

# **SCADA Current Trends & Opportunities**

## **Leveraging SCADA as a Tool for Operations**

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City of Guelph Water Services

Halton Region SCADA Seminar  
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# Presentation Outline

- Some Background
  - Review of what SCADA is
  - State of Most SCADA Systems
- 
- Situational Awareness
  - High Performance HMI
  - Alarm Management
  - Data Redundancy – making it easier
  - SCADA communication networks
  - Cyber Security
- 
- Building on What You Have
  - What Guelph Water is Doing







**I wanna be a  
Water Guy  
when I grow up!**



# So I got to live the dream!





# About the Speaker

**Graham Nasby, P.Eng., PMP, CAP**  
**Water SCADA & Security Specialist**  
**City of Guelph Water Services**



- 10 years in the consulting sector;
- Joined Guelph Water Services in 2015
- OWWA and WEAO Member, Member of OWWA Automation Committee
- Co-chair of ISA112 SCADA Systems standards committee
- Voting member of ISA101 HMI Design standards committee
- Voting member of ISA18 Alarm Management standards committee
- Named Canadian Expert on IEC/SCC-TC65 with Standards Council of Canada
- Guest instructor at McMaster University and Fleming College
- Has published over 40 papers and articles on automation topics
- Received University of Guelph “Mid Career Achievement Award” in 2014
- Named ISA’s technical division leader of the year award in 2013.
- Contact: [graham.nasby@guelph.ca](mailto:graham.nasby@guelph.ca)



# City of Guelph Water Services

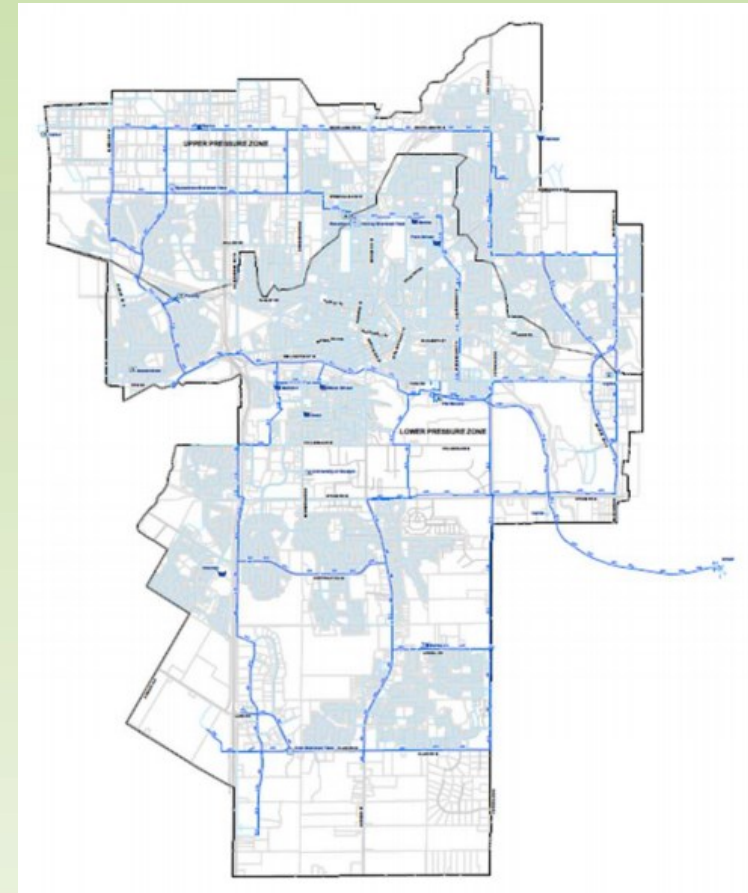
- Guelph, Ontario, Canada
- 130,000 residents
- 21 groundwater wells
- 3 water towers
- 549 km of water mains
- 49,000 service connections
- 2,750 fire hydrants
- 46,000 m<sup>3</sup>/day [12 MGD]





# Guelph Water Facilities

- Approx. 15km x 15km area
- 35 Facilities
  - 4 booster stations
  - 21 wells
  - 2 valve chambers
  - 3 water towers
  - 5 monitoring sites
- 40 PLCs plus 2 data centers
- Redundant Datalogging
  - Realtime datalogging
  - QuickPanels with store/forward
  - DNP3 Dataloggers with Store/Forward
- High availability SCADA network
  - Primary: private fibre optic
  - Secondary: private wireless, with 45 second auto-failover





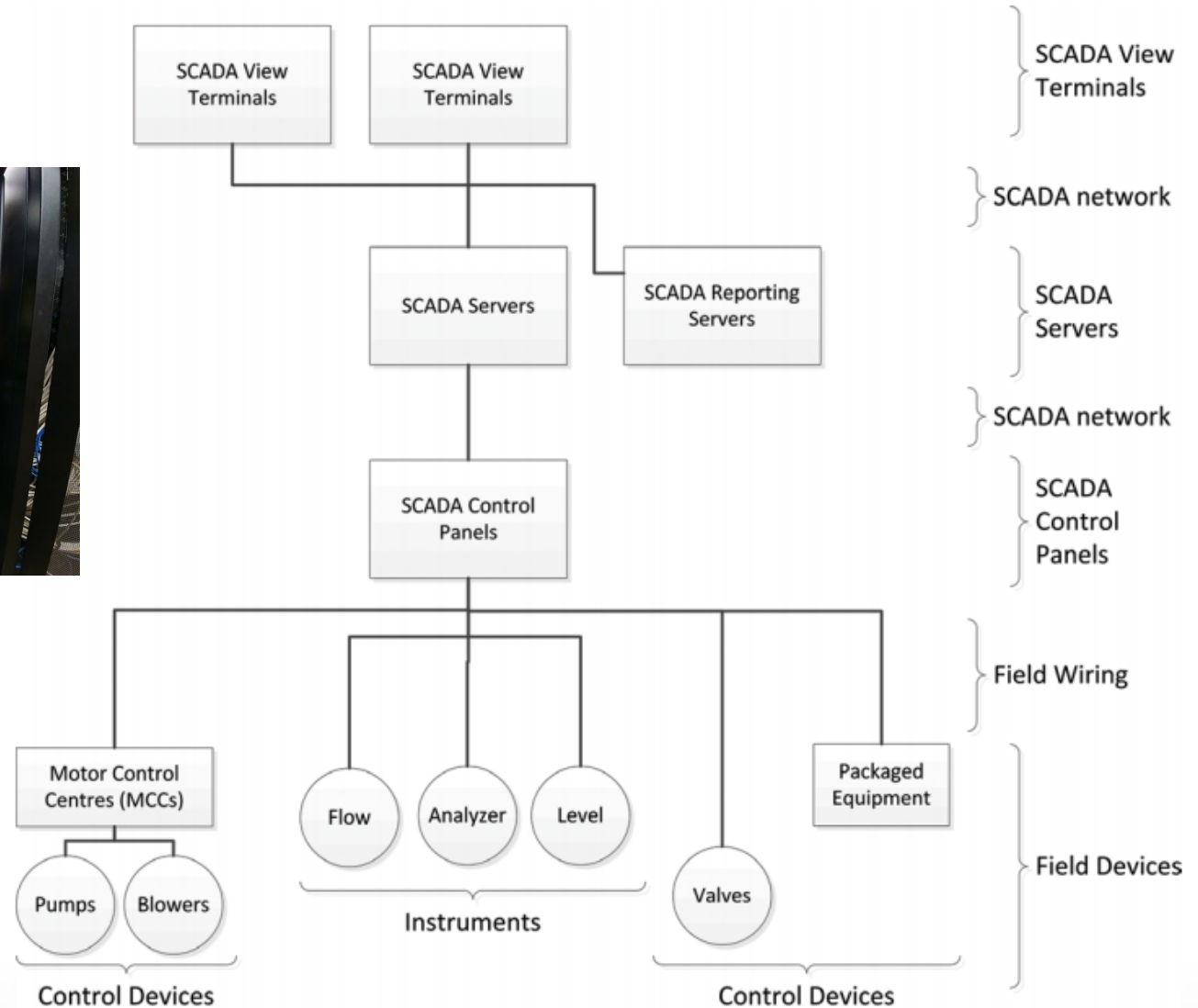
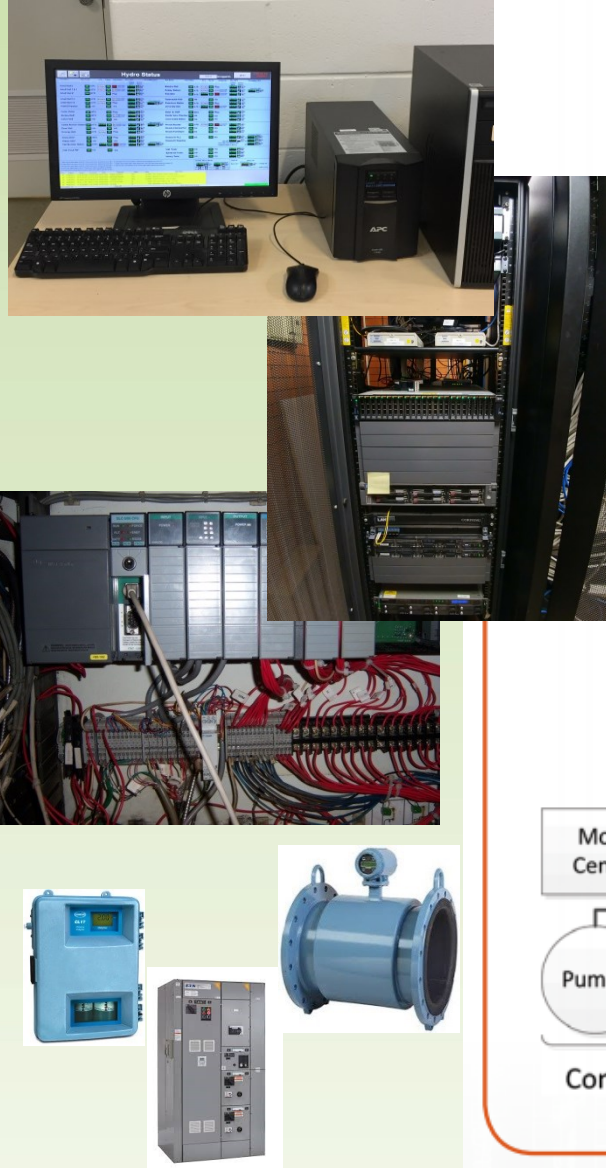
# Review: What is SCADA?



**SCADA = Supervisory Control and Data Acquisition**



# Typical SCADA Architecture





# Why we have SCADA systems

- Unattended automatic control of water facilities
- Logging of critical control parameters
  - Chlorine Residuals (e.g., 5 minute recording intervals)
  - Turbidity
  - Well Flow Rates & Daily Flow Totals
  - POE Flow Rates & Daily flow Totals
  - Tower Levels & Pressure
- Provides “visualization” of water facilities to Operators
- Enables remote monitoring and control by Operators
- Triggering and Annunciation of Alarms
- Automated responses (increase chlorine dose, shutdown, etc.)
- Reporting based on logged process data



# Current State of SCADA Systems

- **“Automation projects have the greatest opportunity to add value when process improvements are made along with the application of new technology.”**

Peter Martin, VP of Schneider Electric  
(previously CEO of Invensys, maker of Wonderware HMI software)

So why do so many of our SCADA systems “barely work”?





# Current State of SCADA Systems



**Should this  
guy be  
designing  
your water  
utility's  
automatic  
control  
system?**



# Current State of SCADA Systems



**How about this person?**

**They seem to know a lot about concrete and pipe...**



# Current State of SCADA Systems



**Do we need to  
involve  
operations and  
maintenance in  
the design  
process?**



# Current State of SCADA Systems



**Does this programmer need to understand the process to be able to program the control system?**



**Good Control System Design  
is a team effort and requires time**

**Rushed Design & Programming  
= Crappy SCADA**





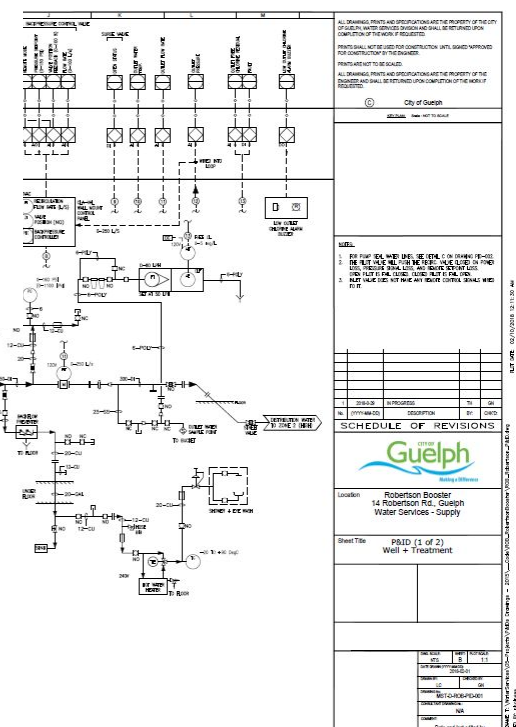
# Designing Process Limits & Operating Envelopes

## 7.6 Post-Contact Chamber Chlorine Residual

Using sodium hypochlorite addition, we aim for an operating envelope as follows from the post-contact chamber sample line. Operationally we have found that a target of 0.80 mg/L (0.60 to 1.10) results in good chlorine residual readings in the distribution system.

Table 16 – Post Contact Chamber Free Chlorine Operating Envelope

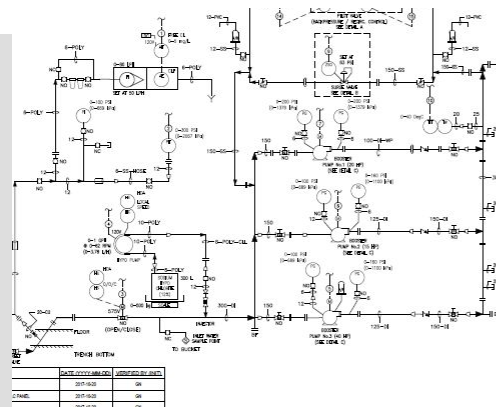
4.00 mg/L	High Regulatory Limit
2.50 mg/L	High Chlorine Shutdown Interlock
2.25 mg/L	HHH Chlorine Alarm
2.00 mg/L	HI Chlorine Alarm
1.90 mg/L	Extreme top of Envelope
1.70 mg/L	Top of Envelope
0.80 mg/L	Target
0.70 mg/L	Bottom of Envelope
0.60 mg/L	Extreme bottom of Envelope
0.55 mg/L	LO Chlorine Alarm
0.45 mg/L	LOLO Chlorine Alarm
0.40 mg/L	Low Chlorine Shutdown Interlock
0.30 mg/L	Low limit to meet CT (regulatory)
0.05 mg/L	Low Distributions Limit (regulatory)



City of Guelph Water Services  
**Emma Well**

**EMMA WELL UPGRADE PROJECT**

Process Control Narrative  
(PCN)





# There is an Automatic Control Systems Profession!

Depending on the project you may need to get a professional who designs automatic control systems involved!

This is not the same as a “programmer.”

An Automation Professional's expertise includes: Control System Theory, Instrumentation, Instrumentation, Safety Systems, Motor Control, Valves, Actuators, Electrical Design, I/O Design, Programming, and Commissioning.

In the USA, where Engineering Licences are discipline-specific, there is a separate Engineering License for “Control Systems Engineer.”

There are also certifications individuals can get to demonstrate their skills/knowledge/experience with Automatic Control Systems.



