/2018 5:52:11.322008 AM	3	In BackWash	Time Online	359.412	0	0	0.04085	0.02718	80	191954	60079.2	0
2/1/2018 6:34:33.903 AM	4	In BackWash	Time Online	357.888	0.92281	0	0.04347	0.03202	71	187320	60526.2	0
2/1/2018 6:34:32.903 AM	5	Resting	Time Online	357.888	0	0	0.03454	0.03717	78	0	0	0
2/1/2018 6:34:32.903 AM	6	Filtering	Time Online	357.888	8.01512	10	0.0262	0.02613	82	0	0	0

Bailey Previous Day RAW Water Report for
2/12/2018

Weekly Source Water Flow (MG)

	2/4/2018	2/11/2018
Juniper Pump Station	33.67	33.74
William Creek Pump Station	33.43	33.49
Bradley Pump Station	33.75	33.79
Plant Influent	35.024	35.018

Daily Production (MG)

2/5/2018	5.004
2/6/2018	5.004
2/7/2018	5.003
2/8/2018	5.004
2/9/2018	5.001
2/10/2018	5
2/11/2018	5.002

Average Daily Production

2/4/2017	through	2/11/2017	0
2/4/2018	through	2/11/2018	0

Total Water Production

2/11/2015	through	2/11/2016	0
2/11/2016	through	2/11/2017	0
2/11/2017	through	2/11/2018	1790.77

Total Water Production To Date

Maximum Water Production

	Date	MG
Year to date Max Daily Production	1/7/2018 3:26:00 AM	5.01
Max Daily Production on Record	6/27/2017 3:27:00 AM	6.84

Ad-Hoc Trending

- Web-based client
 - Users to analyze enterprise data
 - Empowering end-users
 - Increased ownership of the data and autonomy
- Ability to access real-time data
 - Displays that meet business needs
 - Mobile accessibility
 - Device agnostic
 - Improves field decision
 - Reduces operational cost



Operational Intelligence for Wastewater Treatment Innovators



LAS VEGAS AWT and Primary



Ad Hoc Display

Las Vegas Waste Water Treatment Operations

19:55:00

RE View DO Readings

1B	1C	2B	2C	3B	3C	4B	4C	5B	5C	Key
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Support Data Entry

Clarifier Blankets

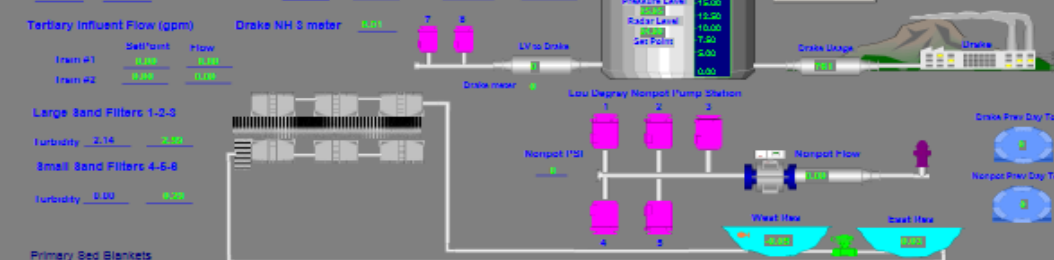
#1	#2	#3	#4	#5	#6	#7	#8
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

AWT Process Numbers

Settle SW	240	Settle 20M	020	Settle SWM	020	UV Channel Turbidity/pH	Plant Previous Day Totals
Chnl SW1	252	Chnl Temp	14.40	Waiting	000	Meter	0.00
Corr # Ch	034	Spin MLSS	3.00	MLSS Chnl	2802	Sample	1.04
Corr # R1	715	Spin Max 1	0.00	MLSS Max 1	0405	pH	0.00
Corr # R2	732	Spin Max 2	0.00	MLSS Max 2	0000	ISS	0.00
INF FLOW	0000	ICE Flow	0000	ICan%	00	JDP Sludge Flow Total	0000.00
						WA BC	0000.00
						Boo WA 8	0000.00

Tertiary/Densadeg/Non-pot

Densadeg	Densadeg Train 1	Densadeg Train 2
Flowrate	Flowrate	Flowrate
Turb (NTU)	Turb (NTU)	Turb (NTU)
1.34	2.72	2.07



Primary Bed Blankets

RS View	Actual	Actual	RS View	Blanket	W	E
1	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00

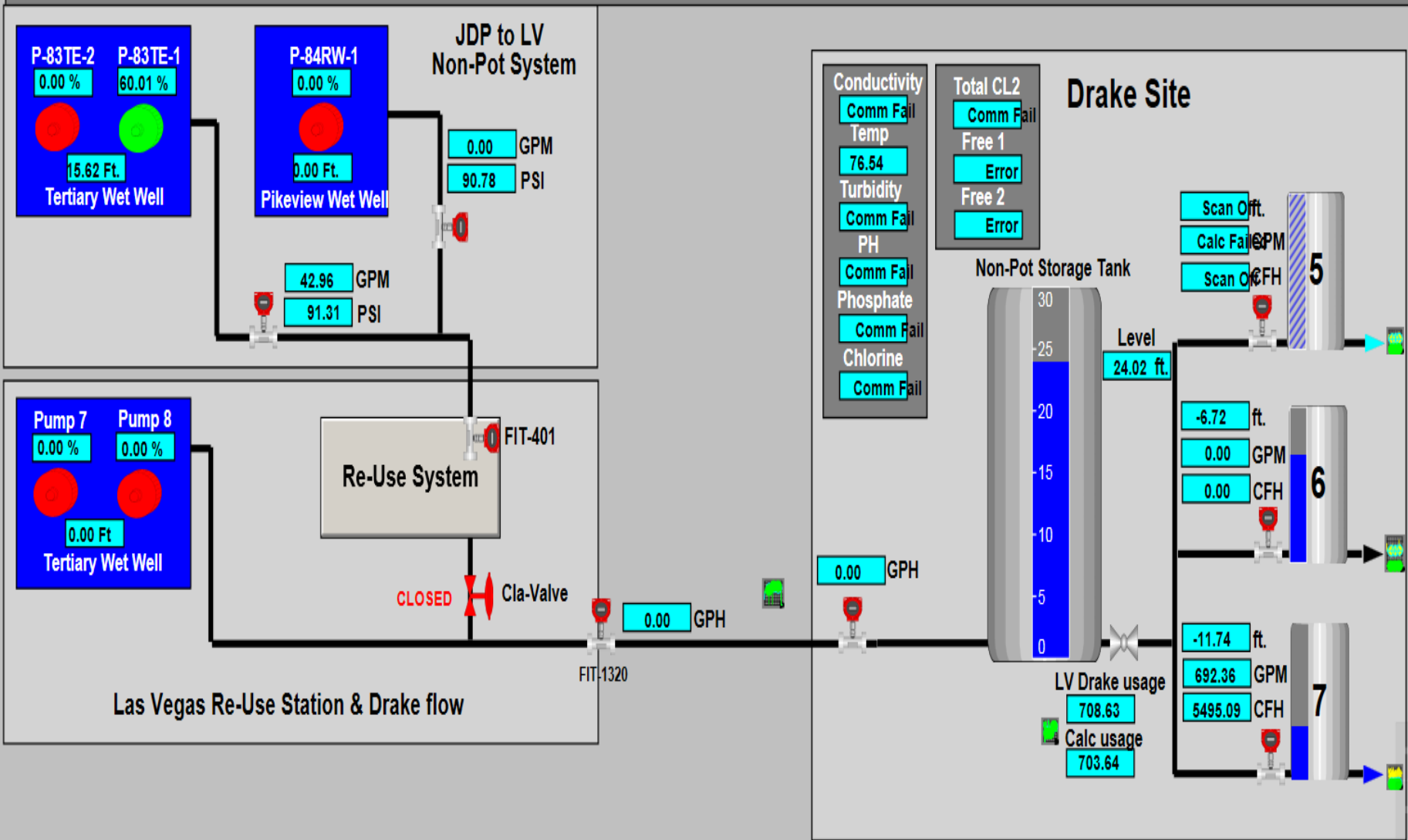
BSIS Able Pump Setting & Readings

Abel	1	2	3	OW	1	2	3	WW Level	BS/Comb	Primary
00	00	00	00	0.00	0.00	0.00	0.00	0.00	3.24	3.44