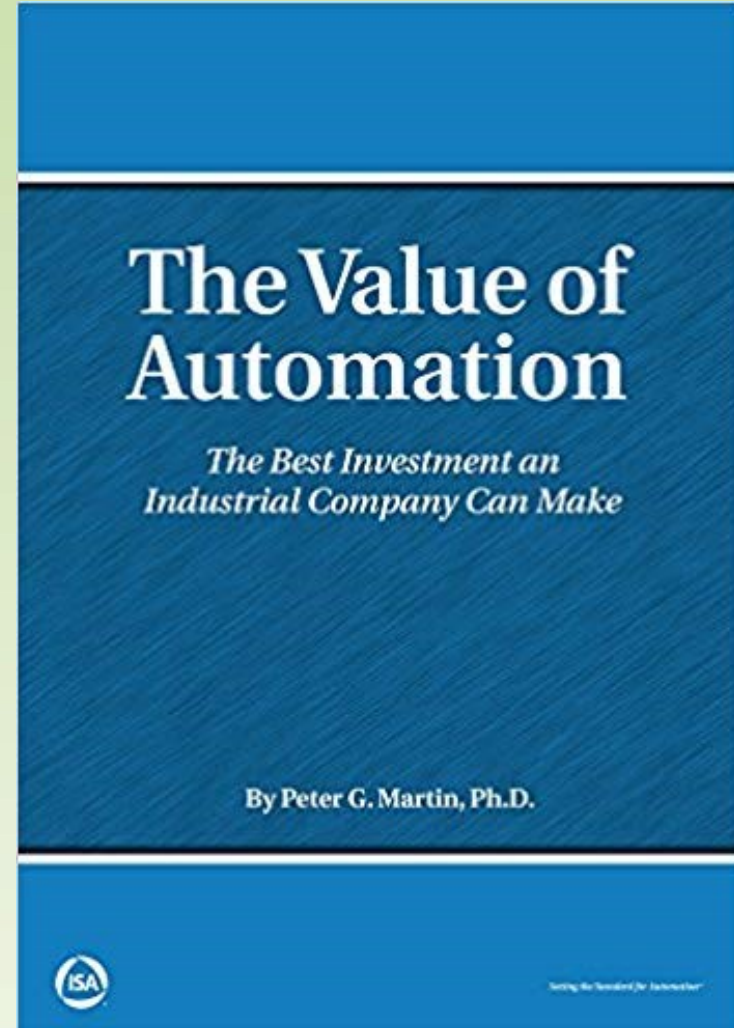
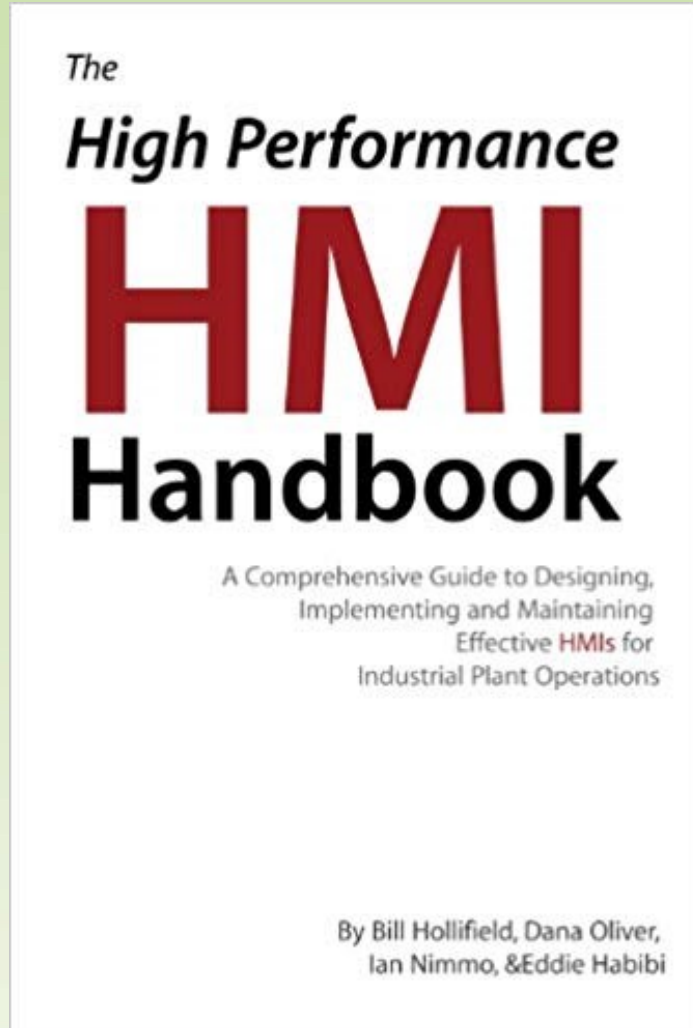


# Common Problems with SCADA Design

- Use of old out-dated technology
- Use of old outdated programming templates and hardware, many of the templates and techniques still being used are over 30 years old
- “Let’s just copy what we did on the last job”
- “Let’s just replicate what the old PLC/HMI did”
- “How the control system will work” often left until too late in design process
- Not enough time allocated to properly design the control system with participation from operations, so programmers always playing catch-up
- Not enough time is spent to model what operating ranges of the plant will be, and when permissives, alarms and interlocks should be activated
- Not enough time invested to write a proper Process Control Narratives and P&ID drawings to define what process is supposed to be doing
- Not enough time allocated in programming & commissioning schedules
- Older SCADA programming packages often labour-intensive to program!



# Two SCADA Books You Should Read



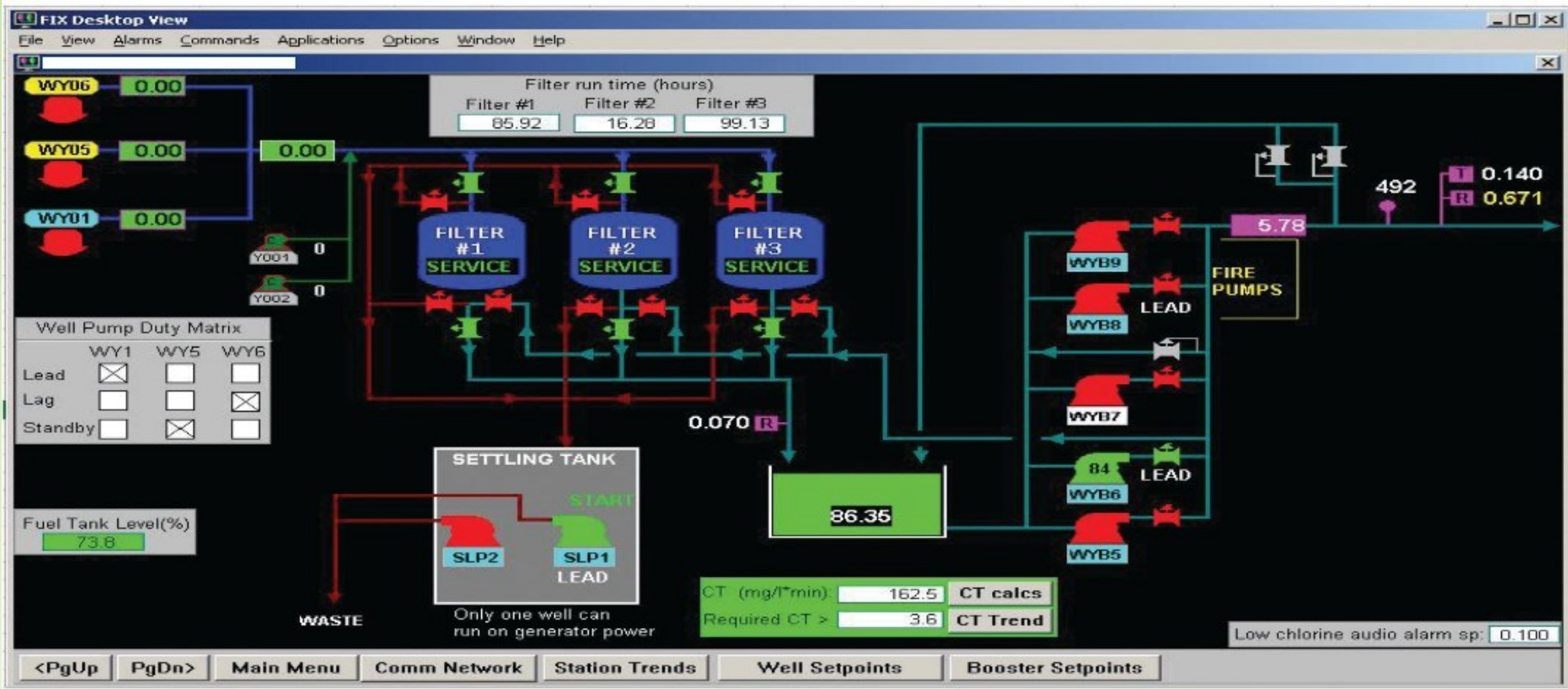


## So, what is new with SCADA?





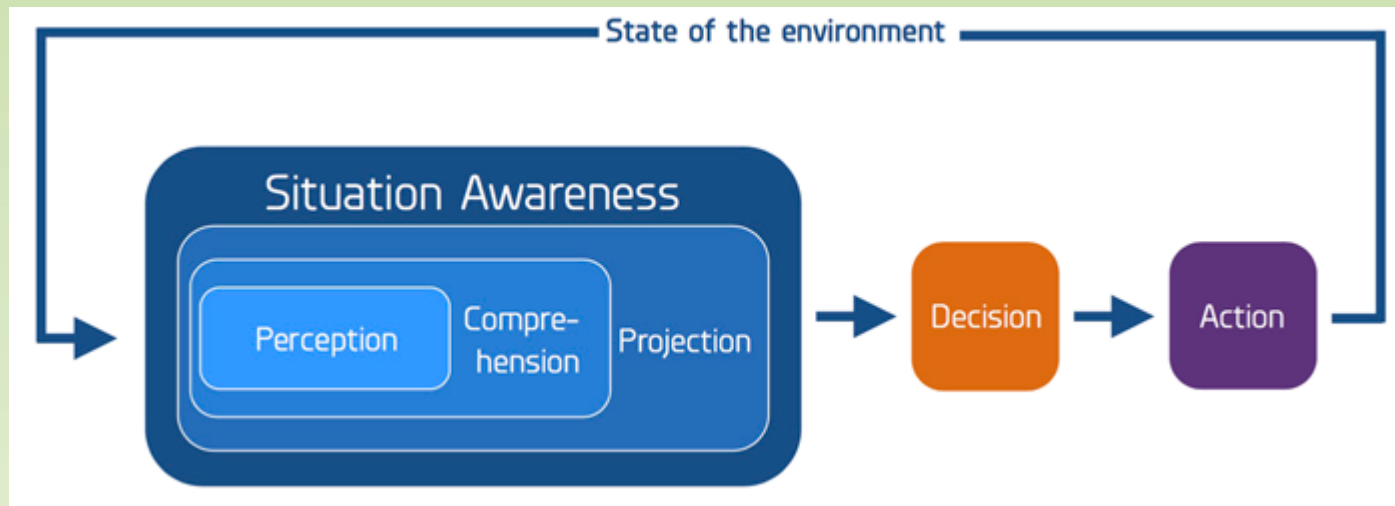
# What's new in SCADA?



- What is running?
- Is the process running well?
- What if your are colour blind?
- Is anything abnormal?



# SCADA: Situational Awareness



**To be an effective operator**

—

**you have to be aware of what your plant is doing**



# Common SCADA problem



**In some SCADA systems....  
You can't see the whole picture**



# Common SCADA problem



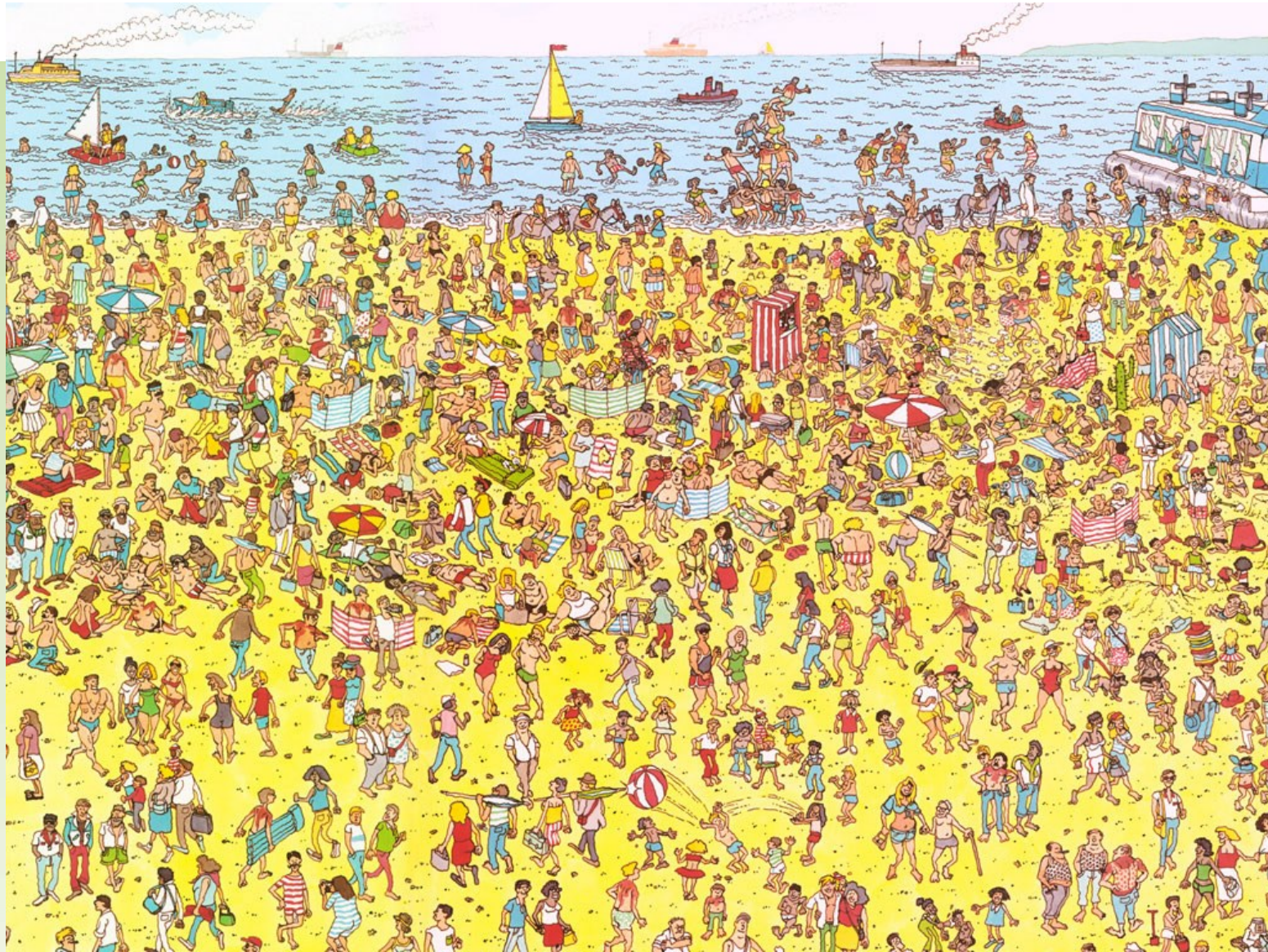
WAIT FOR IT

.....Wait for it.....

**What your SCADA system may not be showing you**



CAN  
YOU  
FIND  
THE  
PROBLEM  
ON THE  
SCADA  
SCREEN?







Friendly  
SCADA Guy





# Situational Awareness

- To be able to react to a problem,  
Operators need to be aware of the problem
- Old way operating “by alarm” (reactively)
- New approach: Present data to operators so they can proactively respond to problems as they develop
- Reserve alarms only for events that require immediate action
- High Performance HMIs (Human Machine Interfaces)
- Alarm Management (better designed alarm systems)
- Understanding your operating envelope (know your plant’s limits)

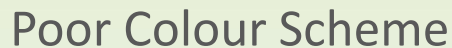


# High Performance HMIs



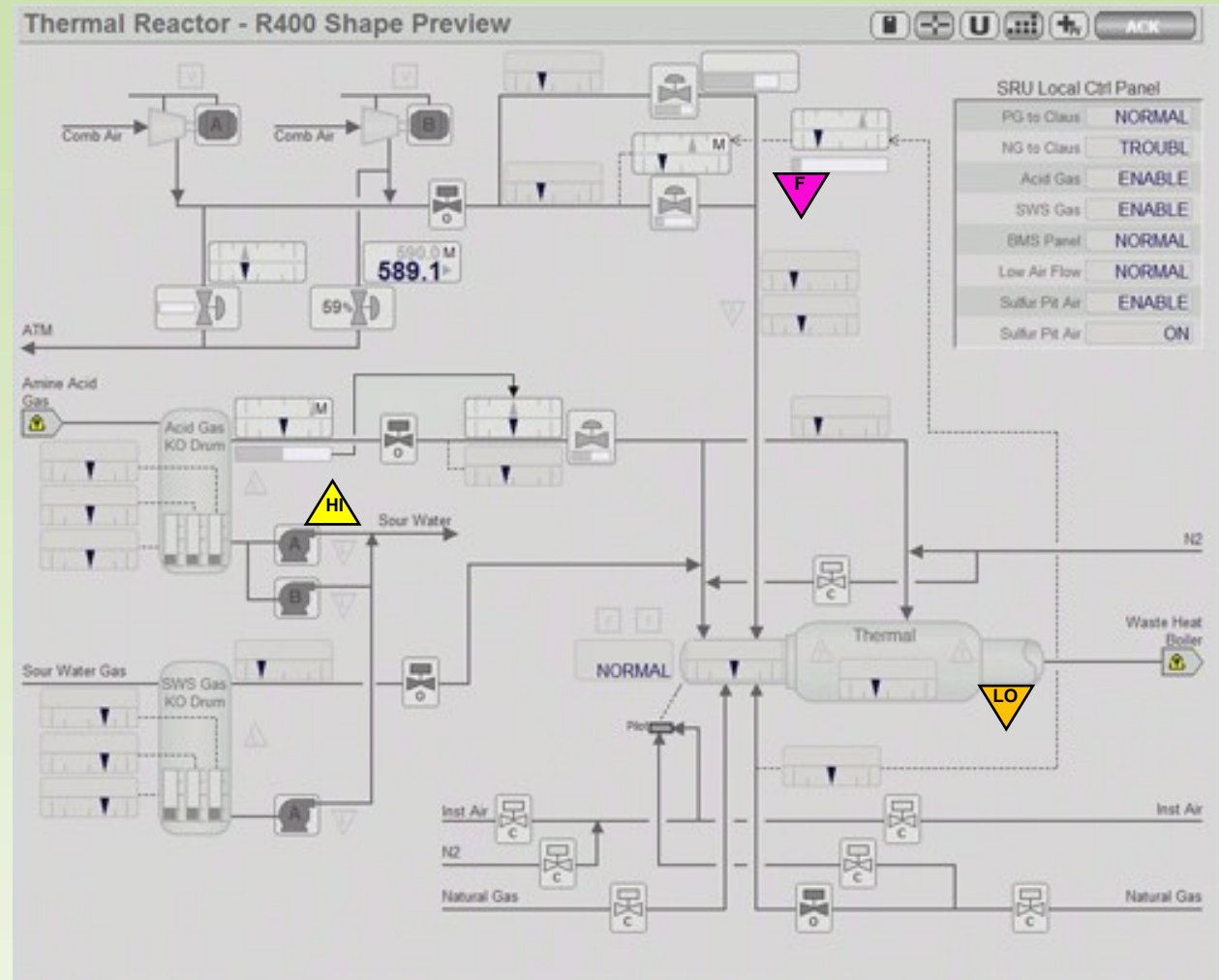
HMI = Human Machine Interface (computer screen)

## High Performance HMI Colour scheme





# High Performance HMI – Plant Running Normally



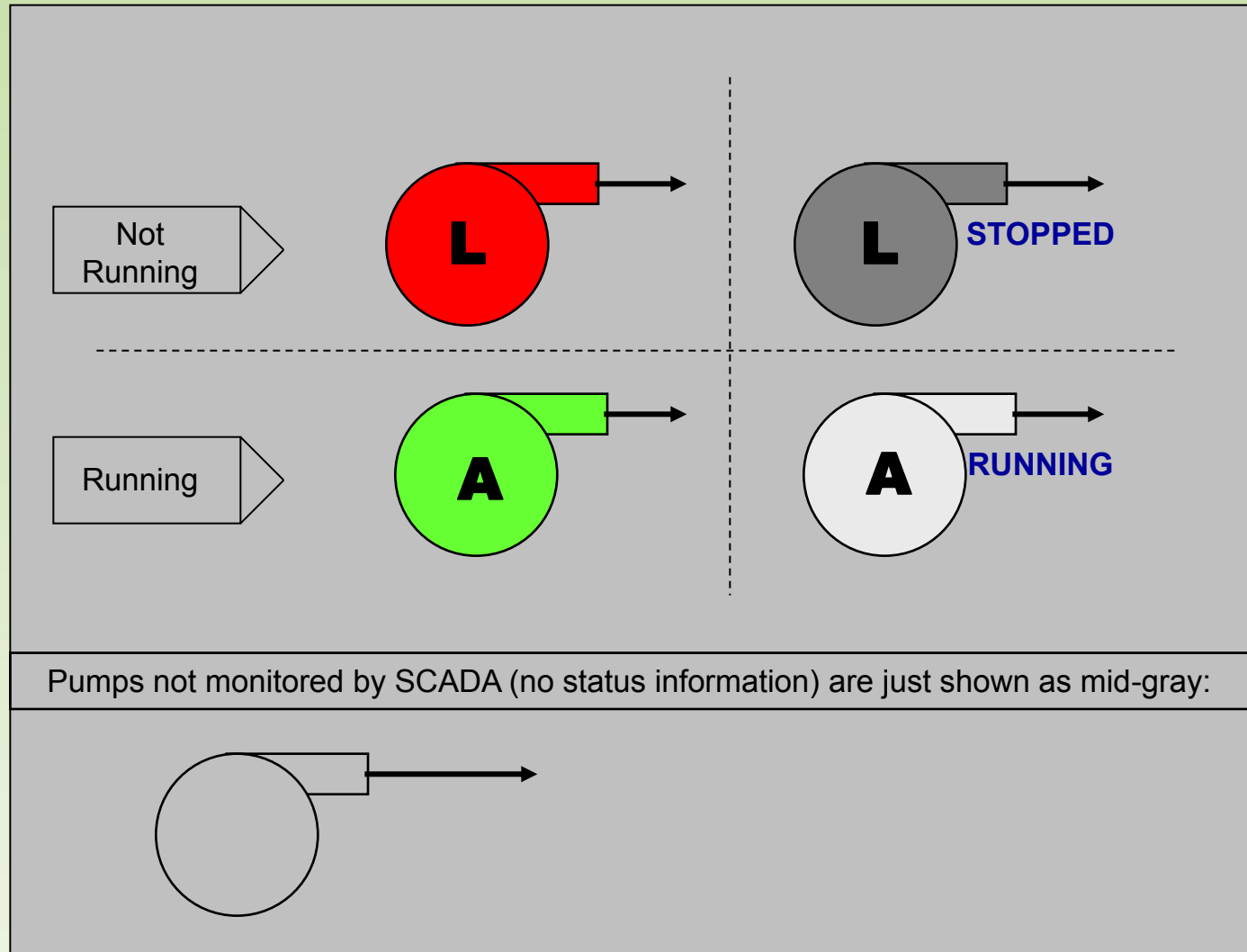


# High Performance HMI – Showing Pump Statuses

Red/Green  
for status

vs.

Greyscale &  
redundant  
coding  
(colour & text)





# High Performance HMI – Analog Values

Often  
Seen

480.1 psi    No Alarm Indication    480.1 psi

Only a Colour  
Change!






Better

480.1 psi    480.1 psi    480.1 psi    480.1 psi  
Diagnostic    Priority 3    Priority 2    Priority 1  
Priority

Betterer

480.1 psi    480.1 psi    480.1 psi    480.1 psi  
Diagnostic    Priority 3    Priority 2    Priority 1  
Priority

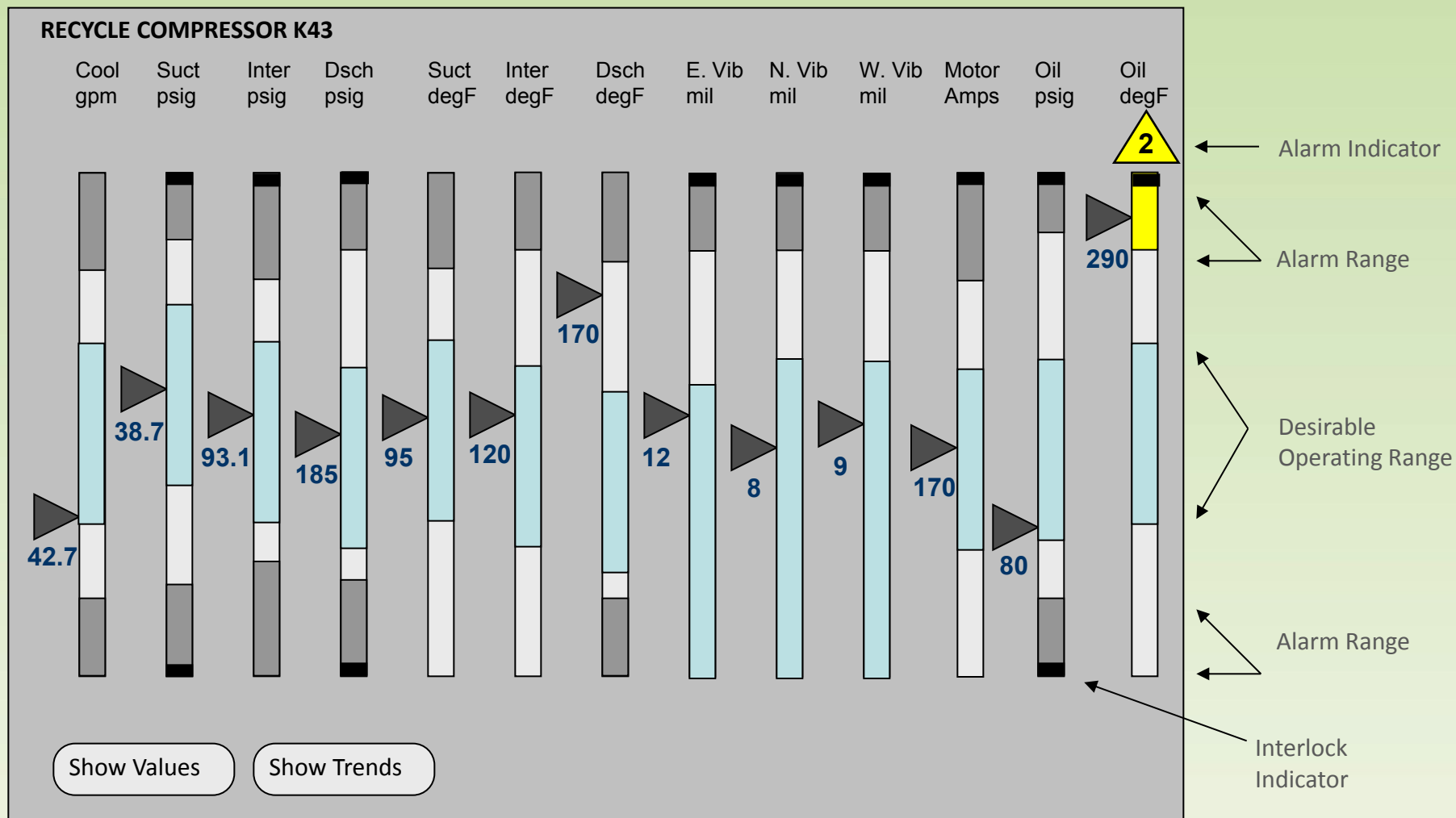
Best!

 480.1 psi     480.1 psi     480.1 psi     480.1 psi     480.1 psi  
Diagnostic    Priority 3    Priority 2    Priority 1    Suppressed  
Priority    Alarm

Show alarms in multiple ways: Colour, Shape, Text (“redundant coding”)



# High Performance HMI – Analog Values Another Way

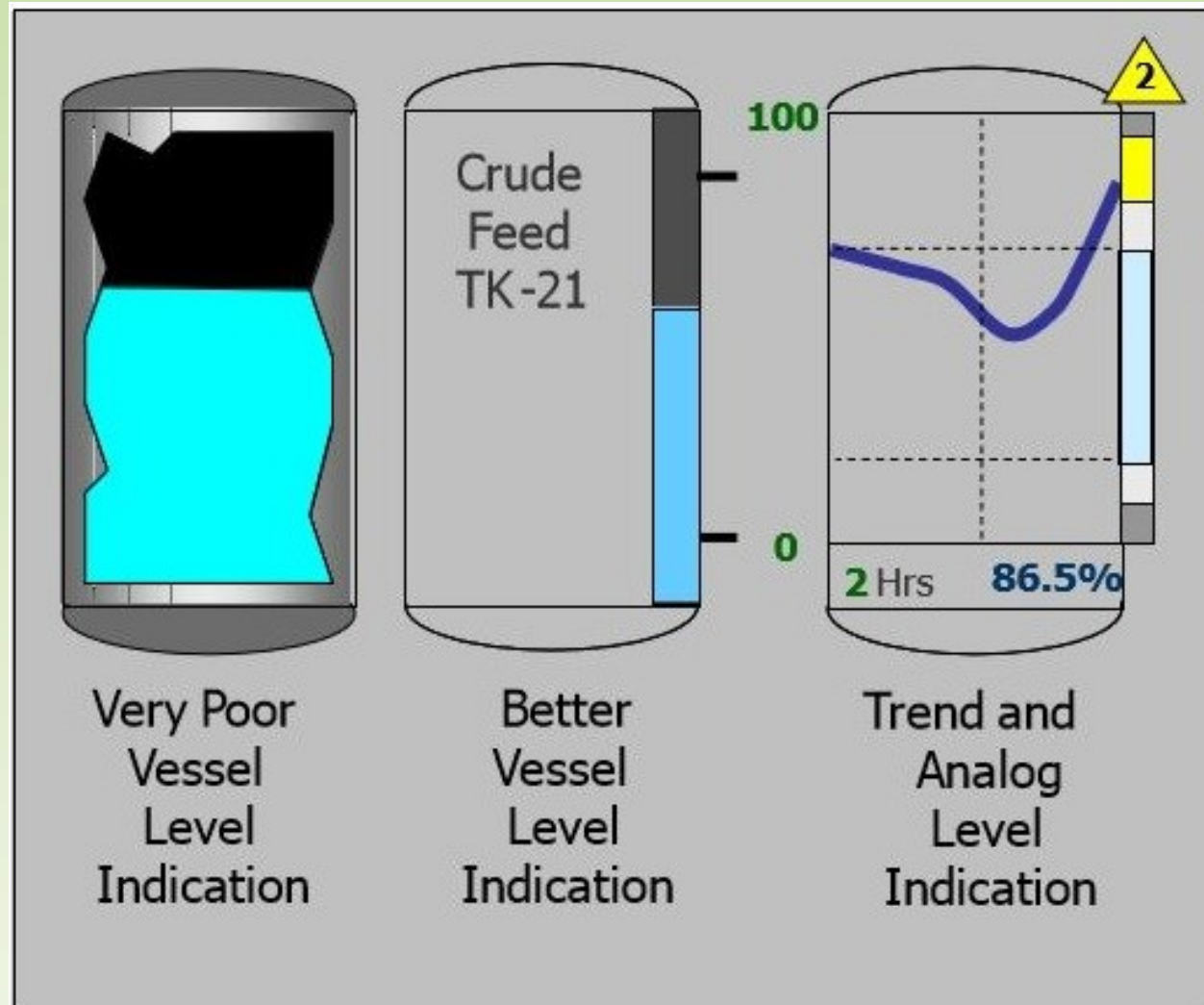


Buttons for additional functionality

Source: High Performance HMI Handbook



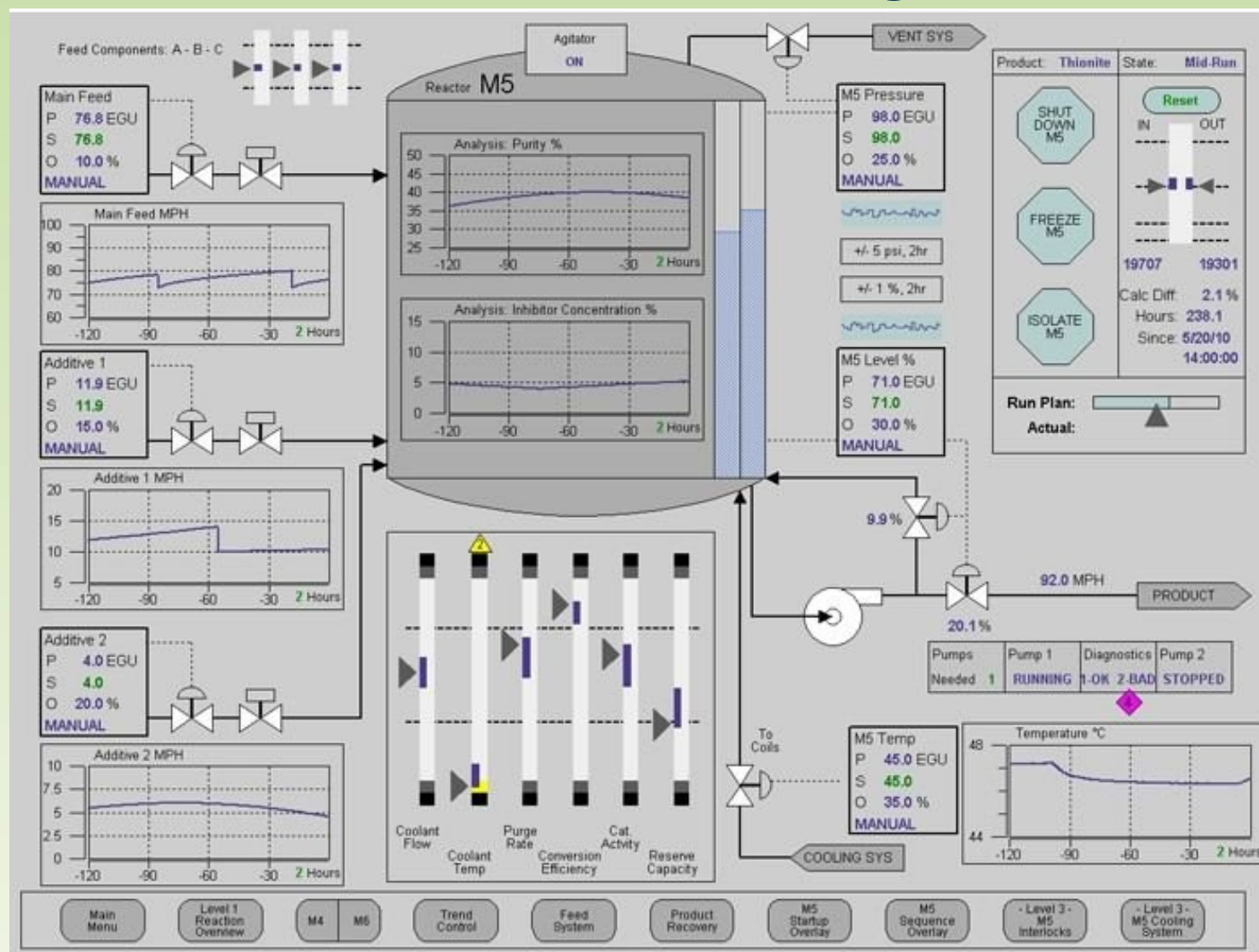
# High Performance HMI – Tank Levels Depiction



Source: High Performance HMI Handbook



# High Performance HMI – Embedding Trends



Source: High Performance HMI Handbook



# High Performance HMI – Display Hierarchy

- **Level 1 – Plant or Entire System Overview**
  - Entire Operator Span of Control. “Single-Glance”
- **Level 2 – Sub-Process Overview**
  - More details than a Level 1 display, smaller area
- **Level 3 – Equipment or Details Screen**
  - Specific details about part of the process or control
- **Level 4 – Specific Task or Diagnostic Screen**
  - Very detailed screen, only used for diagnostics