2/12/2018
20:26:30

Non-Pot Drake Water System

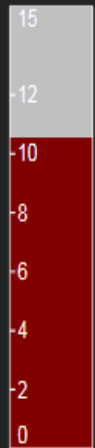
AWT & Primary Overview



JDP PLANT kW vs FLOW MAIN PAGE

Current Hourly Cost

No Data



10.5764

Current Influent Flow



No Data

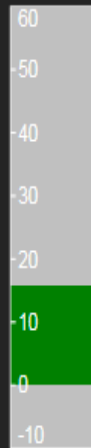
kW



-4.07

Ambient

Temp C

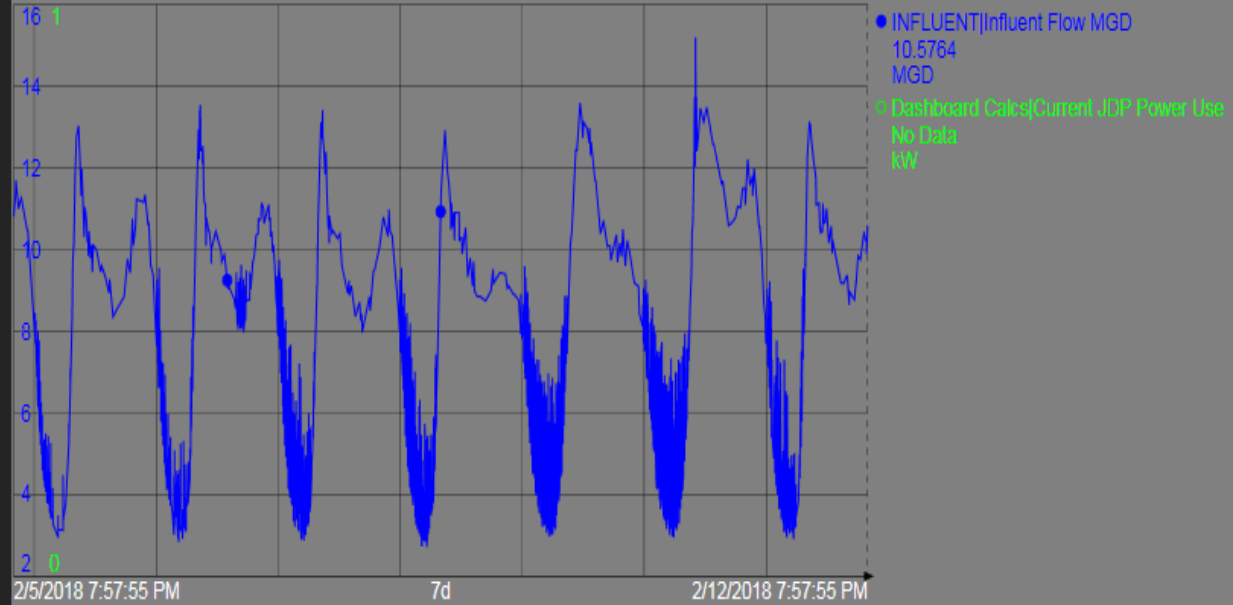


15.66

Effluent

Temp C

TOTAL USAGE vs FLOW



BLOWER BUILDING

HEADWORKS

UV FILTER BUILDING

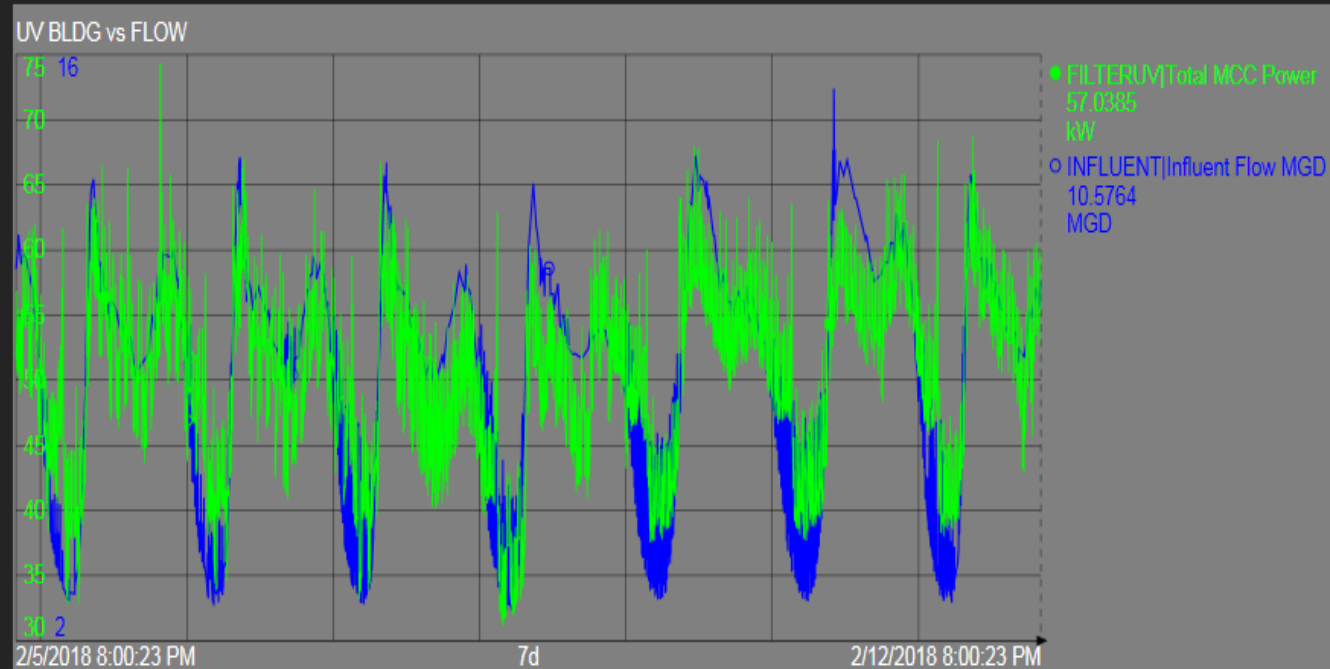
ODOR BUILDING

NONPOT BUILDING

RASWAS BUILDING

JDP UV FILTER BUILDING kW vs FLOW

Year Ago	Yesterday	Current
40.73 kW	51.34 kW	57.04 kW



MAIN PAGE



Reservoir Water Quality Display

Rampart Reservoir



Waldo Canyon Fire Study

Rampart Reservoir Dam Area		
Sample Date		
10/13/2015 2:00 PM		
Top Water Column		
Chlorophyll	1	2.1 ug/L
Conductivity	68	68 umhos/cm
DO	6.4	6.3 mg/L
pH	7.2	7.2
Temperature	12	12 deg C
Turbidity	0.35	NTU

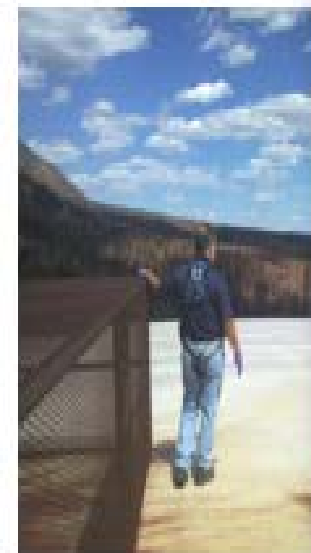
Rampart Valve House

Reservoir Effluent

Sample Date
3/13/2015 8:40 AM

Aluminum 0 mg/L
 Chlorophyll 2 ug/L
 Conductivity 72 umhos/cm
 E col 2.66E+006
 Fluoride 0.16 mg/L
 Nitrate 28.1 mg/L
 Iron 62.8 ug/L
 Magnesium 1800 ug/L
 Manganese 44.7 ug/L
 Nitrite 0 mg/L
 TOC 1.88 ug/L
 pH 7.3 BU
 Phosphate 0 ug/L
 Temp 12 deg C
 Sulfate 1.07E+006 ug/L
 Organics 20 POC
 Turbidity 0.88 NTU

Reservoir Level: 17211	pH	Temp	Turbidity	Conductivity	Alkalinity	DO	Chlorophyll	TOC	Ammonia	Fluoride	Nitrate	Nitrite	Iron	Magnesium	Manganese
TOP Secchi Depth: 22.71	6.8	12	0.35	68	15	6.3	0	1.63	0	0.16	0	0	0	1420	0
MIDDLE	7.1	12	0.4	67	15	4.8	1	1.78	0	0.14	0	0	0	1440	0
BOTTOM	7.1	12	0.4	68	15	5.5	1	1.76	0	0.14	0	0	20.8	1450	7.80