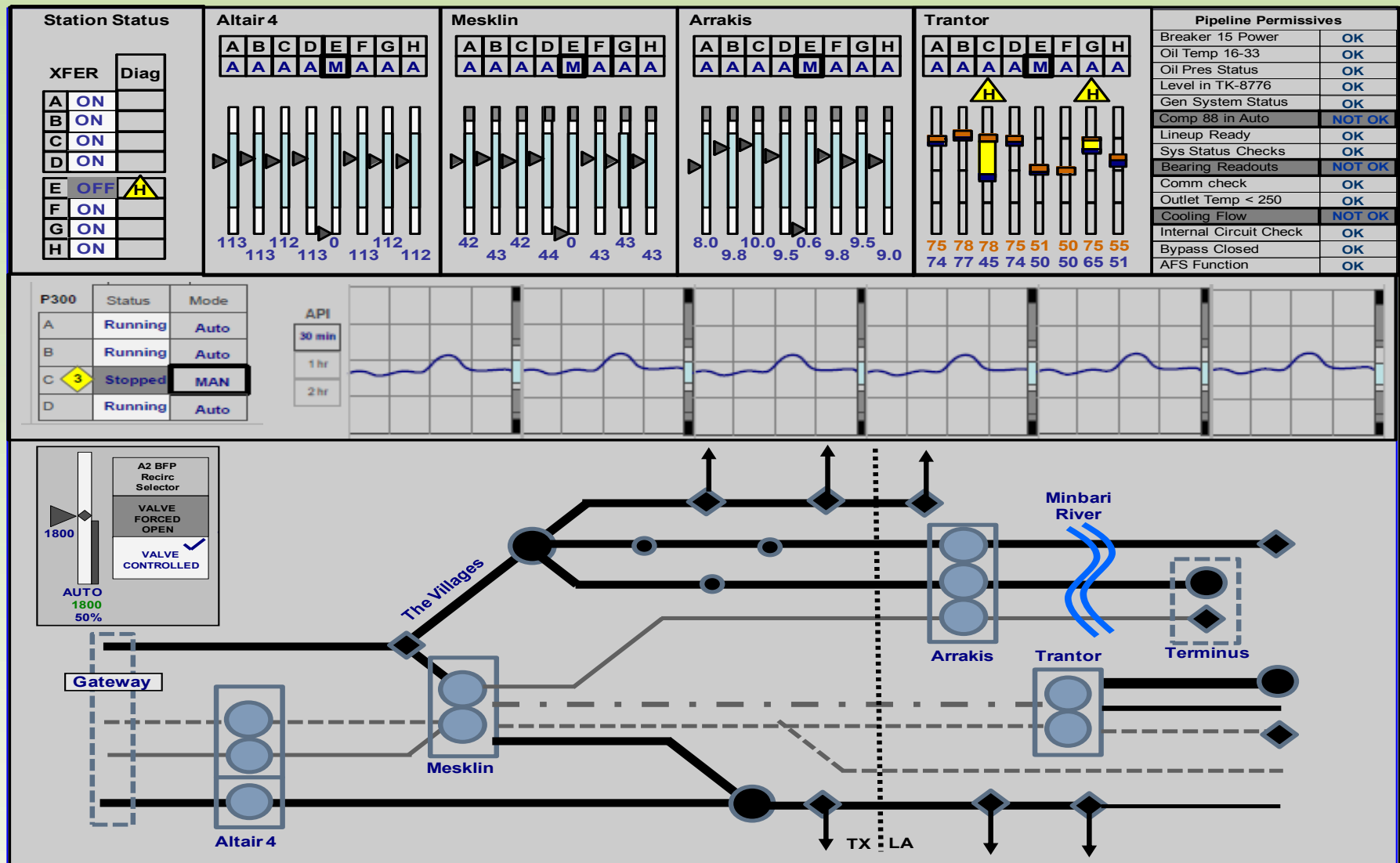


# High Performance HMI – The old way





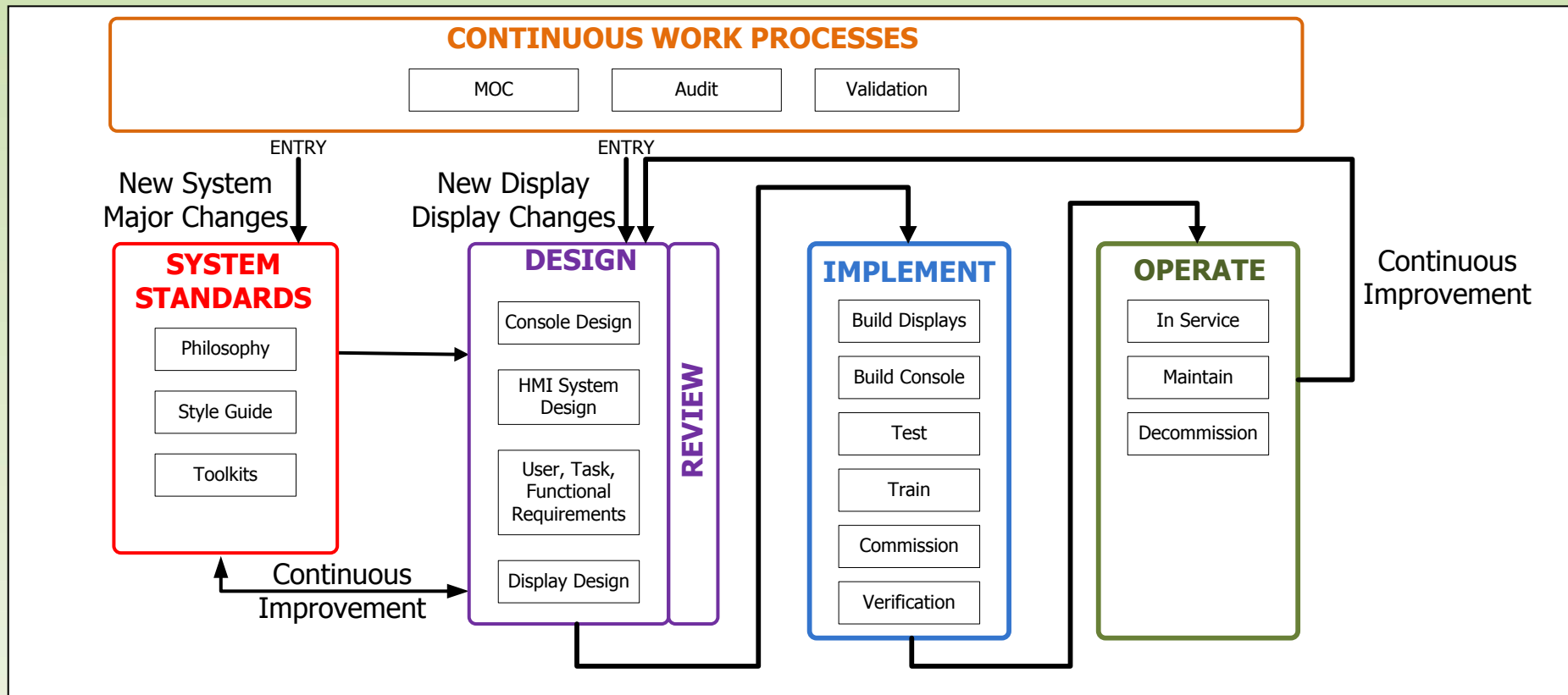
# High Performance HMI – Proper Level 1 Display



Source: High Performance HMI Handbook



# High Performance HMI – ISA101 Standard



Source: ISA101 HMI Lifecycle Diagram



# Alarm Management



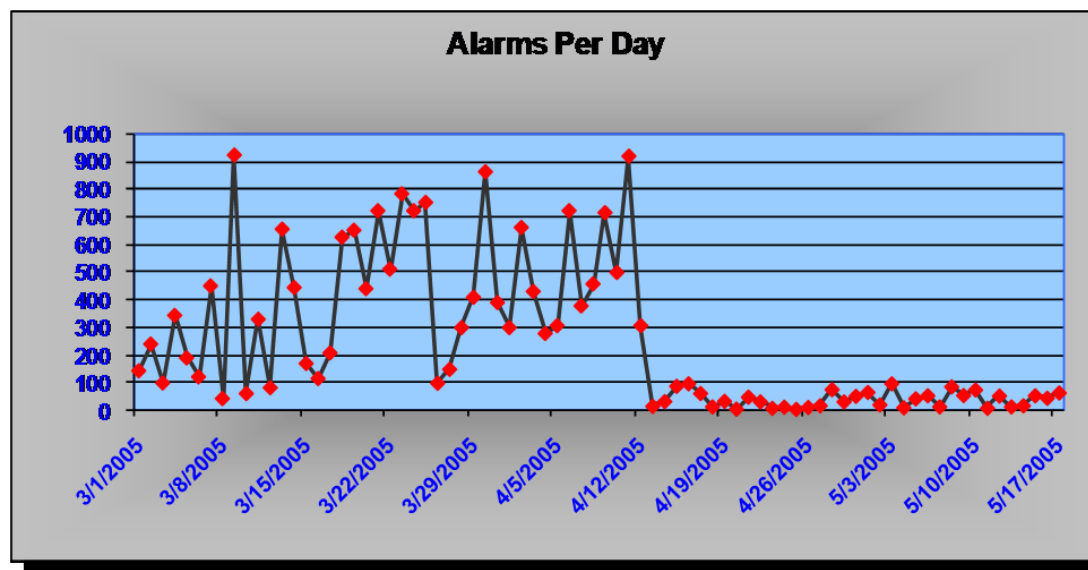
# Alarm Management: ISA18.2

ANSI/ISA-18.2-2016 \*

Management of Alarm Systems for the Process Industries

**Alarm:** *An audible and/or visible means of indicating to the operator an equipment malfunction, process deviation or abnormal condition requiring a timely response.*

Methodology for identifying, rationalizing and designing alarms to be a powerful tool for operations, and eliminating non-useful alarms



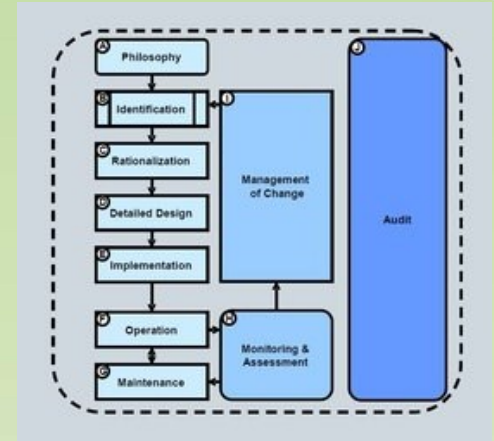
Typical example of results of 18.2 being implemented (showing before/after)



# Alarm Management: ISA18.2

## **ANSI/ISA-18.2-2016:**

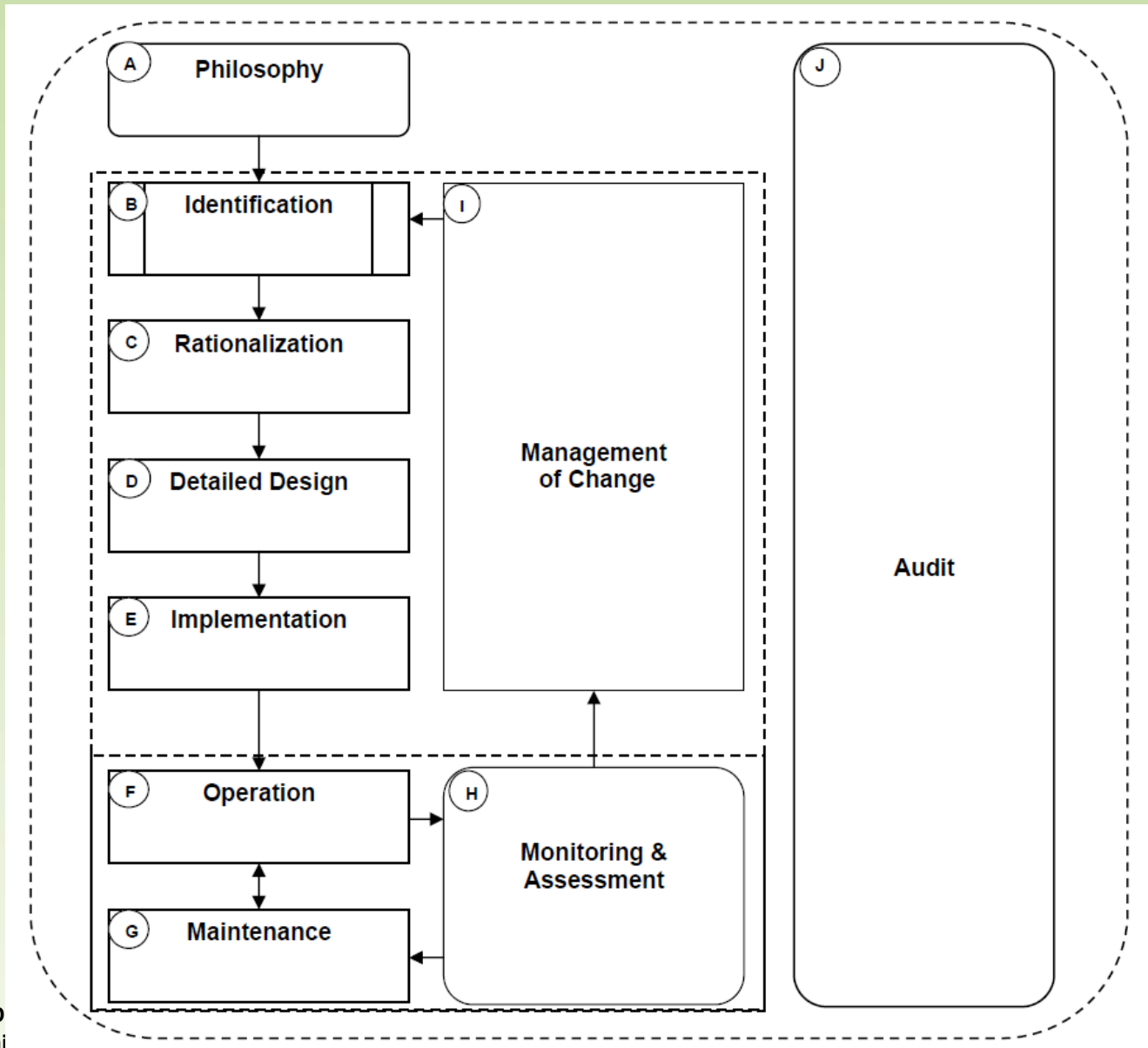
### Management of Alarm Systems for the Process Industries



- Addresses the development, design, installation, and management of alarm systems in the process industries
- Defines the terminology and models to develop an alarm system – and the work processes to effectively maintain it throughout its lifecycle
- Six technical reports available to explain specific applications in greater detail
- Based on work by the ISA18 committee, which has been active since 2003.
- First version of ISA18.2 standard published in 2009, became IEC-62682 in 2015, and updated version published in 2016.



# Alarm Management: ISA18.2 Alarm Mgmt. Lifecycle





# Alarm Management: Master Alarm Database (MADB)

Centralized repository of approved alarms and their configuration.

An approved/documented list of all your alarms in one place.

Tag	Priority	Desc.	Condition	Consequence If Ignored	Consequence Severity	Expected Operator Response	Time to Respond
P1-380-LAH-201	LOW	Aeration 1 High Level	High Level Switch Activated for 10sec	Overflows in Secondary clarifiers.	MINOR	Check Level Controller	2 hours
P1-380-AAL-102	MED	Aeration 1 Low DO	DO below 3ppm for 30min	Loss of Biological Action, Risk of Damage to Biological Mass	MAJOR	Investigate and turn on additional blowers	1 hour
P1-380-PALL-456A	LOW	Aeration 1 Air Pres. Low Low	Less than 15psi for 5min	Loss of Energy if Air Leak, Poor Aeration (Note: there is a low DO alarm)	MINOR	Check pressures in air distribution system via HMI, check valves in field	4 hrs



# Alarm Management: Master Alarm Database

- **Alarm Tag**
- **Alarm Description** (full description & what is shown on HMI)
- **Identification:** Trigger Condition, Purpose
- **Rationalization:**
  - Consequence & Severity if Ignored
  - Expected Operator Response, Time to Respond
  - Alarm Priority & Alarm Class
  - Justification for having this alarm configured!
- **Design:** Trigger Condition, On/Off Delays, Additional Filtering Logic, Setpoints, Routing/grouping information for the HMI
- **Operation:** When put into service, If Periodic Testing is required



# Alarm Management: Key SCADA Features

- Master Alarm Database
- Ability to create non-alarm messages and logged events
- Support for Alerts, Prompts, and Maintenance Messages
- HMI Alarm Summary Display Screen
- Alarm Sorting, Filtering, Routing
- Alarm Areas/Grouping
- Alarm Priorities
- Alarm Classes



# Alarm Management: Key SCADA Features cont'd

- Standardizing Alarm Features with Function Blocks
- On-Delay, Off-Delay, Deadband
- Conditional Alarming: base condition plus additional logic
- Alarm Shelving Method with Authorization / Logging
- Alarm Out of Service
- Change Control – Permissions, Setpoints, Configuration
- Configuration Change Logging
- Alarm Setpoint/Attribute verification & enforcement



# Alarm Management: Non-Alarms

## HMI: Alarms, Events and Notifications

- SCADA Systems can have multiple types of notifications

Operator notification types	Operator is expected to take an action	Operator might need to be aware but is not required to take action <i>(Action might be expected from someone other than the operator.)</i>
Arises from an abnormal process or equipment situation	Alarm	Alert
Arises from a normal situation	Prompt	Status

Figure 6 – Sample criteria for notification types from an alarm philosophy

- SCADA systems should have support for:
  - Alarms
  - Other notifications: alerts, prompts, maintenance messages
  - Event messages
  - Logged-only events



# Alarm Management: Dedicated Alarm Display

- Dedicated screen for displays alarms – only alarms
- Ideally on its own dedicated monitor in multi-monitor setup

Open Alarm Viewer

☒ Catastrophic  
☒ Critical  
☒ High  
☒ Medium  
☒ Low  
☒ Selected  
☐ Acknowledged

Home Refresh ? Help X Exit JAVED (Role)  
 Acknowledge Global Ack X Delete Delete All Tue Jun 02 09:22:58 GMT+05:00 2009  
 Alarm Viewer

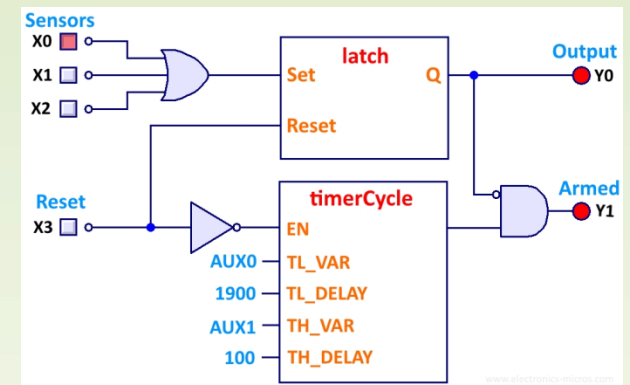
Recent Alarms Historical Alarms

Date/Time	Type	Name	Tag Name	Value/Diff	Severity	Quality	Message	Acknowledgem...
2009-06-02 09:23:02	Limit	SULPHURIC	Channel_0_User_Defi...	0.009421819	Critical	192	lohi message sul	Required
2009-06-02 09:23:02	Deviation	TEST	Channel_0_User_Defi...	612.0	Catastrophic	192	hihi deviation message test	Required
2009-06-02 09:23:02	Limit	TEST	Channel_0_User_Defi...	48.0	Critical	192	lohi limit message test	Required
2009-06-02 09:22:58	Limit	HCL	Channel_0_User_Defi...	0.02438214	Catastrophic	192	hihi message hcl	Required
2009-06-02 09:22:58	Limit	MIXTURE	Channel_0_User_Defi...	20.004639	Critical	192	lohi message limit Mixture	Required
2009-06-02 09:22:58	Limit	SULPHURIC	Channel_0_User_Defi...	0.44344157	Critical	192	lohi message sul	Required
2009-06-02 09:22:57	Deviation	TEST	Channel_0_User_Defi...	919.0	Catastrophic	192	hihi deviation message test	Required
2009-06-02 09:22:57	Limit	TEST	Channel_0_User_Defi...	45.0	Critical	192	lohi limit message test	Required
2009-06-02 09:22:53	Limit	HCL	Channel_0_User_Defi...	0.97925013	Catastrophic	192	hihi message hcl	JAVED
2009-06-02 09:22:53	Limit	MIXTURE	Channel_0_User_Defi...	30.2855	Catastrophic	192	lohi message limit Mixture	JAVED
2009-06-02 09:22:53	Limit	SULPHURIC	Channel_0_User_Defi...	0.6835348	Critical	192	lohi message sul	JAVED
2009-06-02 09:22:52	Limit	TEST	Channel_0_User_Defi...	41.0	Critical	192	lohi limit message test	JAVED
2009-06-02 09:22:48	Limit	HCL	Channel_0_User_Defi...	0.047570862	Catastrophic	192	hihi message hcl	JAVED
2009-06-02 09:22:48	Limit	MIXTURE	Channel_0_User_Defi...	3.2709394	Low	192	lohi message limit Mix	JAVED
2009-06-02 09:22:48	Limit	SULPHURIC	Channel_0_User_Defi...	0.02965525	Critical	192	lohi message sul	JAVED
2009-06-02 09:22:48	Deviation	TEST	Channel_0_User_Defi...	721.0	Catastrophic	192	hihi deviation message test	JAVED
2009-06-02 09:22:48	Limit	TEST	Channel_0_User_Defi...	39.0	Critical	192	lohi limit message test	JAVED
2009-06-02 09:22:43	Limit	HCL	Channel_0_User_Defi...	0.3043463	Catastrophic	192	hihi message hcl	JAVED
2009-06-02 09:22:43	Limit	MIXTURE	Channel_0_User_Defi...	0.21913764	Critical	192	lohi message limit Mixture	JAVED
2009-06-02 09:22:43	Limit	SULPHURIC	Channel_0_User_Defi...	0.21913764	Critical	192	lohi message sul	JAVED
2009-06-02 09:22:43	Deviation	TEST	Channel_0_User_Defi...	824.0	Catastrophic	192	hihi deviation message test	JAVED
2009-06-02 09:22:43	Limit	TEST	Channel_0_User_Defi...	36.0	Critical	192	lohi limit message test	JAVED
2009-06-02 09:22:39	Limit	HCL	Channel_0_User_Defi...	0.96717709	Catastrophic	192	hihi message hcl	JAVED
2009-06-02 09:22:38	Limit	MIXTURE	Channel_0_User_Defi...	29.449152	Critical	192	lohi message limit Mixture	JAVED
2009-06-02 09:22:38	Limit	SULPHURIC	Channel_0_User_Defi...	0.66381353	Critical	192	lohi message sul	JAVED
2009-06-02 09:22:38	Deviation	TEST	Channel_0_User_Defi...	88.0	Catastrophic	192	hihi deviation message test	JAVED
2009-06-02 09:22:38	Limit	TEST	Channel_0_User_Defi...	32.0	Critical	192	lohi limit message test	JAVED
2009-06-02 09:22:34	Limit	HCL	Channel_0_User_Defi...	0.2701796	Catastrophic	192	hihi message hcl	JAVED
2009-06-02 09:22:34	Limit	MIXTURE	Channel_0_User_Defi...	8.772794	Medium	192	lo message limit Mixture	JAVED
2009-06-02 09:22:33	Limit	SULPHURIC	Channel_0_User_Defi...	0.18136518	Critical	192	lohi message sul	JAVED
2009-06-02 09:22:33	Deviation	TEST	Channel_0_User_Defi...	830.0	Catastrophic	192	hihi deviation message test	JAVED
2009-06-02 09:22:33	Limit	TEST	Channel_0_User_Defi...	30.0	Critical	192	lohi limit message test	JAVED
2009-06-02 09:22:28	Limit	HCL	Channel_0_User_Defi...	0.06492469	Catastrophic	192	hihi message hcl	JAVED
2009-06-02 09:22:29	Limit	MIXTURE	Channel_0_User_Defi...	3.1376188	Low	192	lohi message limit Mix	JAVED
2009-06-02 09:22:28	Limit	SULPHURIC	Channel_0_User_Defi...	0.04975392	Critical	192	lohi message sul	JAVED



# Alarm Management: Programming Best Practices

- Use a standardized function block in your PLC for all alarms
- Key Features:
  - Raw Status vs. Alarm Bit
  - Condition Inversion
  - Logic-Based Suppression
  - ON-Delay
  - OFF-Delay
  - Shelving / Out of Service support (if required at PLC-level)
- Additional Features for Analog/Value Alarms
  - Deadband
  - Alarm Masking if Signal is Bad
  - Masking of Lesser Alarms (L vs. LL)
  - Rate of Change





# Data Redundancy

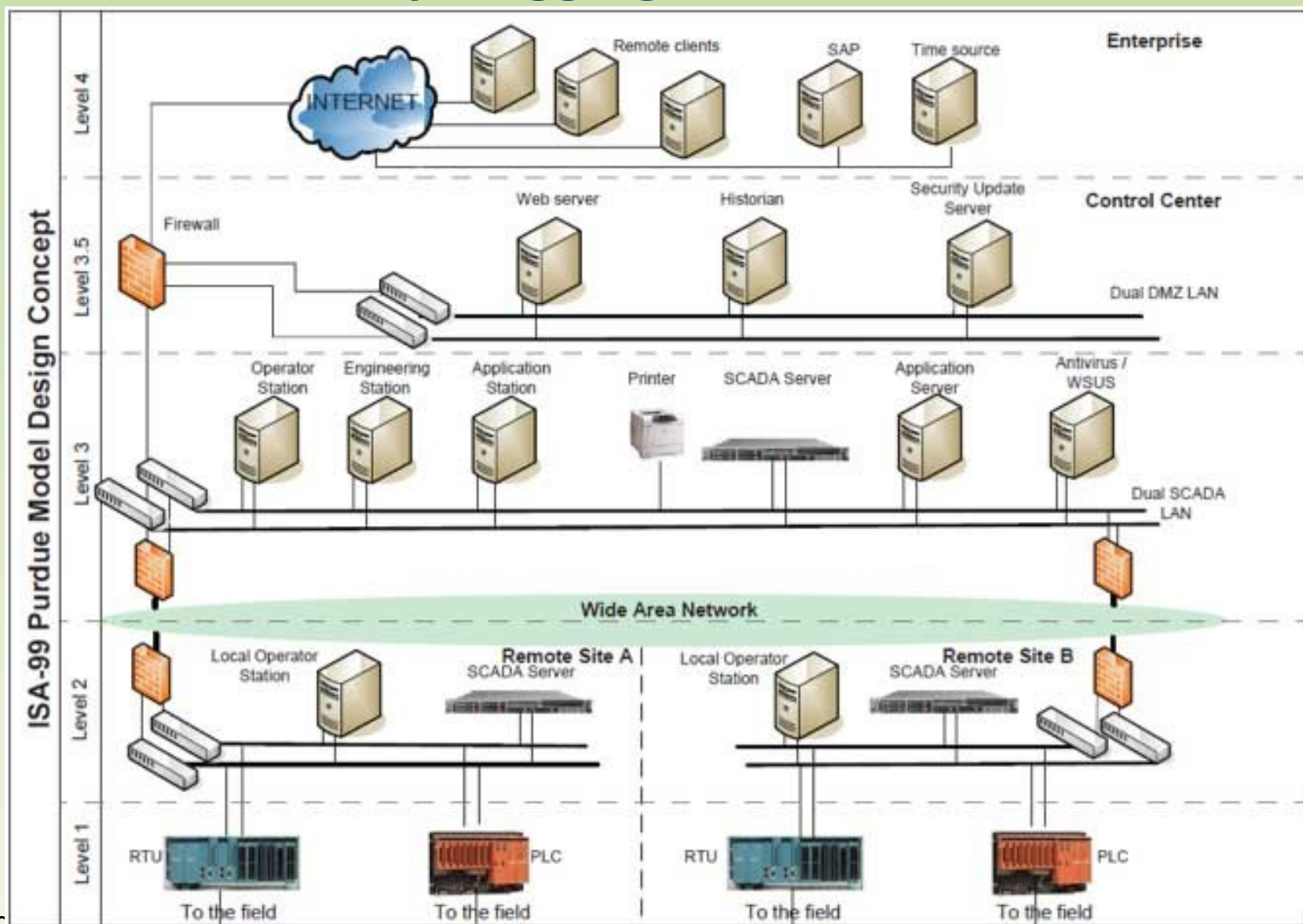


# Data Redundancy: Logging Data

- O.Reg. 170 requires us to log chlorine residuals every 5 minutes (water)
- Permits require us to track flow rates and flow totals at facilities
- SCADA Systems are not perfect: unit failures and network outages do happen
- Best Practice is to have redundant data logging
  - Main SCADA System logging data
  - Data loggers at sites
- Existing Practice
  - Redundant data loggers. Data must be gathered or imported manually into reporting system
  - Custom programming often needed to implement backup data logging in PLCs
- New Developments
  - New data loggers and operator terminals that do store/forward data logging
  - Reporting systems and historians that can accept data from multiple sources
  - Networking Protocols, e.g., DNP3, that have built-in time- stamping & store/forward logging



# Data Redundancy: Logging Data



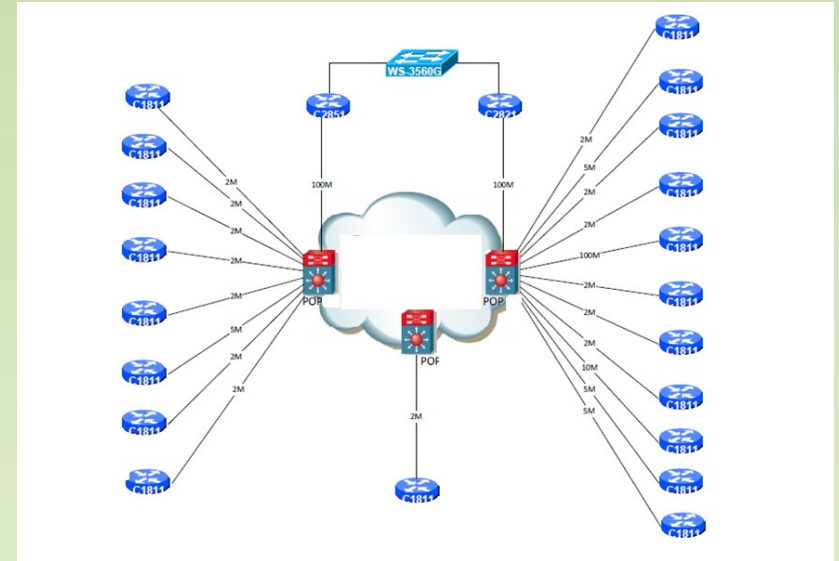


# SCADA Network Redundancy



# SCADA Network Redundancy

- SCADA is critical to operations
  - Data Logging,
  - Situational Awareness,
  - Remote Control by Operators,
  - Automatic Control,
  - Alarms,
  - Reporting
- SCADA relies on its process control network to stay online
  - In-plant Ethernet networks
  - Wide Area Networks (WAN) to remote sites
- Without the SCADA network, the SCADA system cannot operate





# SCADA Network Redundancy

- **O.Reg. 170 – Drinking Water Systems**
- Free Chlorine Residuals Must be Logged Minimum Every 5 minutes
- Low chlorine alarms must be communicated promptly
- **Very challenging to meet this uptime for a SCADA network**
- SCADA system must be online 24/7, 365 days/year
- Less than 5 min downtime/year = 99.9995% uptime
- Most IT Systems only reach 95 to 99% uptime (outages at night ok)
- SCADA system has to be **10,000 X more reliable** than an IT system



# SCADA Network Redundancy

- **SCADA Network Technologies**

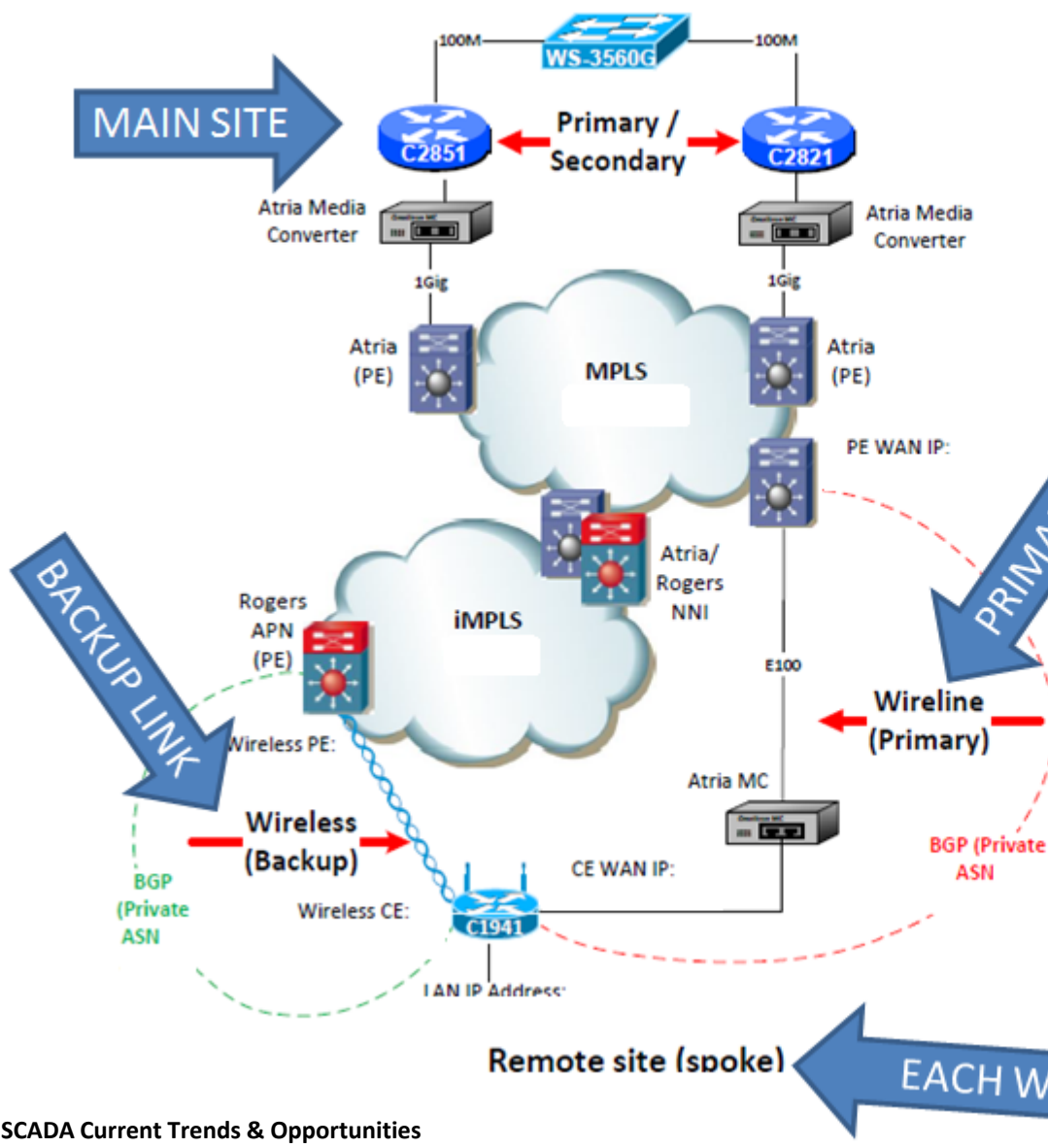
- Fibre optic (public)\*
- Fibre optic (MPLS)
- Fibre optic (utility owned)
- Cellular / Wireless\*
- DSL (private or public)\*
- Radios – licensed\*
- Radios – unlicensed\*
- Bell Lines
- Private Cables
- ?