Utilization Real-Time Data

Maintaining operational efficiency

- Proactively identify treatment plant zone of influence and system disruptions
- Optimize system control by decreasing water age
- Reduce treatment plant effluent chlorination usage

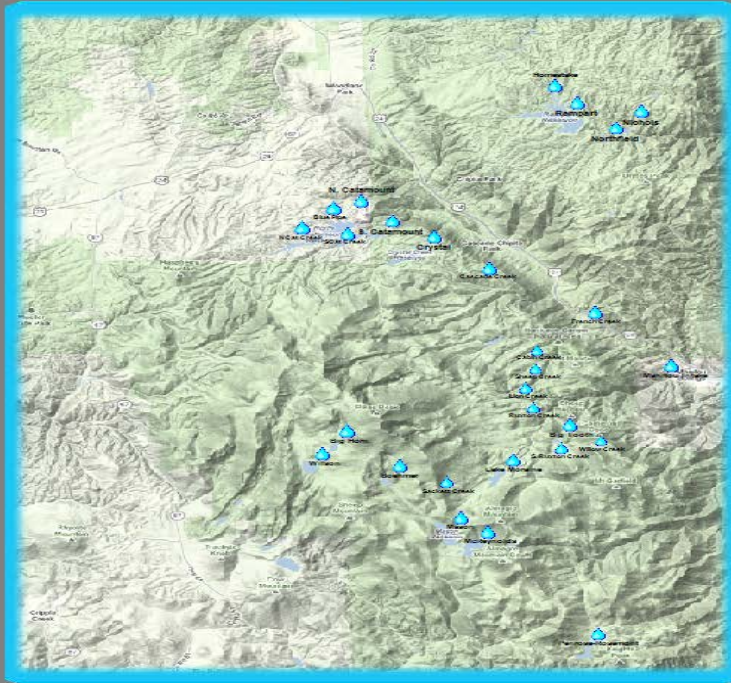
Lead to Improved operational efficiencies

- Accessibility to data
- Heightened internal and external customers service
- Sustain operational needs

Providing Real-Time Value for Water Quality



Source Water



Treatment/Distribution/Local Source



Map Icons

- Bacti Site
- Monitoring Station
- Chlorination Station
- Water Treatment Plant
- Source Water Site
- Waste Water Treatment Plant

Key

CL2 Color Scale associated with map icons

Main Map Bacti Sites	Treatment Plant CL2 Color Scale
	> 0.80 mg/L
	< 0.80 mg/L
	< 0.21 mg/L

System Links

- Stations Overview
- WTP Bactis
- Bacti Conductivity Stations Maps
- WWTW Overview
- WWTW Flows

WQSC Resources

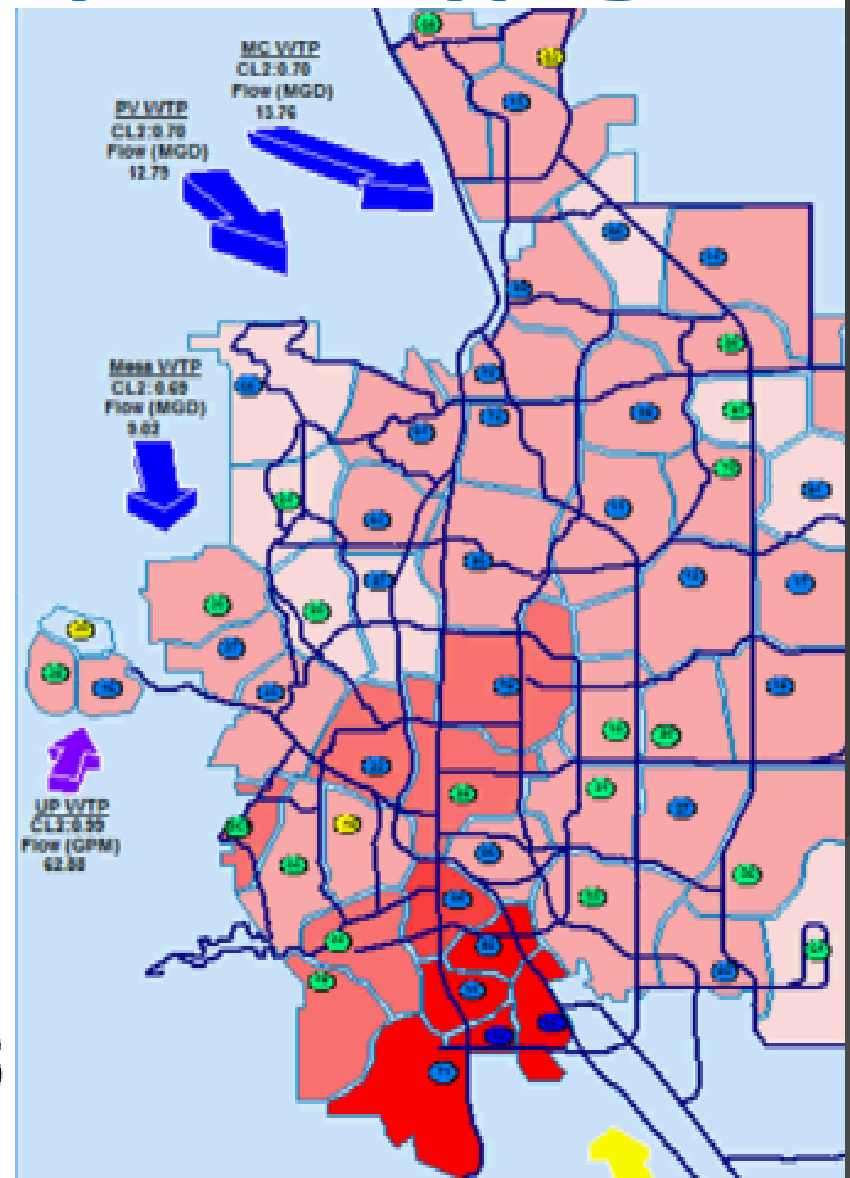
- Water Quality Meters
- South Slope Source Water
- WTP Bacti Sites (NWGO)
- FV/MC Raw Water Overview
- Weekend Station Template

I-25

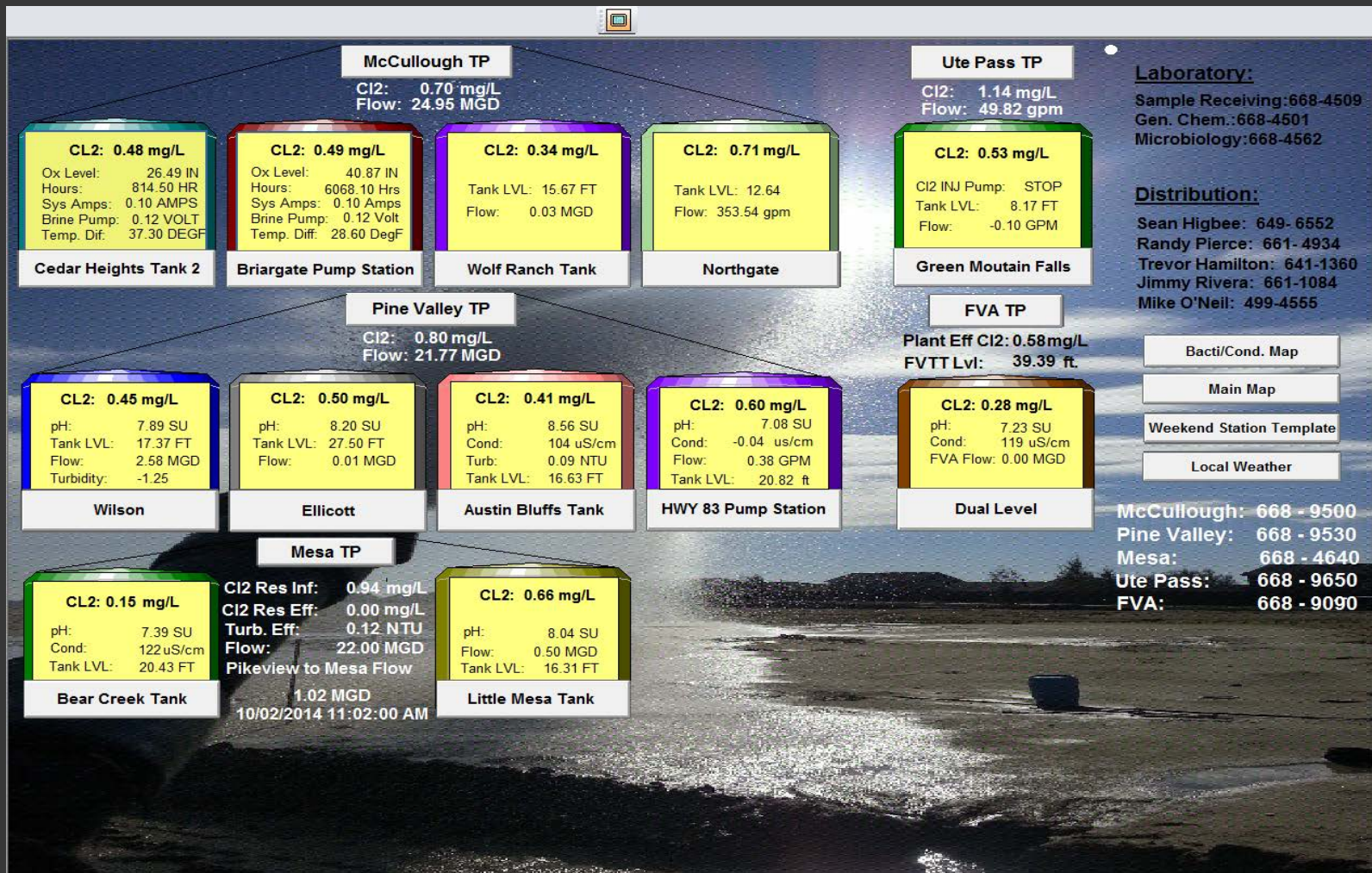


Treatment Source Trace Dynamic Mapping

- Centralized data source
- Leverage Data Sources
- Visualization Data
- System awareness
 - Event Analysis
 - Understand
 - Predict
 - Mitigate
 - Operational Efficiency
- Creates Training opportunities



Providing Real-time Value for Water Treatment and Water Distribution



Providing Value to Raw Water Monitoring & FERC for Rampart Dam

Rampart Reservoir Dam Surveillance



Area 1-1 OW Series		
Well	Well Level	Action Level
Rampart Pool Level; 8982 ft		
OW 1	8915 ft	8951 ft
OW 4	8964 ft	8906 ft
OW 5	8775 ft	8874 ft
OW 7	8799 ft	8824 ft

Area 1-2 OW Series		
Well	Well Level	Action Level
OW 8	8847 ft	8911 ft
OW 9	8939 ft	8911 ft
OW 10	8819 ft	8886 ft
OW 15	8774 ft	8793 ft
OW 16	8921 ft	8925 ft
OW 17	8872 ft	8925 ft
OW 19	8903 ft	8912 ft

Area 1-3 OW Series		
Well	Well Level	Action Level
OW 20	8868 ft	8912 ft
OW 21	8953 ft	8962 ft
OW 22	8922 ft	8925 ft
OW 23	8889 ft	8925 ft
OW 24	8899 ft	8912 ft
OW 25	8877 ft	8917 ft
OW 26	8773 ft	8793 ft

Area 1-4 OW Series		
Well	Well Level	Action Level
OW 30	8835 ft	8904 ft
OW 31	8872 ft	8903 ft
OW 32	8819 ft	8869 ft
OW 33	8809 ft	8845 ft
OW 34	8792 ft	8800 ft
OW 35	8795 ft	8804 ft

Area 3 CP Series		
Well	Well Level	Action Level
CP 1	8800 ft	8800 ft
CP 2	8800 ft	8800 ft
CP 3	8800 ft	8800 ft

Area 2-1 P Series		
Well	Well Level	Action Level
Rampart Pool Level; 8982 ft		
P-1	8959 ft	8951 ft
P-14	8940 ft	8951 ft
P-15	8982 Manual	0 ft
P-16	8901 Manual	0 ft
P-26	8806 Manual	0 ft

Area 2-2 P Series		
Well	Well Level	Action Level
P-13	8947 ft	0 ft
P-2	8960 ft	0 ft
P-25	8881 ft	0 ft
P-26	8887 Manual	0 ft
P-28	No Instr, no Meas	0 ft Data
P-3	8955 ft	0 ft

Area 2-3 P Series		
Well	Well Level	Action Level
P-12	8923 Manual	0 ft
P-4	8959 ft	8970 ft

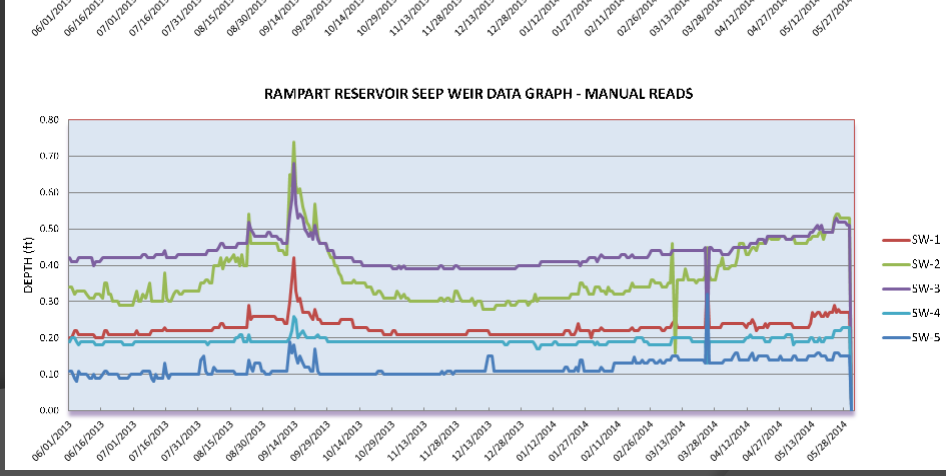
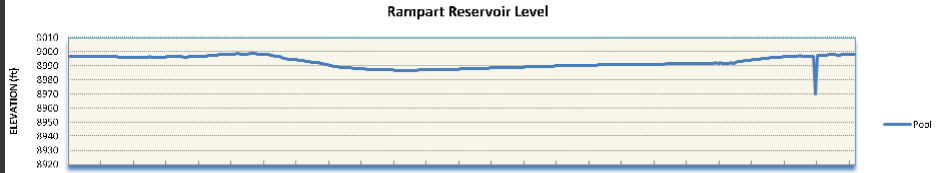
Area 2-4 P Series		
Well	Well Level	Action Level
P-5	8964 ft	8970 ft

Area 2-5 P Series		
Well	Well Level	Action Level
P-6	8970 ft	8970 ft
P-7	8957 ft	8970 ft

Area 2-6 P Series		
Well	Well Level	Action Level
P-8	8954 ft	8970 ft

Seep Weirs		
Well	Well Level	Action Level
SW-1	0.20 ft	0.20 ft
SW-2	0.20 ft	0.20 ft
SW-3	0.20 ft	0.20 ft
SW-4	0.20 ft	0.20 ft
SW-5	0.20 ft	0.20 ft