\*these approaches usually require extra VPN routers/firewalls be used



# SCADA Network Redundancy: One Solution



## Main site objectives:

- Maintain status quo with existing Primary / Secondary (standby) routers (no config. changes)
- Both Primary and Secondary routers will continue to handle traffic via existing Atria MPLS network
- Rogers will extend a connection from Atria network to Rogers EON network via a new inter-as bridge specific to the customer's VRF
- Both Primary / Secondary routers will communicate to new Wireless backup accesses over this bridge via the existing Atria MPLS network over BGP

## Remote sites objectives:

- Maintain current Atria access via Fiber/MC
- Replace current Atria Router with a Rogers Managed Cisco 1941 router w/HSPA+ wireless backup module & antenna
- Rogers will build a new MPLS customer VRF on the EON platform and inter-connect this with the Atria MPLS customer VRF
- Wireless backup will be via Rogers EON network back to Atria MPLS via inter-as bridge
- Wireline primary access will be direct from 1941 to Atria MPLS core via BGP
- Wireless will use AS Prepend inbound and local pref outbound for Wireline
- Assumptions:
  1. Private AS different from Host AS (no AS-Override Required)
  2. Hub and Spoke will be maintained and each spoke will re-use the same Private-As (not required but can be done)



# Cyber Security



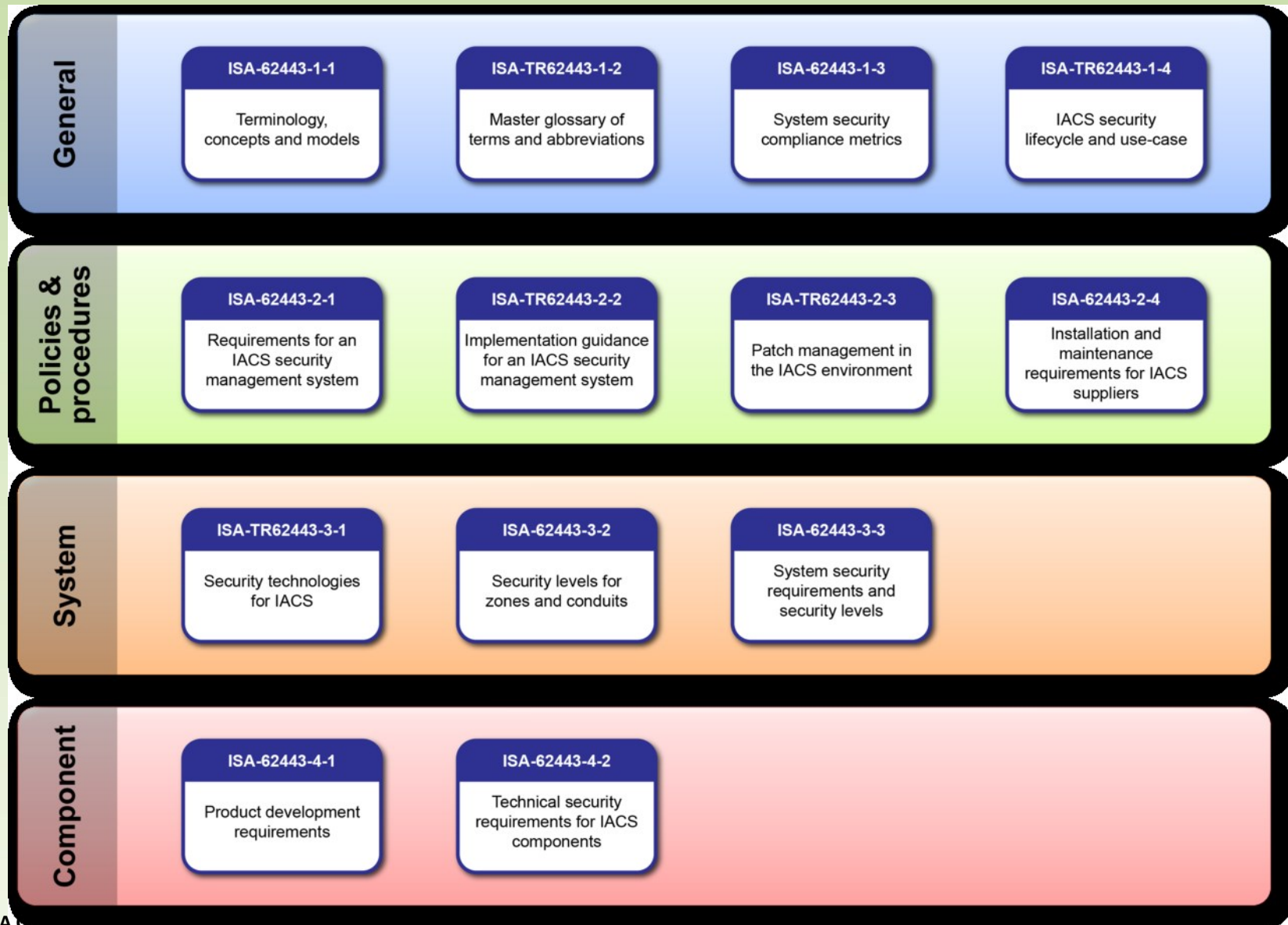
# SCADA Cyber Security

- You need to protect your SCADA system for unauthorized access
- In the past this was difficult to do
- Requires multipronged approach
  - People
  - Process
  - Technology
- There is guidance now available on how to do this
  - ISA/IEC-62443 (formerly known as ISA-99)
  - AWWA GW430
  - NIST Cyber Security Framework

SCADA control system networks must be kept separate from Corporate IT networks

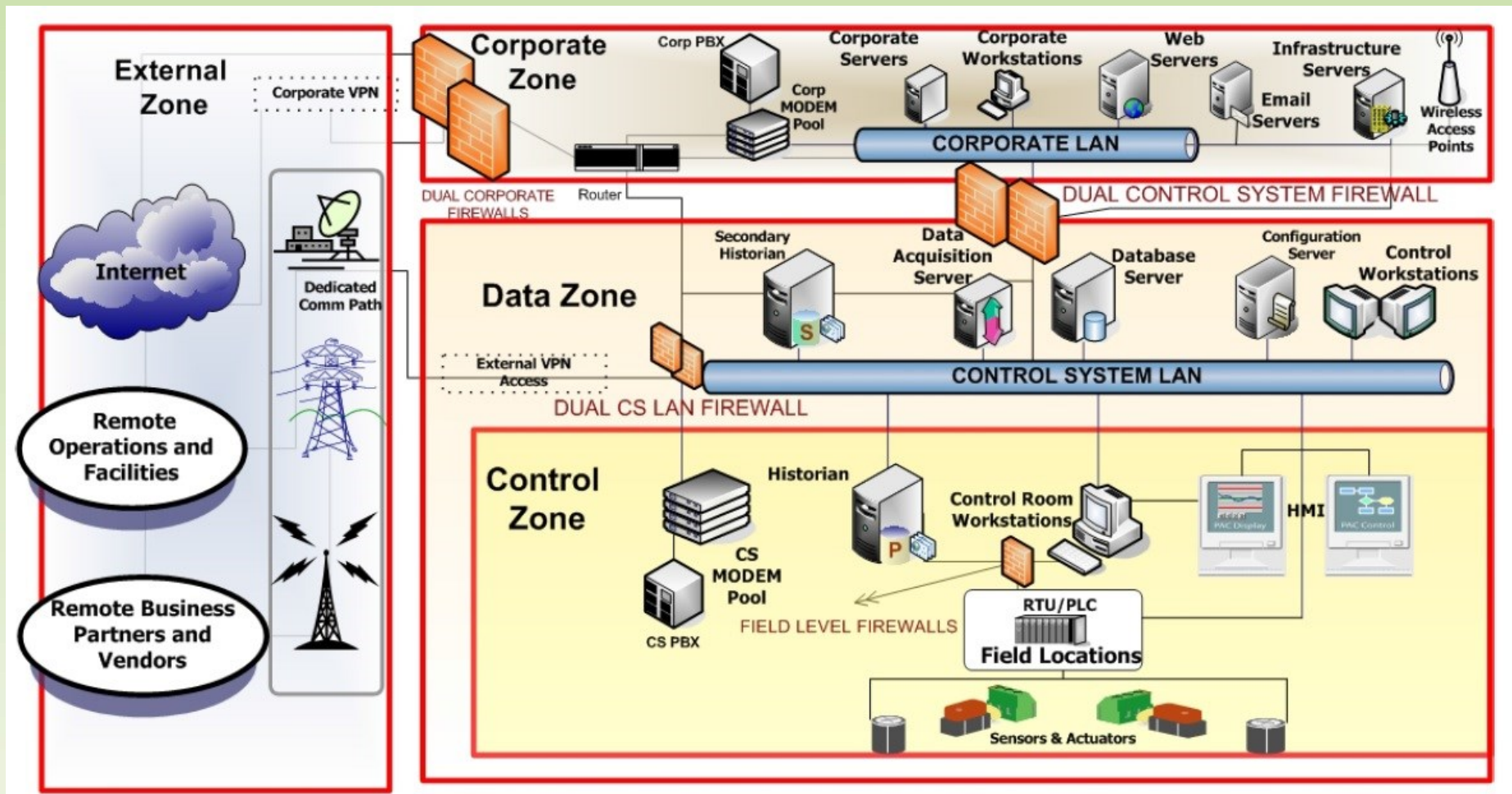


# SCADA Cyber Security: ISA/IEC-62443





# SCADA Cyber Security: ISA/IEC-62443





# Build on What you Have

- SCADA is essential for both Operations and Compliance
- Operators Need Situational Awareness to Operate Effectively
- Use the SCADA HMI to show the whole picture to operators
- SCADA Alarms systems must be rationalized/documented
- Pay attention to data integrity by investing in data redundancy
- SCADA networks are key to robust SCADA systems
- Cyber Security is requires a multi-pronged approach
- When upgraded SCADA systems, leverage what you have
- Take advantage of new technology and ideas



# How Guelph Water is Applying these Concepts



# SCADA: What Guelph Water is doing

Guelph Water Services

ADMIN1

7:06:18 PM

GUEST

is logged in

02/10/2018

Arkell Diversion Chamber

Arkell Well 6

Arkell Well 7 & Well 1

Arkell Well 8

Arkell Well 14

Arkell Well 15

Arkell - Woods System

Burkes Well

Calico Well

Carter Wells

Clair Tower

Clair Booster

Clythe Booster

Dean Well

Dodds Avenue Valve Chamber

Downey Well

Emma Well

Helmar Well

Membro Well

Paisley Station

Park Wells

Queensdale Well

Robertson Booster

Scout Camp Station

Speedvale Tower

University Well & Reservoir

Verney Tower

Water Street Well

Woods Chlorination

Woods Power

Woods Reservoirs

Woods Hatches

Woods Booster

Woods UV

Alarm System Test

Security Systems & Bldg Temp

Smallfield

Edinburgh

Gazer

Runtime 1 (old)

Runtime 2 (old)

Runtime 3 (old)

Storage Update

Arkell Control

Verney / Clair Control

Yesterday Pumpage

System Overview

Zone 1 Overview

Zone 3 Overview

Zone 2 Overview

Aqueduct Test

Aqueduct Model

Well Levels

Chlorine Residuals

Historian Trends

Teledac Menu

Pump Runtimes

Waste Vs Production

Hydro-UPS-Generators

Power Monitors

Well Limit Warnings/Shutdowns

UV/Gen Runtimes

Pressure Map

PLC Controllers 1

PLC Controllers 2

MAP

Dashboard

Weather/Temp

Woods Fuel Depot

PLC Fault Check

Open SCADA Sync

**Alarm History**

Rain Fall 0.00 mm/min

Temperature 12.03 °C

Unacknowledged Alarms

2

●

TELEDAC OK

Storage Indicator (%)

71.1

Overall

77.5

Enabled Sites

WDSCADA1

WDSCADA2

SCADA Node Failover Status: Active

Standby

SCADA node SAC Status: RUN

RUN

Ack	Date In	Time In	Time Last	Node	Tagname	Status	Value	Description
✓	02/10/2018	10:55:14.273	10:55:14.273	WDSCADA	DOBG00100EPF	CFN		ALARM Downey Well Pump Power Monitor
✓	29/09/2018	12:54:05.987	12:54:05.987	WDSCADA	MEBG00100EPF	CFN		ALARM Membro Well Pump Disconnect Off
✓	29/09/2018	12:54:05.921	12:54:05.921	WDSCADA	MEBG00100EOL	CFN		ALARM Membro Well Pump Overload Alarm
✓	29/09/2018	12:54:05.921	12:54:05.921	WDSCADA	MEBG00100EGA	CFN		ALARM Membro Well Pump General Alarm
✓	29/09/2018	12:54:01.935	12:54:01.935	WDSCADA	MEBG00100EPF	CFN		ALARM Membro Booster Pump Disconnect Off

Total Alarms: 46

Filter: Off

Sort: Time In, Descending

Run



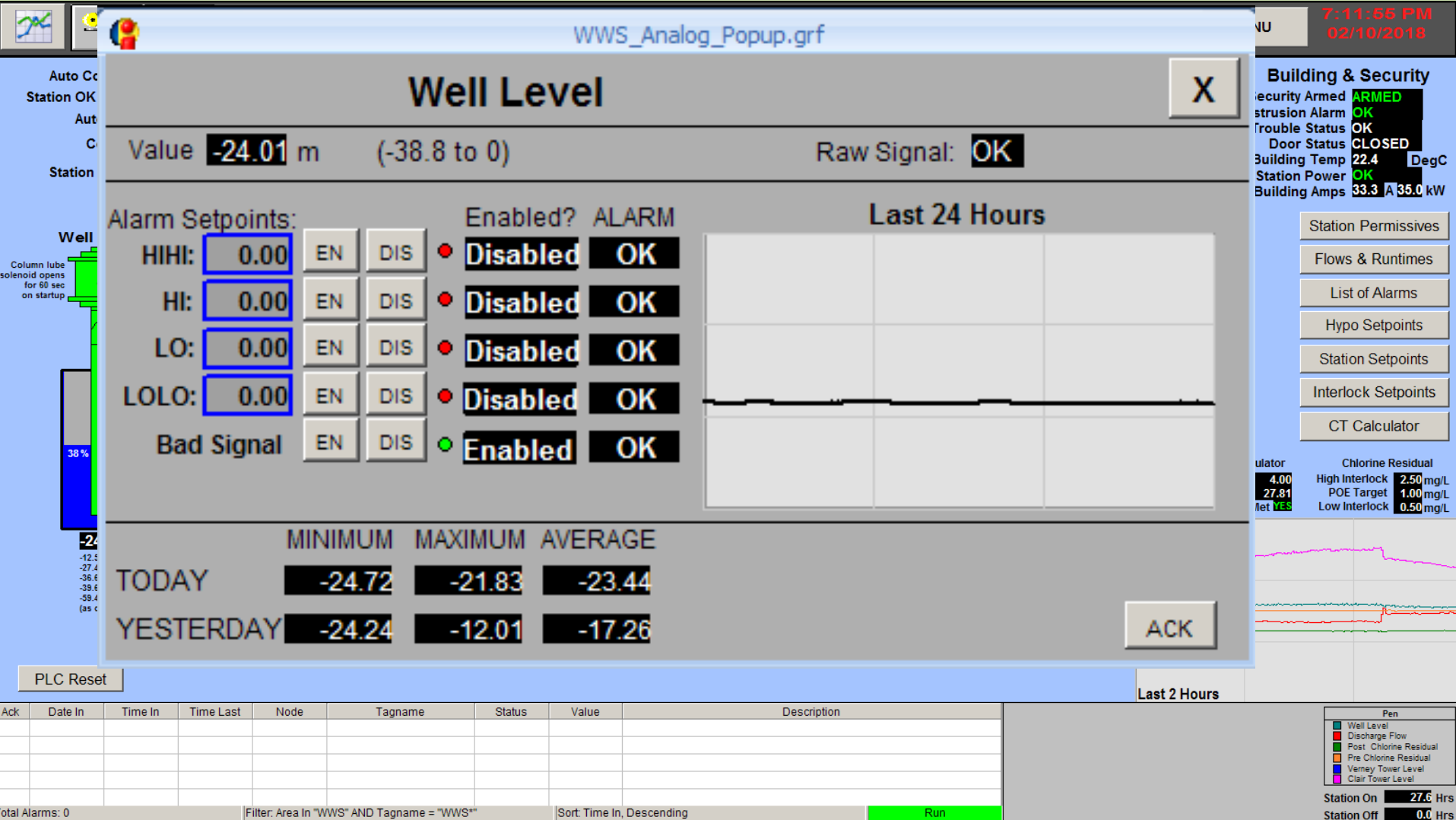






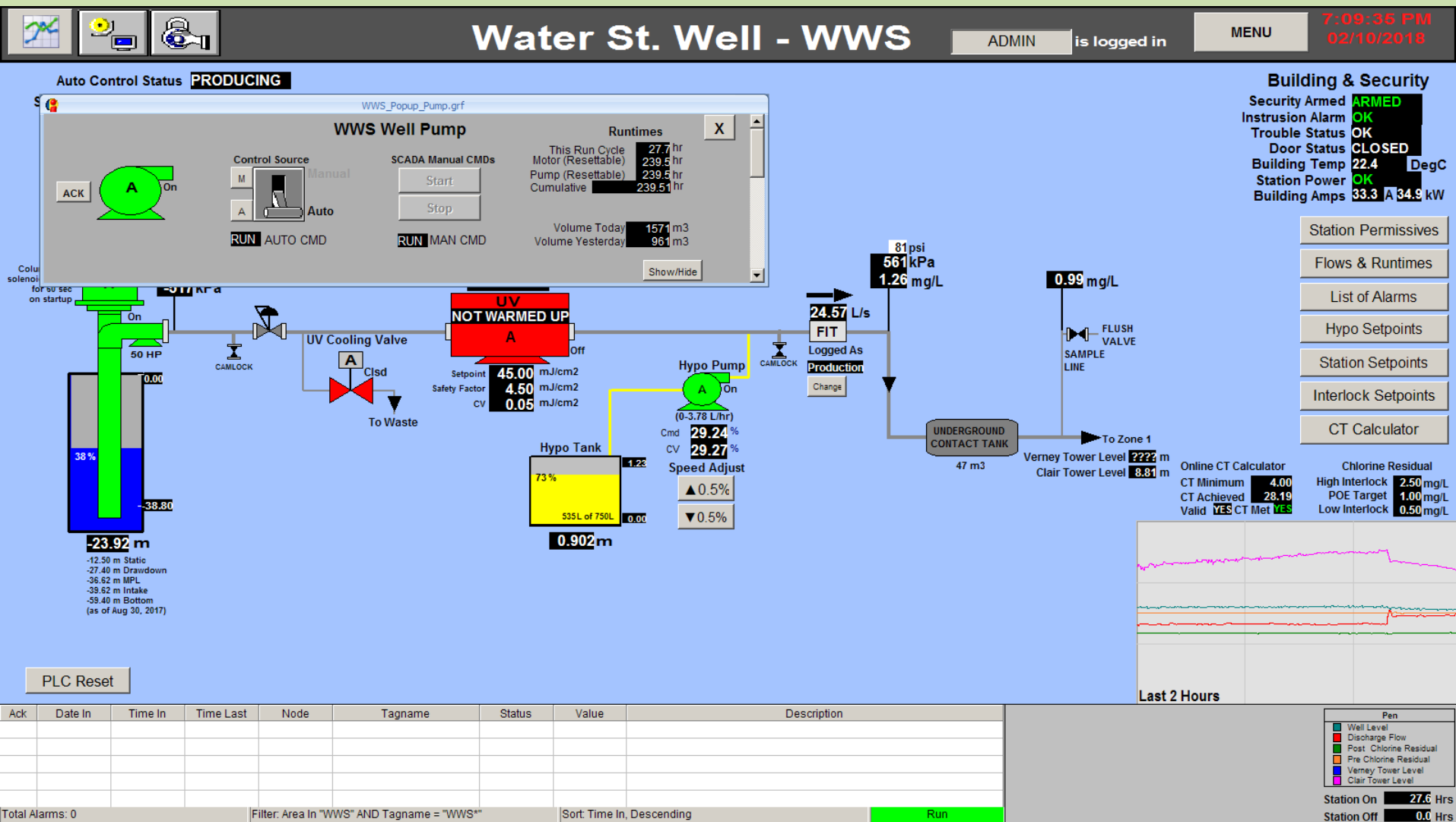


# Better Pop-Up Windows – “analog”



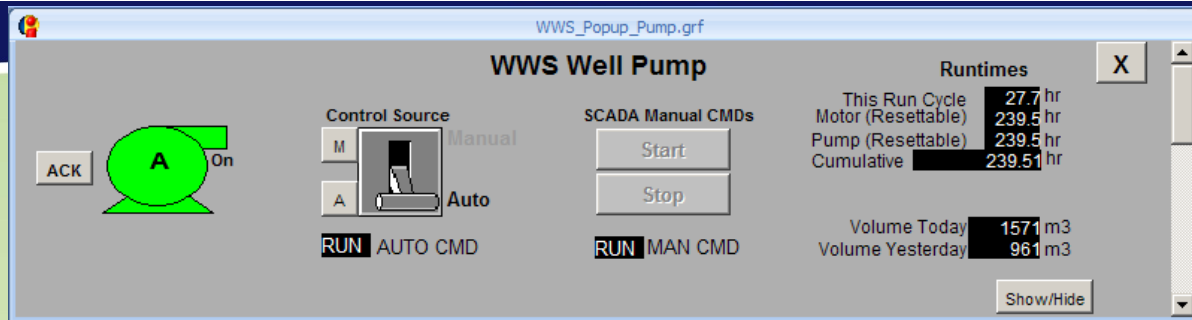


# Better Pop-Up Windows – pump starter





# Better Pop-Up Windows - pumps



WWS\_Popup\_Pump.grf

**WWS Well Pump**

Control Source: Manual (M), Auto (A)

SCADA Manual CMDs: Start, Stop

Runtimes: This Run Cycle 27.7 hr, Motor (Resettable) 239.5 hr, Pump (Resettable) 239.5 hr, Cumulative 239.51 hr

Volume Today 1571 m3, Volume Yesterday 961 m3

Show/Hide

**Permissives**

Facility Power OK

Well Pump Starter Power OK

**Interlocks (Reset Required)**

Man. Auto	Interlocks (Reset Required)
01 OK OK	Well Level Below MPL
02 OK OK	Well Pump Flow Rate Above Permit
03 OK OK	Well Pump Daily Flow Above Permit
04 OK OK	Well Pump Starter Fault
05 OK OK	Well Pump Low Flow (< 5L/s, 30s)
06 OK OK	Global Chlorine Interlock
07 OK OK	Hypo Pump Interlocked
08 OK OK	Hypo Pump Did Not Start In 5 Sec
09 OK OK	Well Level Bad Signal
10 OK OK	UV Lost Warmed Up Status (Mode 2)
11 OK OK	UV Interlocked (Mode 2)
12 OK OK	Well Pump E-Stop Pressed
13 OK OK	Hardwired Low Chlorine Interlock

**Alarms**

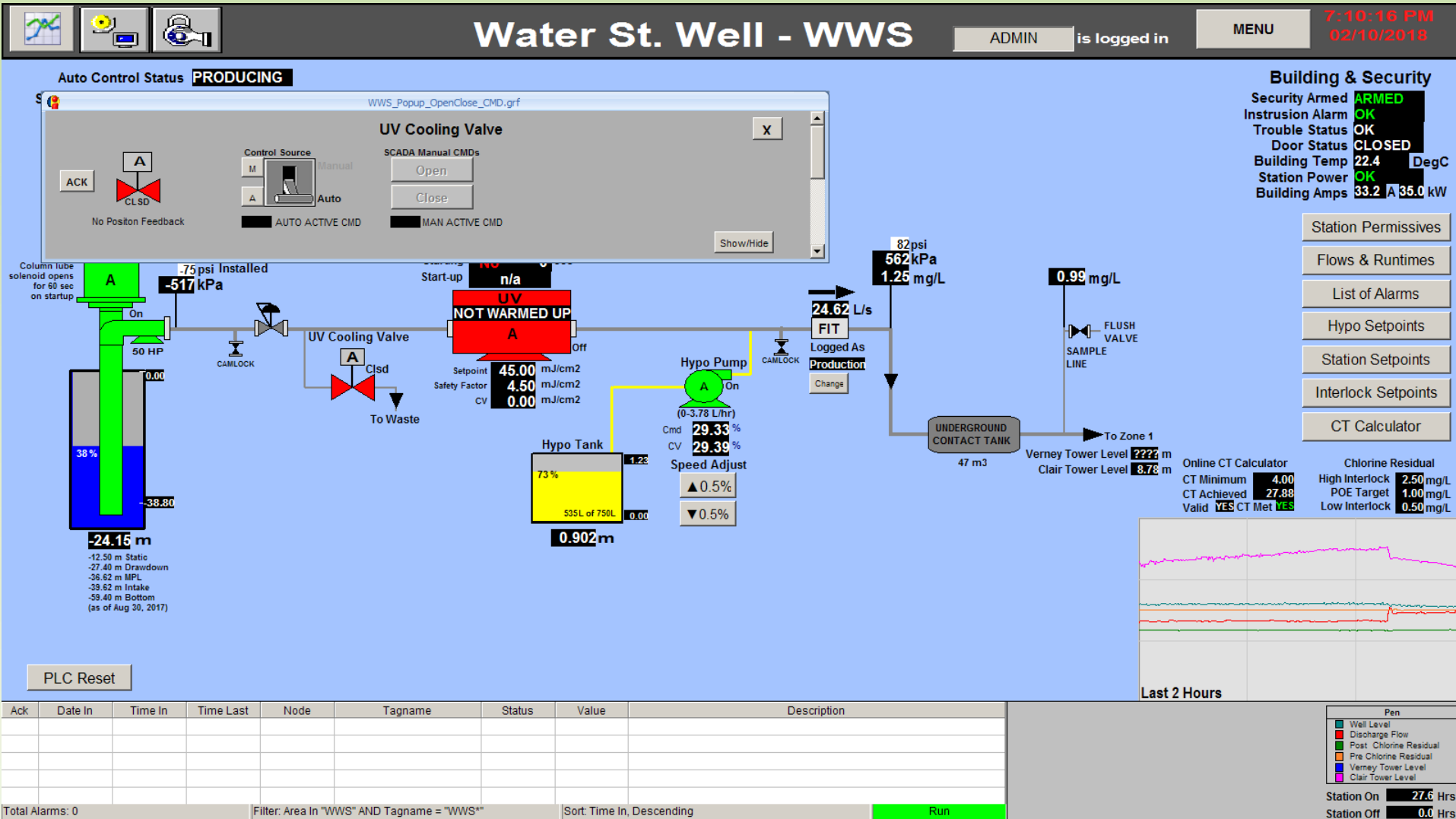
Alarms
01 OK (S) Well Pump Fail to Start Alarm
02 OK (S) Well Pump Fail to Stop Alarm
03 OK (S) Well Pump Uncommanded Start Alarm
04 OK (S) Well Pump Uncommanded Stop Alarm
05 OK Well Pump Starter No Power
06 OK Well Pump Left In Local For 30 min
07 OK Well Pump Starter Fault Alarm
08 OK Well Level Near MPL Alarm
09 OK Well Pump Daily Flow Near Permit Alarm
10 OK Well Pump Flow Near Permit Alarm
11 OK Well Pump Shutdown on Interlock Alarm
12 OK Well Pump E-Stop Pressed Alarm

Legend:   
● Enabled   
● Disabled

(S) = Special Case: Virtual alarms masked on power outage.   
 Virtual alarms also act as interlocks & require reset.

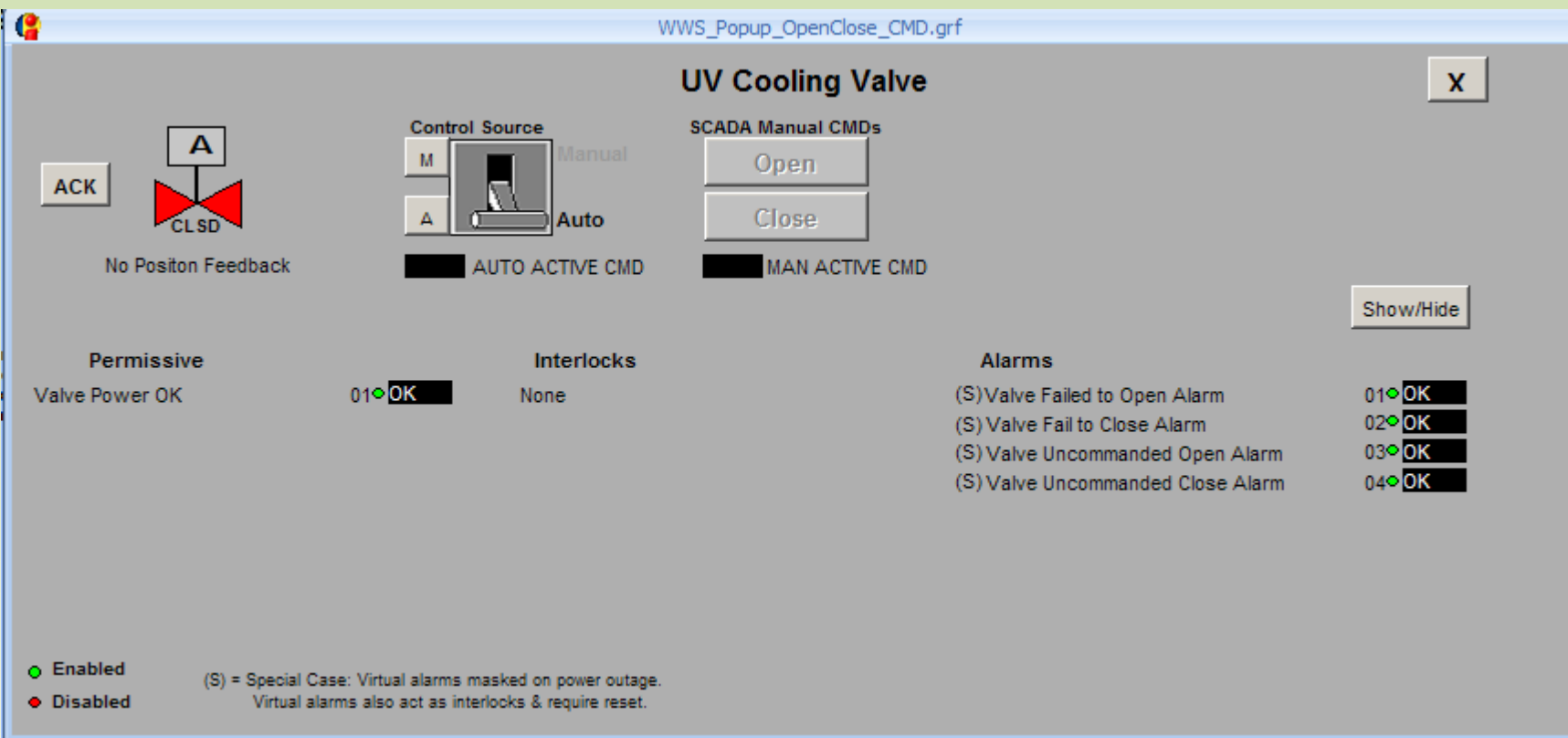
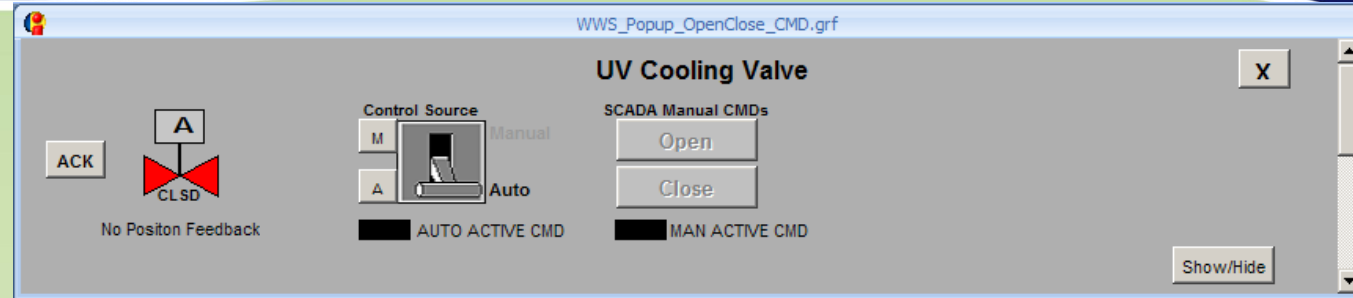


# Better Pop-Up Windows – motorized valve





# Better Pop-Up Windows - Motorized Valves





## Water St. Well - WWS

is logged in

74



## Water St. Well - WWS

is logged in

## Runtimes

Lamp 1 Runtime	824.0 hr
Lamp 2 Runtime	824.0 hr
Lamp 3 Runtime	2186.0 hr
Lamp 4 Runtime	2186.0 hr

Show/Hide

01 OK

02 OK

04 OK  
05 OK  
06 OK  
07 OK  
08 OK  
09 OK

(S) = Special Case: Virtual alarms masked on power outage.  
Virtual alarms also act as interlocks & require reset.

Clair Tower Level **8.74** m

Online CT Calculator

CT Minimum	4.00
CT Achieved	28.11
Valid	YES
CT Met	YES

Chlorine Residual	
High Interlock	2.50 mg/L
POE Target	1.00 mg/L
Low Interlock	0.50 mg/L