Area 1-1 Main Dam Original Well Piezometers - Manual Reads															
Start Time:	01-Jun-13	End Time:	31-May-14	OW-1	OW-4	OW-6	OW-7	Rampart Pool Level	Water	Water					
WIS_M_IPN1133_RMPF_RESERVOIR	WIS_M_IPN2689_BMPF_PIEZO.OW-1	WIS_M_IPN2689_BMPF_PIEZO.OW-4	WIS_M_IPN2689_BMPF_PIEZO.OW-6	WIS_M_IPN2689_BMPF_PIEZO.OW-7	WIS_M_IPN1133_RMPF_RESERVOIR	Water	Water	Water	Water	Water					
Action Level:	8951.4	8906.4	8824.4	8824.4											
Threshold Level:	8946.4	8878.4	8813.4	8813.4											
Top of the Casing Elevation:	9017.42	8913.4	8862.33	8861.64											
WIS_M_IPN2689_BMPF_PIEZO.OW-1	06/15/2013	102.51	8954.91	06/15/2013	46.06	8867.34	06/15/2013	87.47	8774.88	06/15/2013	62.36	8799.48	06/01/2013	173.75	8996.92
WIS_M_IPN2689_BMPF_PIEZO.OW-4	07/15/2013	102.49	8946.81	07/15/2013	46.48	8864.96	07/15/2013	87.45	8774.88	07/15/2013	62.22	8799.44	06/02/2013	173.71	8996.88
WIS_M_IPN2689_BMPF_PIEZO.OW-6	08/15/2013	101.65	8955.77	08/15/2013	47.95	8865.45	08/15/2013	87.43	8774.90	08/15/2013	62.08	8799.44	06/08/2013	173.66	8996.83
WIS_M_IPN2689_BMPF_PIEZO.OW-7	09/15/2013	103.45	8913.54	09/15/2013	48.03	8865.37	09/15/2013	87.43	8774.90	09/15/2013	62.08	8799.44	06/04/2013	173.60	8996.77
WIS_M_IPN2689_BMPF_PIEZO.OW-1	10/15/2013	105.65	8911.77	10/15/2013	48.49	8864.71	10/15/2013	87.43	8774.90	10/15/2013	62.08	8799.44	06/06/2013	173.47	8996.84
WIS_M_IPN2689_BMPF_PIEZO.OW-4	11/15/2013	106.02	8911.40	11/15/2013	48.96	8864.44	11/15/2013	87.45	8774.88	11/15/2013	62.65	8796.99	06/09/2013	173.83	8997.10
WIS_M_IPN2689_BMPF_PIEZO.OW-6	12/15/2013	105.83	8911.59	12/15/2013	49.02	8864.36	12/15/2013	87.47	8774.88	12/15/2013	62.65	8796.99	06/07/2013	173.99	8997.10
WIS_M_IPN2689_BMPF_PIEZO.OW-7	01/15/2014	105.58	8911.84	01/15/2014	49.00	8864.40	01/15/2014	87.48	8774.85	01/15/2014	62.65	8796.99	06/08/2013	173.95	8997.12
WIS_M_IPN2689_BMPF_PIEZO.OW-1	06/15/2014	102.98	8914.44	06/15/2014	48.76	8864.64	06/15/2014	87.47	8774.86	06/15/2014	62.51	8799.13	06/09/2013	173.93	8997.10
WIS_M_IPN2689_BMPF_PIEZO.OW-4			#VALUE!			#VALUE!			#VALUE!			#VALUE!	06/11/2013	173.89	8997.06
WIS_M_IPN2689_BMPF_PIEZO.OW-6			#VALUE!			#VALUE!			#VALUE!			#VALUE!	06/12/2013	173.78	8996.95
WIS_M_IPN2689_BMPF_PIEZO.OW-7			#VALUE!			#VALUE!			#VALUE!			#VALUE!	06/12/2013	173.57	8996.74
WIS_M_IPN2689_BMPF_PIEZO.OW-1			#VALUE!			#VALUE!			#VALUE!			#VALUE!	06/13/2013	173.53	8996.69
WIS_M_IPN2689_BMPF_PIEZO.OW-4			#VALUE!			#VALUE!			#VALUE!			#VALUE!	06/14/2013	173.49	8996.66
WIS_M_IPN2689_BMPF_PIEZO.OW-6			#VALUE!			#VALUE!			#VALUE!			#VALUE!	06/15/2013	173.41	8996.50
WIS_M_IPN2689_BMPF_PIEZO.OW-7			#VALUE!			#VALUE!			#VALUE!			#VALUE!	06/16/2013	173.40	8996.57
WIS_M_IPN2689_BMPF_PIEZO.OW-1			#VALUE!			#VALUE!			#VALUE!			#VALUE!	06/17/2013	173.35	8996.52
WIS_M_IPN2689_BMPF_PIEZO.OW-4			#VALUE!			#VALUE!			#VALUE!			#VALUE!	06/18/2013	173.41	8996.58



Operational Intelligence for Wastewater Lift Stations

Situational Awareness meets Operations



Wastewater Lift Stations

Lift Station	GPM	Lead Pump	Pump Start	Wet well Level	Start	Stop
Support Business Park L.S.	0 GPM	0	1 STOP 2 STOP	4.95536 ft	6 ft	4 ft
Valley L.S.	0 GPM	1	1 STOP 2 STOP	2.57975 ft	2.8 ft	2 ft
Ridge L.S.	0 GPM	1	1 STOP 2 STOP	3.66911 ft	4 ft	2.8 ft
Squirrel L.S.	0 GPM	2	1 STOP 2 STOP	4.78442 ft	5.5 ft	3.5 ft
Hills L.S.	0 GPM	1	1 STOP 2 STOP	3.73207 ft	4.5 ft	2.6 ft
o L.S.	0 GPM	1	1 STOP 2 STOP	2.7735 ft	4.5 ft	2.5 ft
an L.S.	0 GPM	1	1 STOP 2 STOP	3.33333 ft	3.5 ft	2.5 ft
Janitell L.S.	0 GPM	1	1 STOP 2 STOP	2.69231 ft	3 ft	2 ft
JL Ranch L.S.	0 GPM	1	1 STOP 2 STOP	2.98474 ft	3 ft	2 ft
Kettle Creek L.S.	1180.39 GPM	Lead 2 Lag 3	1 STOP 2 RUN 3 STOP 4 STOP	5.31364 ft	5.2 ft	4.2 ft
Middle Tributary L.S.	0 GPM	2	1 STOP 2 STOP	4.78251 ft	5.5 ft	3 ft
Middle Monument L.S.	0 GPM	2	1 STOP 2 STOP	5.08013 ft	5.5 ft	3.5 ft
Pando Lift Station L.S.	273.29 GPM	2	1 STOP 2 RUN	4.00053 ft	4.5 ft	2 ft
Peregrine L.S.	245.301 GPM	2	1 STOP 2 RUN	4.24603 ft	4.5 ft	3 ft
Sand Creek L.S.	VIBRATION P1 0.020 P2 0.008 P3 0.136 P4 0.230 8352.58 GPM	Lead 3 Lag 4	1 STOP 2 STOP 3 RUN 4 RUN	A 13.9658 ft B 14.0585 ft	14 ft 8.2 ft 15 ft 13 ft	Start Stop Start Stop
Smith Creek L.S.	0 GPM	2	2 STOP 1 STOP	3.52885 ft	3.6 ft	2.2 ft
Stratton Meadows L.S.	534.824 GPM	2	1 STOP 2 RUN	3.98016 ft	5.75 ft	3.25 ft
Talon Hill L.S.	0 GPM	2	1 STOP 2 STOP	9.98924 ft	10 ft	6 ft



03/21/14 11:19 PM Missouri Outage Team (CEET-04-0000)

Location: Cherokee Lift Station
 Address: 1001 Cherokee Rd.
 EID: LS-0001
 Flow Legend: CEET-2001 Flow: AT

Status: Flow is less than 20% of total flow
 Max Flow: 340
 Lead Pump: 1
 Pump 1 Status: RUN
 Pump 2 Status: STOP
 Flow At time of Alarm: 14.014670078

Copyright Dashboard for Lift Stations: [http://www.missouri.gov/CEET/04-0000/04-0000-Dashboard-Web-1.html](#)
 LOW FLOW ALARM WILL ACTIVATE WHEN FLOW IS LESS THAN 20% GPM

Providing Value to Waste Water Lift Stations

Coronado Low Flow Alarm has generated a new Low Flow notification event. - Message HTML

From: replicatory
To: Jarmette Ortiz
Subject: Coronado Low Flow Alarm has generated a new Low Flow notification event.

Coronado Low Flow Alarm

9/28/2014 10:14:00 PM Mountain Daylight Time (GMT-06:00:00)

Location: Coronado Lift Station
Address: 1590 W. Filmore St.
EID: LS-G00610

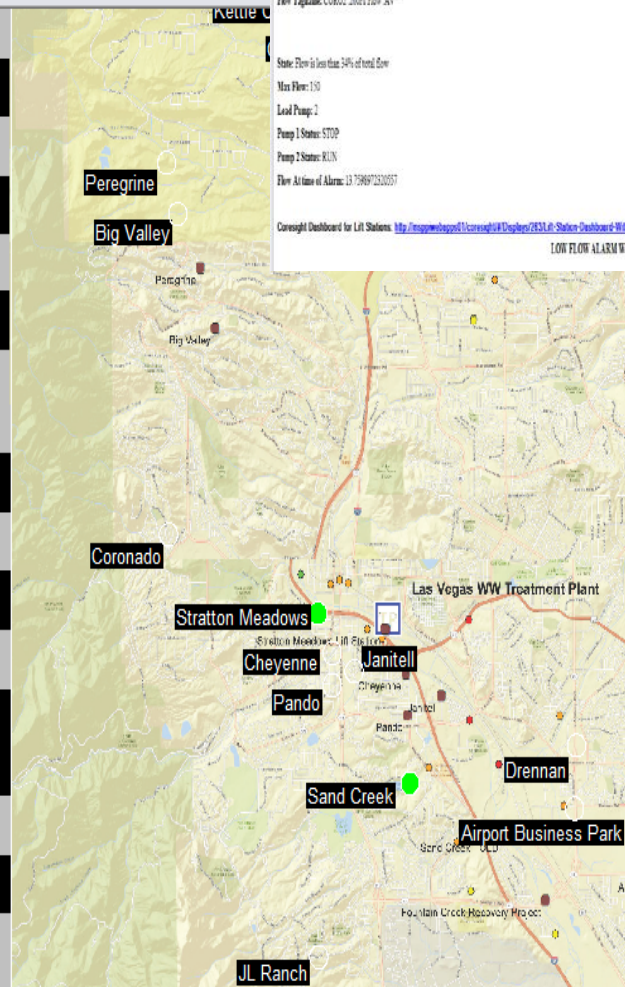
Flow Tagname: COR002_20072 Flow: AV

Status: Flow is less than 34% of total flow
Max Flow: 150
Lead Pump: 2
Pump 1 Status: STOP
Pump 2 Status: RUN
Flow At time of Alarm: 13.7598972320057

Copyright Dashboard for Lift Stations: <http://trappwebapp021.conceptsl.com/Display/03216-Stations-Disabled-With-1.html>

LOW FLOW ALARM WILL ACTIVE WHEN FLOW IS LESS THAN 51 GPM

Chapel Hills L.S.	0 GPM		1	1 STOP 2 STOP		3.88164 ft	Start 4.5 ft Stop 2.6 ft			
Cheyenne L.S.	0 GPM		2	1 STOP 2 STOP		3.29674 ft	Start 4.5 ft Stop 2.5 ft			
Coronado L.S.	0 GPM		1	1 STOP 2 STOP		3.91331 ft	Start 4.1 ft Stop 2.2 ft			
Drennan L.S.	0 GPM		1	1 STOP 2 STOP		2.50343 ft	Start 3.5 ft Stop 2.5 ft			
Janitell L.S.	0 GPM		1	1 STOP 2 STOP		2.7579 ft	Start 3 ft Stop 2 ft			
JL Ranch L.S.	0 GPM		1	1 STOP 2 STOP		2.08059 ft	Start 3 ft Stop 2 ft			
Kettle Creek L.S.	0 GPM		Lead 4 Lag 2	1 STOP 2 STOP 3 STOP 4 STOP		4.5467 ft	Start 5.2 ft Stop 4.2 ft			
Middle Tributary L.S.	0 GPM		2	1 STOP 2 STOP		4.27007 ft	Start 5.5 ft Stop 3 ft			
Middle Monument L.S.	0 GPM		1	1 STOP 2 STOP		5.14461 ft	Start 5.5 ft Stop 3.5 ft			
Pando Lift Station L.S.	0 GPM		1	1 STOP 2 STOP		2.37473 ft	Start 4.5 ft Stop 2.5 ft			
Peregrine L.S.	0 GPM		2	1 STOP 2 STOP		3.92666 ft	Start 4.5 ft Stop 3 ft			
Sand Creek L.S.	8487.05 GPM		Lead 4 Lag 1	1 RUN		A 14.2344 ft	Start 14 ft			
				2 STOP				B 14.3091 ft	Start 12.5 ft	
				3 STOP						Start 15 ft
				4 RUN						
Smith Creek L.S.	0 GPM		1	2 STOP 1 STOP		2.17491 ft	Start 3.6 ft Stop 2.2 ft			
Stratton Meadows L.S.	587.225 GPM		2	1 STOP 2 RUN		4.12048 ft	Start 5.75 ft Stop 3.25 ft			
Talon Hill L.S.	0 GPM		1	1 STOP 2 STOP		3.61157 ft	Start 10 ft Stop 6 ft			



Providing Value to Wastewater Treatment

Bradley Pump Station SKF Vibration

Description	Value	Units
PMP-1100-Vib - Bradley PS Pump 1 Vibration Motor Top X-Axis Vibration	0.0013428	in/s ²
PMP-1100-Vib - Bradley PS Pump 1 Vibration Motor Top Y-Axis Vibration	0.0018006	in/s ²
PMP-1100-Vib - Bradley PS Pump 1 Vibration Motor Top Z-Axis Vibration	0.0018006	in/s ²
PMP-1100-Vib - Bradley PS Pump 1 Vibration Motor Bottom X-Axis Vibration	0.0013428	in/s ²
PMP-1100-Vib - Bradley PS Pump 1 Vibration Motor Bottom Y-Axis Vibration	0.0018006	in/s ²
PMP-1100-Vib - Bradley PS Pump 1 Vibration Tachometer	0	RPM
PMP-1100 - Bradley PS Pump 1 Running	Not Running	

Description ▼	Value	Units
PMP-1300-Vib - Bradley PS Pump 3 Vibration Tachometer	0	RPM
PMP-1300-Vib - Bradley PS Pump 3 Vibration Motor Top Z-Axis Vibration	0.0022279	in/s ²
PMP-1300-Vib - Bradley PS Pump 3 Vibration Motor Top Y-Axis Vibration	0.0018006	in/s ²
PMP-1300-Vib - Bradley PS Pump 3 Vibration Motor Top X-Axis Vibration	0.0022584	in/s ²
PMP-1300-Vib - Bradley PS Pump 3 Vibration Motor Bottom Y-Axis Vibration	0.0013428	in/s ²
PMP-1300-Vib - Bradley PS Pump 3 Vibration Motor Bottom X-Axis Vibration	0.0013428	in/s ²
PMP-1300 - Bradley PS Pump 3 Running	Not Running	

Williams Creek Juniper Pump

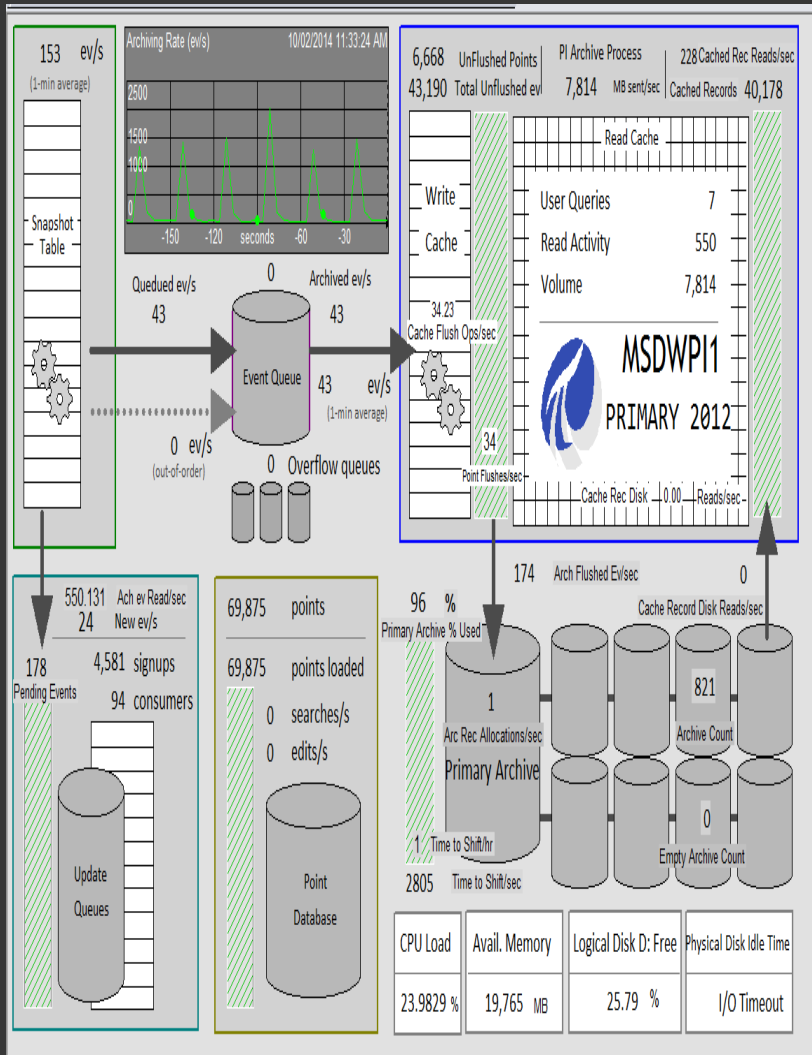
Description	Value	Units
PMP-1400-Vib - Bradley PS Pump 4 Vibration Motor Top X-Axis Vibration	0.00088504	in/s ²
PMP-1400-Vib - Bradley PS Pump 4 Vibration Motor Top Y-Axis Vibration	0.00088504	in/s ²
PMP-1400-Vib - Bradley PS Pump 4 Vibration Motor Top Z-Axis Vibration	0.00088504	in/s ²
PMP-1400-Vib - Bradley PS Pump 4 Vibration Motor Bottom X-Axis Vibration	0.00088504	in/s ²
PMP-1400-Vib - Bradley PS Pump 4 Vibration Motor Bottom Y-Axis Vibration	0.00088504	in/s ²
PMP-1400-Vib - Bradley PS Pump 4 Vibration Tachometer	0	RPM
PMP-1400 - Bradley PS Pump 4 Running	Not Running	

0.16 0.02 0.07 0.09 0.045 1,000 Running



WPSDB_PS_Pmp1_V
0.0013428 in/s²
WPSDB_PS_Pmp1_V
0.0018006 in/s²
WPSDB_PS_Pmp1_V
0.0018006 in/s²
WPSDB_PS_Pmp1_V
0.0013428 in/s²
WPSDB_PS_Pmp1_V
0.0018006 in/s²
WPSDB_PS_Pmp1_V
0 RPM
WPSDB_PS_Pmp1_F
Not Running

PI To Monitor PI



PI Manual Logger & SKF Microlog Inspector



Operator Driven Reliability

Improve Maintenance Management and Reliability
Great for Inspection Programs

Compare Manual Data with Real-Time DCS/SCADA Data (online data)

Use manually collected data with automatically collected PI System data for comprehensive analysis and a complete operational picture.

Consistency in Data Collection

Task Instructions

Route can include task instructions for data collection. Can attach PDF's, JPEG's and Hyperlinks

Barcodes & RFID

Use Barcodes and RFID to guide the user through Data Collection points and prompts for appropriate data.

Data Validation During Data Entry

Performs automatic data validation and supports limit checks including High, HiHi, LoLo and Delta.

Conditional Data Entry

Conditional expressions can be used to specify if an item is due for collection.

Lower Cost Data Collection

These Systems do not require customized software programming. Both System are fully configurable. This is an inexpensive way to gather Manual Data for performance comparisons.

Requires Plant/User Ownership

In Order for your Operator Driven Reliability Program to be successful the Plants and Users must OWN their program and be committed to its success.

Future - WIFI

-Depending on appropriate placement of Access Points These systems are WIFI Capable

Devices

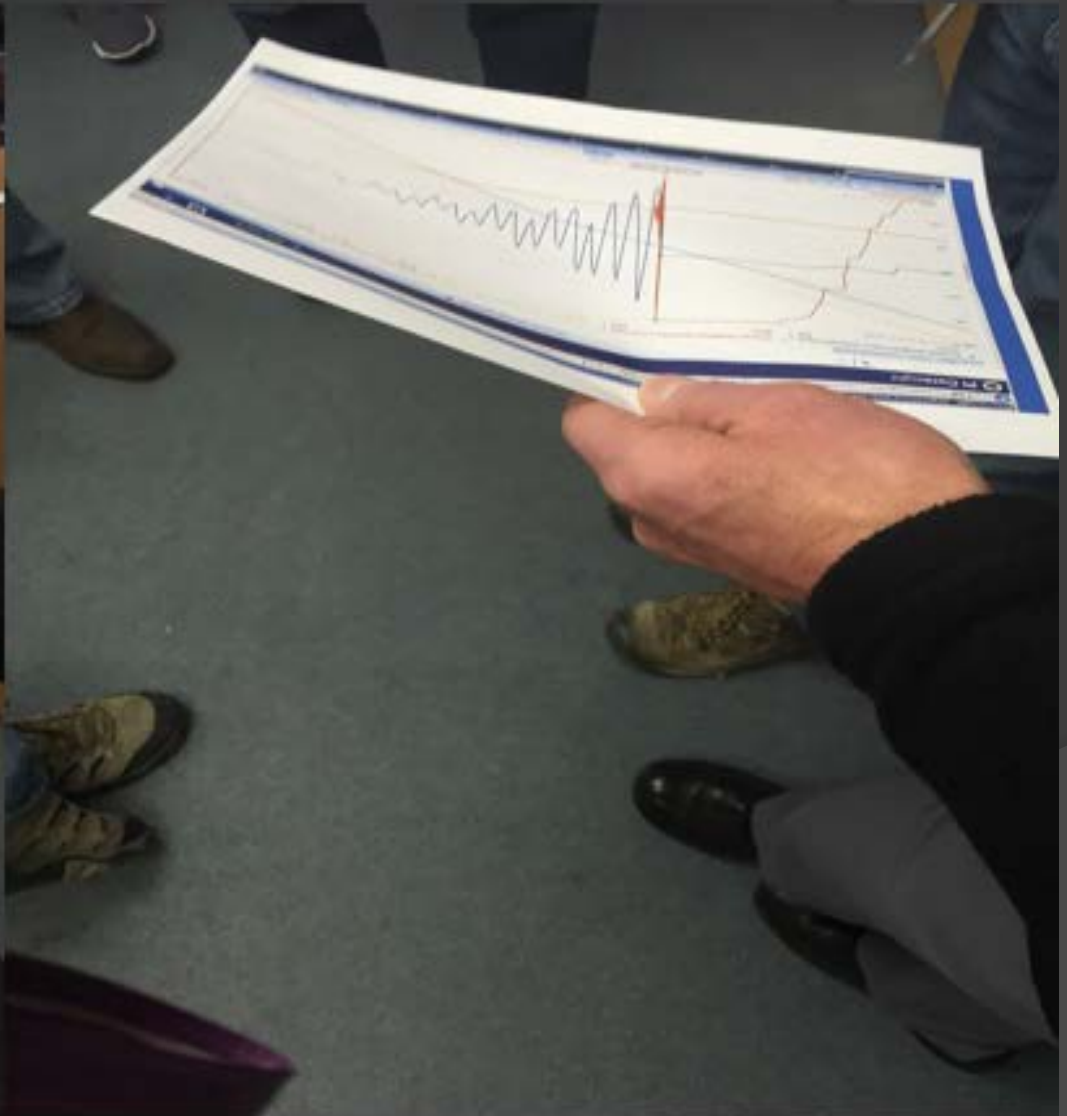
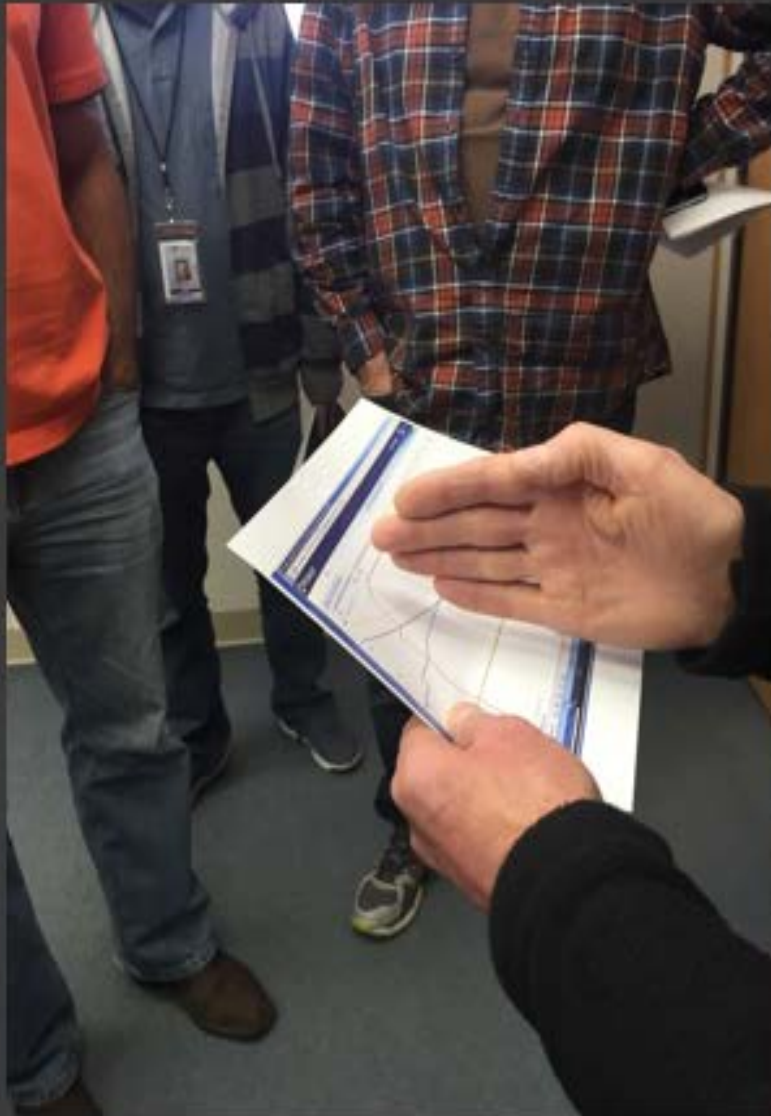
Any Windows Mobile 6.0 Professional

Wi-Fi Enabled Windows Mobile With Scanner

Wireless Enabled Windows Tablet PC



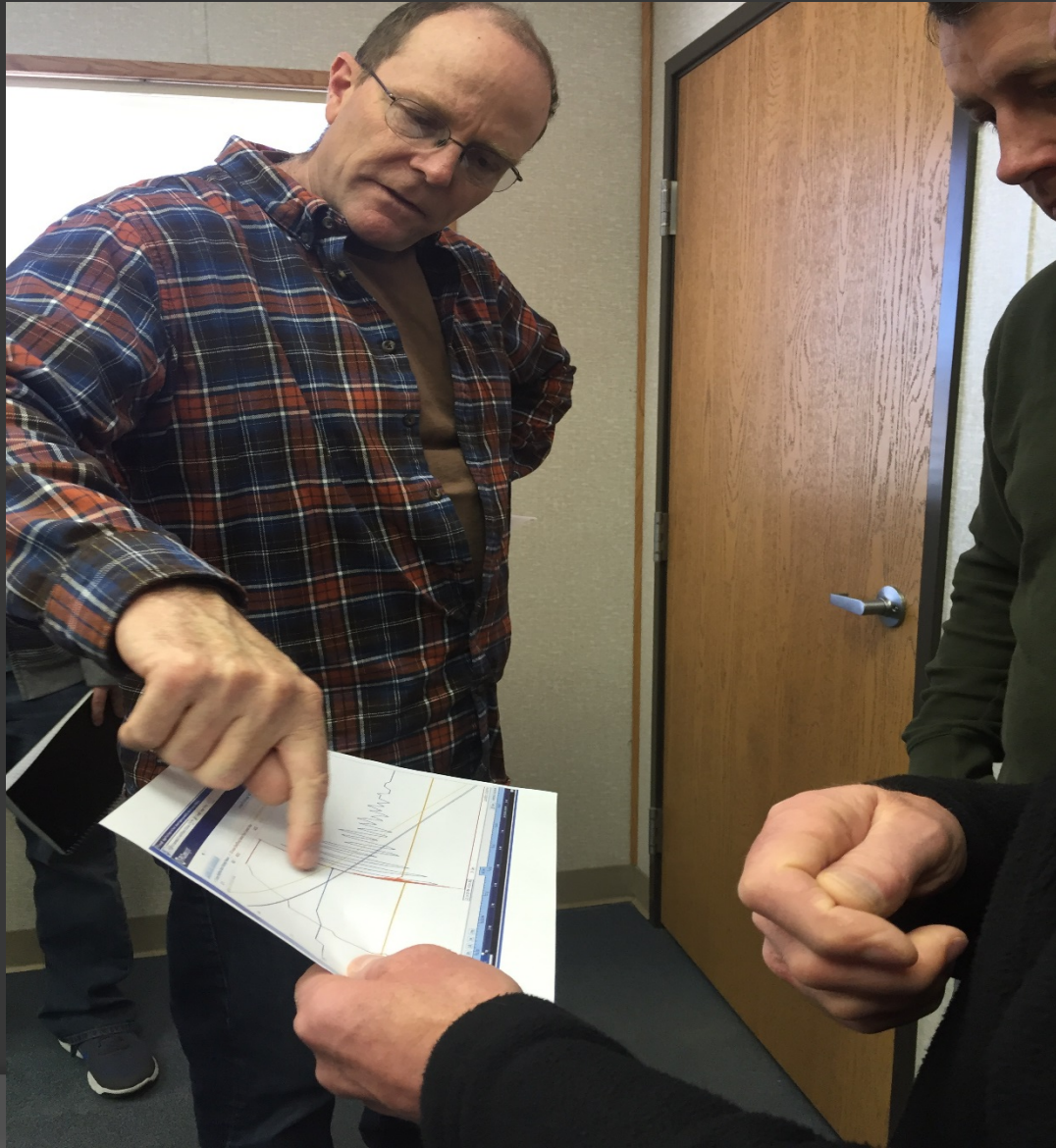
Putting the Data to Work!



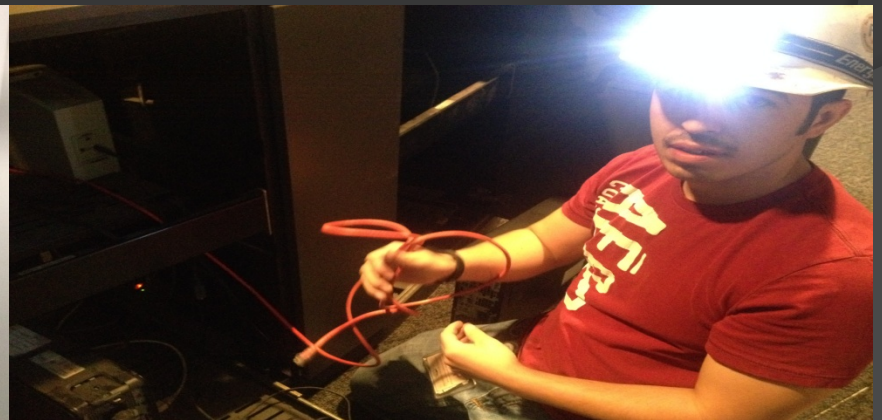
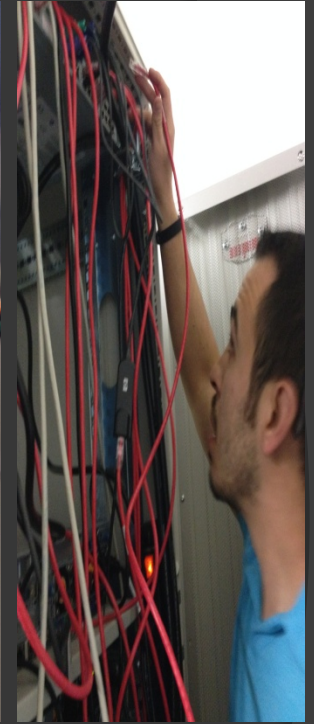
What does the Data Mean?



Just Ask The PI Team...



Drake Rebuild



Providing Value to Transmission System Operations



Sharing Mobility & Lessons Learned across the organization









The Value We Gained...

- ⦿ Lead to Convergence with IT and OT
- ⦿ Transformation of business processes and utilization of KPI's
- ⦿ Eliminate the need for assistance from other operating areas
- ⦿ Identify System disruptions
- ⦿ Improved decision quality
- ⦿ Disaster Recovery and Event Analysis
- ⦿ Quick access to critical data with the ability to visualize data in real-time

Leveraging data has truly revolutionize our company dynamics and our impact on decision making with the use of Real-Time Operational data

Transformed Operations from a static and reactionary to everyone can be a **SOLUTION** based team

Water Quality

Financial Gains Realized

- **Significant O&M Reductions Realized**
 - 29% Reduction in resource allocation for online Instrumentation Inspections
 - 30% Reduction in Vehicle Usage Annually
 - 58% Reduction in Overtime
- **Saving has helped with reallocation of O&M dollars**
 - To expand our Water Quality Instrumentation Program
 - Pre PI System utilization we had only 6 operating WQ systems
 - Compared to 18 now



COLLABORATION, TEAMWORK AND INFRASTRUCTURE

What is in our Future?

- ~~● Depending on Budget & resources – PI for Water Treatment – Reporting & Analytics~~
- Pilot Integrations with AMI
- ~~● System Capability Forecasting~~
- Energy Optimization for CSU's Assets
- ~~● PI Event Frames~~
- PI To Maximo
- ~~● PI to GIS~~
- ~~● PI & SKF for SDS~~
- ~~● Drake Scrubbers~~

How to Contact the PI Team

- Call 8Help put in a case
- Case Self Service
- Call After hours
- Call the PI Team



So What is Pi?

- Pi is Power to the People!
- It's the infrastructure and the integrations that connects people with the information from Control Rooms & SCADA and other data sources about CSU Operations to make critical operational decisions.