**Last 2 Hours**

Run

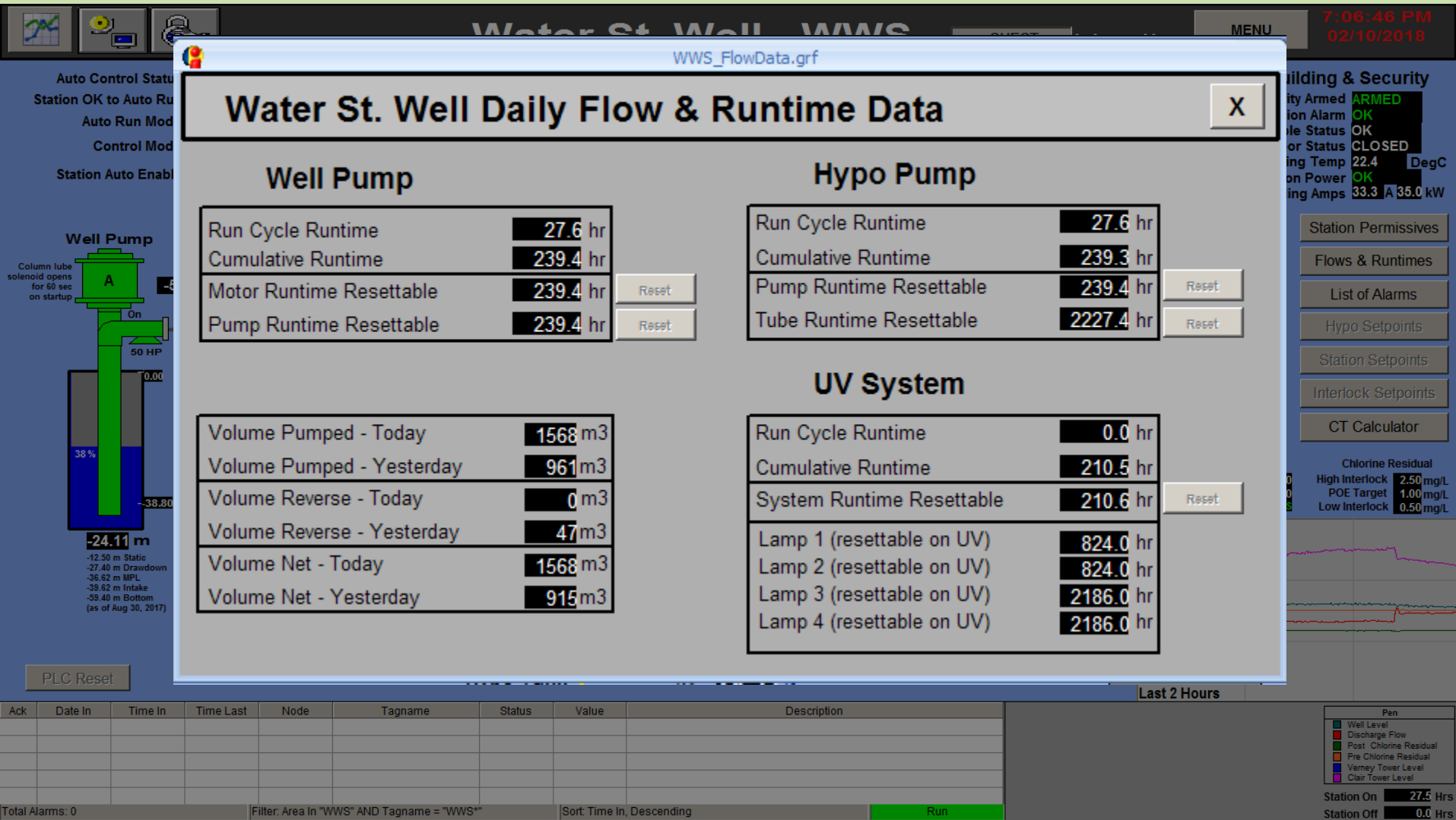
Station On	27.6 Hrs
Station Off	0.0 Hrs





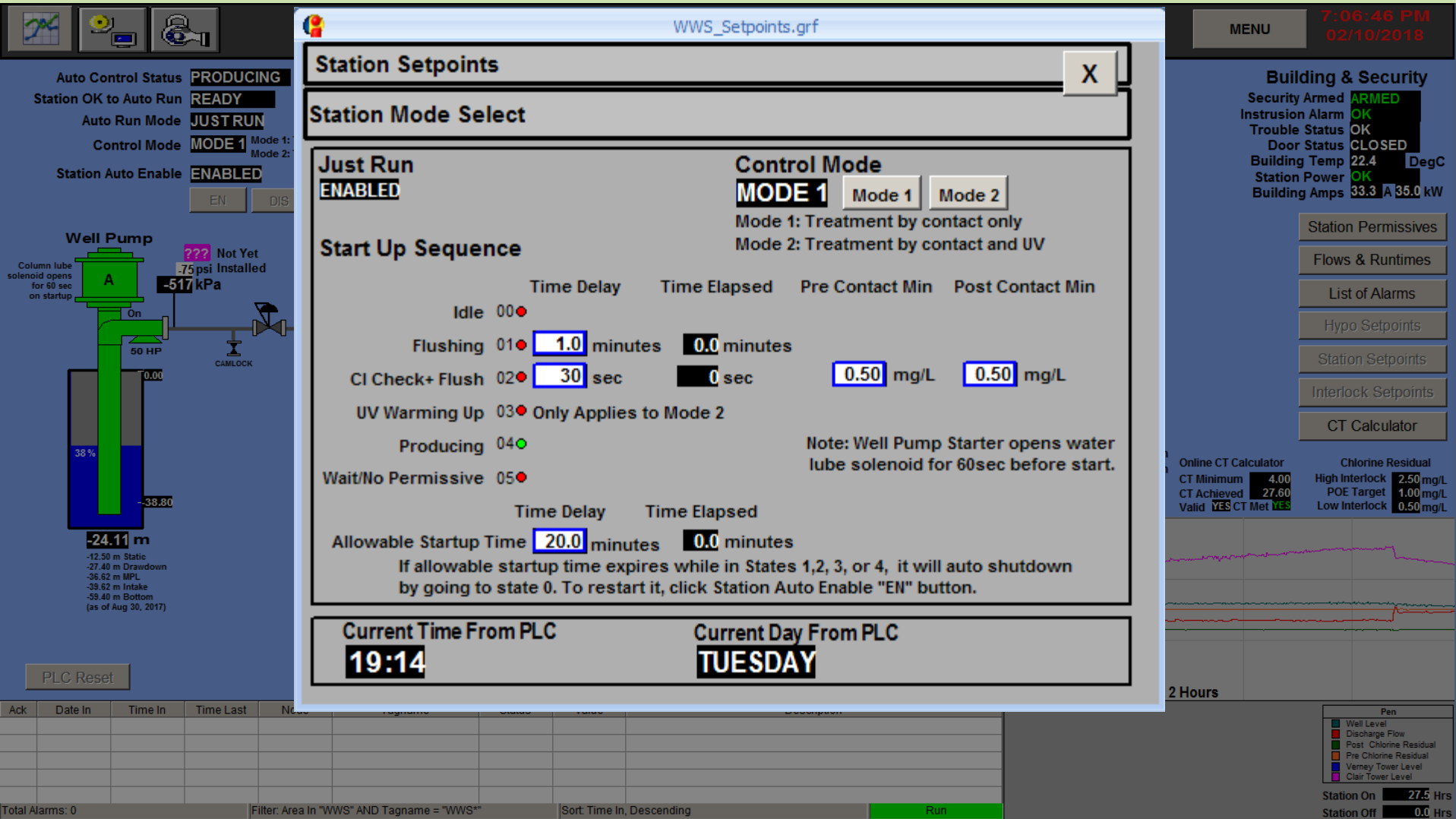


# Pump Runtimes



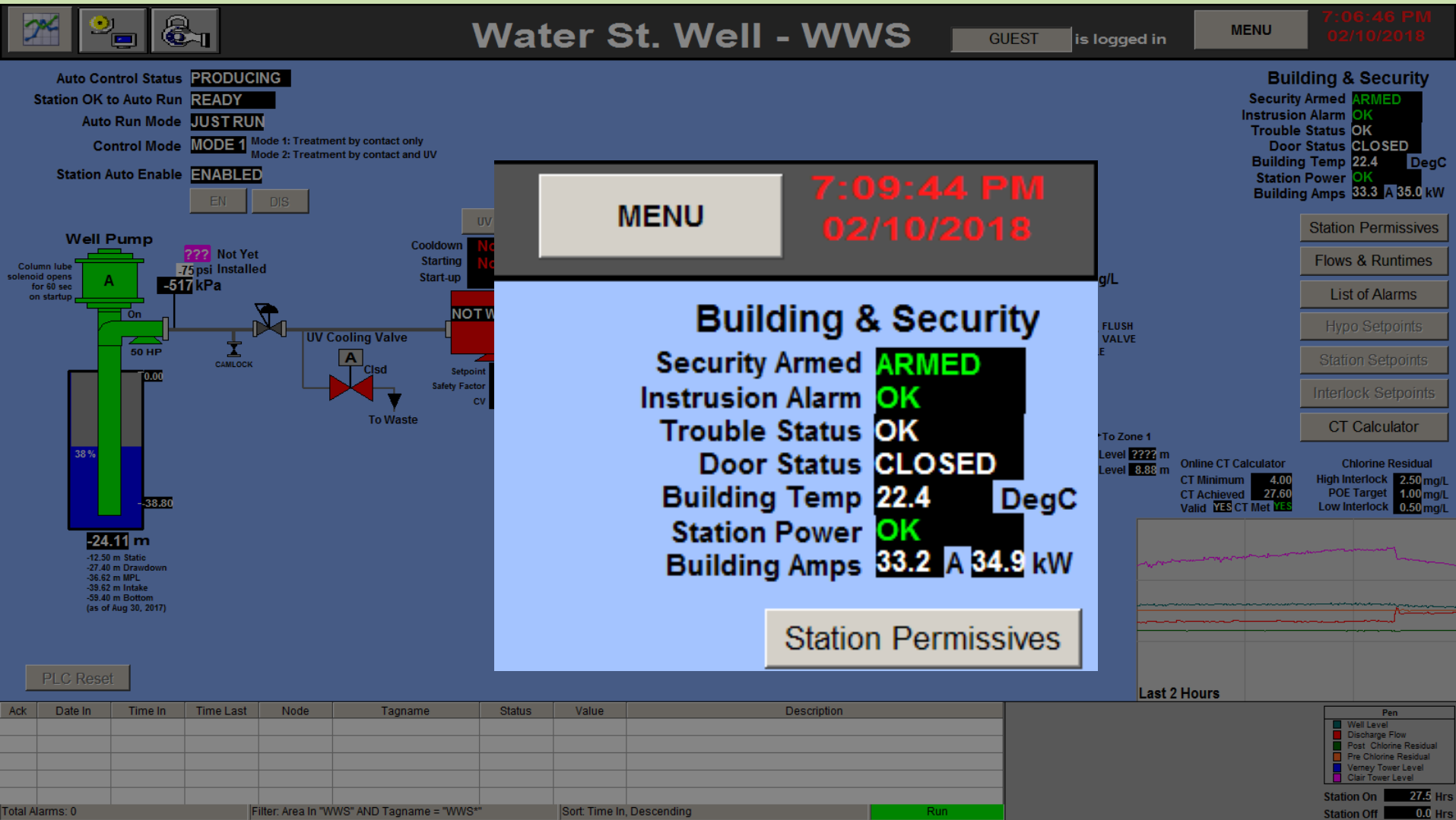


## Status Information on Sequences



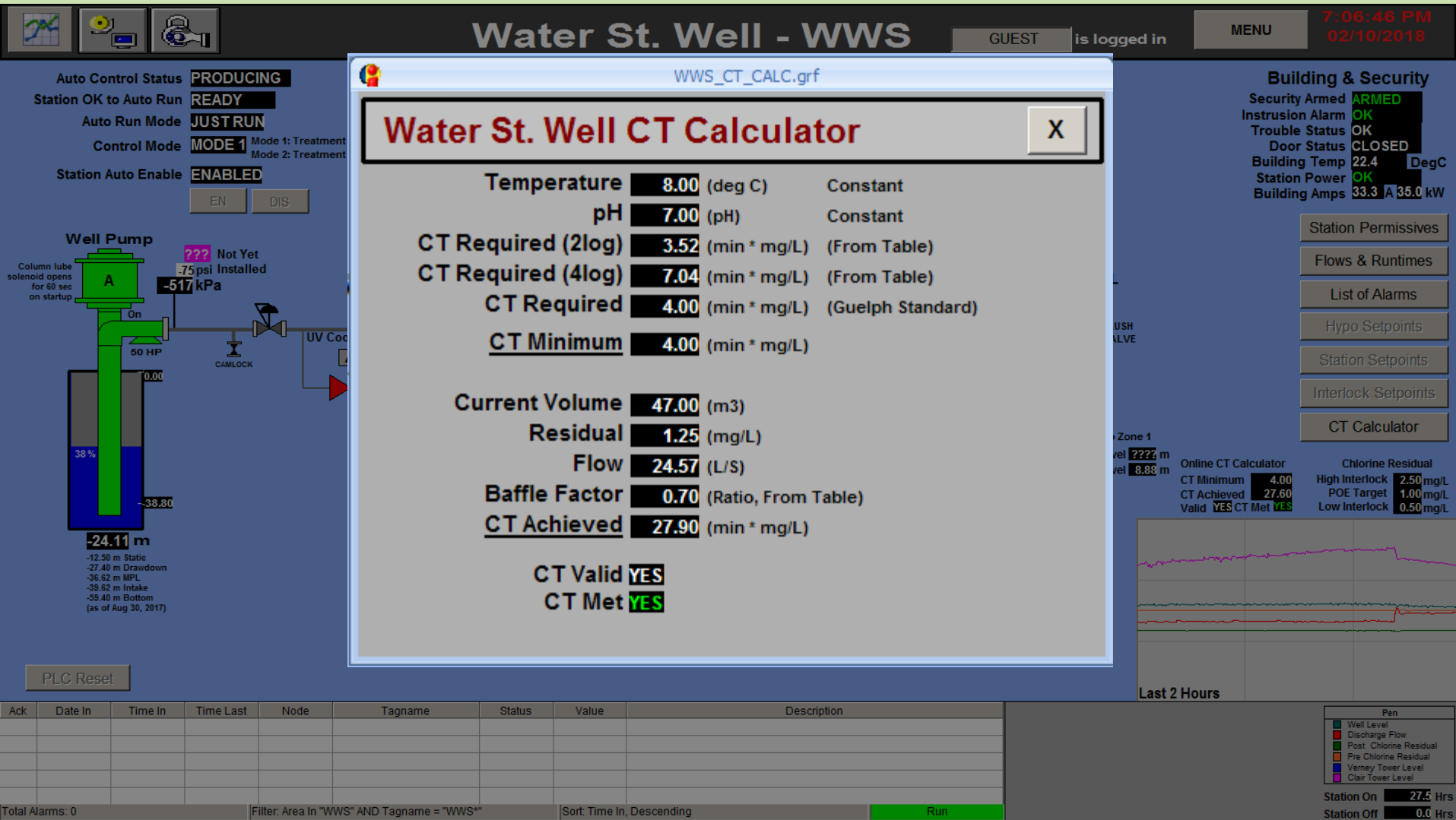


## Building & Security Information



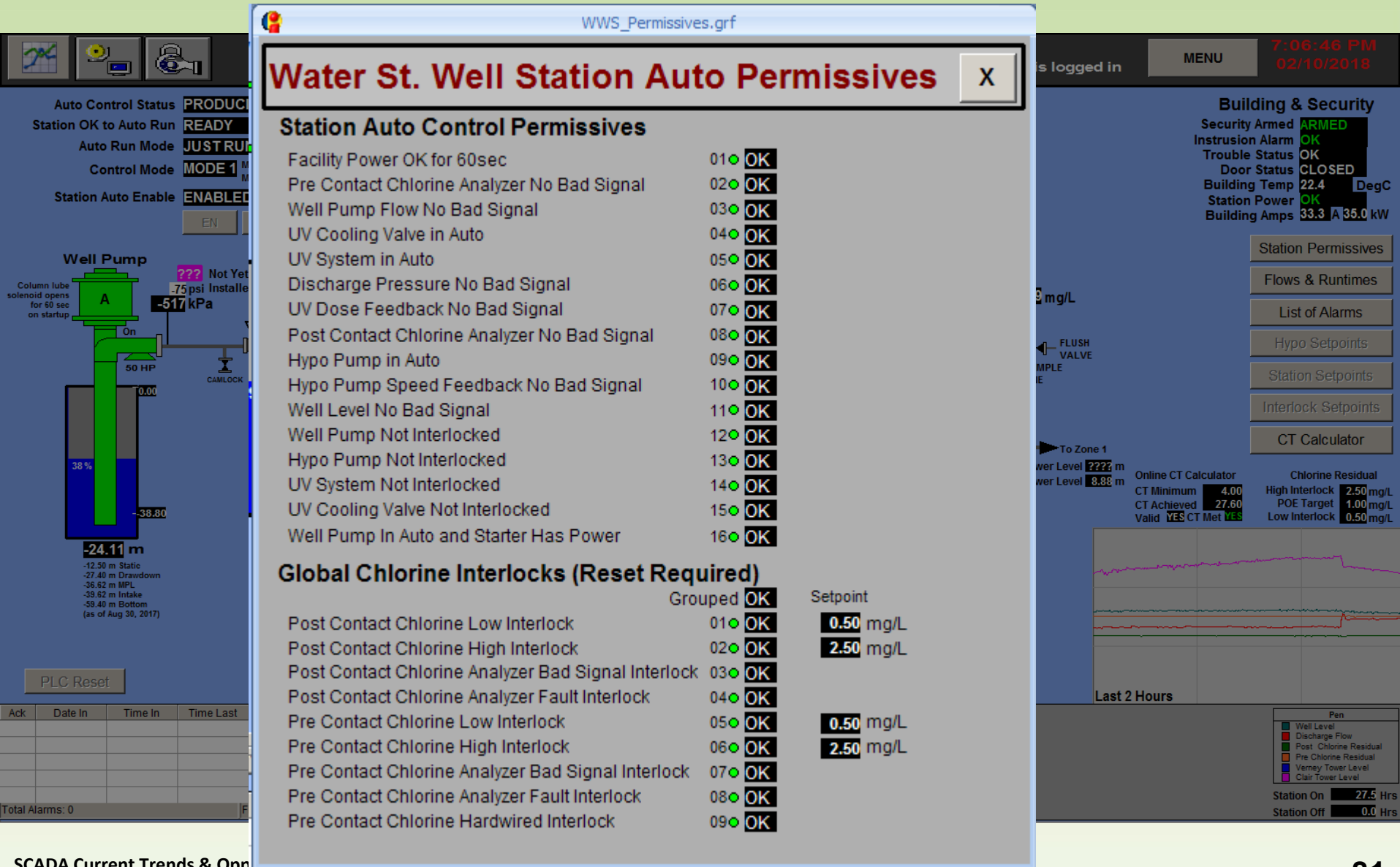


# Online CT Calculator – drinking water treatment





# Station Permissives





# List of All Configured Alarms for a Site

**Well Pump A**

Column tube solenoid opens for 60 sec on startup

On 50 HP

0.00

38%

-38.80

**-24.11 m**

-12.50 m Static  
-27.40 m Drawdown  
-36.62 m MPL  
-39.62 m Intake  
-59.40 m Bottom  
(as of Aug 30, 2017)

PLC Reset

Ack Date In Time In

Auto Control Status

Station OK to Auto Run

Auto Run Mode

Control Mode

Station Auto Enable

**Water St. Well Alarms**

Alarm ID	Alarm Description	Status
01	Building Power Failure Alarm	OK
02	Building Security Intrusion Alarm	OK
03	Building Security Trouble Alarm	OK
04	Station Failed to Auto Start Alarm	OK
05	Pre Contact Cl. Residual Bad Signal Alarm	OK
06	Pre Contact Cl. Residual HIHI Alarm	OK
07	Pre Contact Cl. Residual HI Alarm	OK
08	Pre Contact Cl. Residual LO Alarm	OK
09	Pre Contact Cl. Residual LOLO Alarm	OK
10	Pre Contact Cl. Analyzer Fault Alarm	OK
11	Well Pump Flow Rate Bad Signal Alarm	OK
12	Well Pump Flow Rate HIHI Alarm	OK
13	Well Pump Flow Rate HI Alarm	OK
14	Well Pump Flow Rate LO Alarm	OK
15	Well Pump Flow Rate LOLO Alarm	OK
16	Hypo Tank Level Bad Signal Alarm	OK
17	Hypo Tank Level HIHI Alarm	OK
18	Hypo Tank Level HI Alarm	OK
19	Hypo Tank Level LO Alarm	OK
20	Hypo Tank Level LOLO Alarm	OK
21	Hypo Tank Level Loss of Echo Alarm	OK
22	Discharge Pressure Bad Signal Alarm	OK
23	Discharge Pressure HIHI Alarm	OK
24	Discharge Pressure HI Alarm	OK
25	Discharge Pressure LO Alarm	OK
26	Discharge Pressure LOLO Alarm	OK
27	Building Temperature Bad Signal Alarm	OK
28	Building Temperature HIHI Alarm	OK
29	Building Temperature HI Alarm	OK
30	Building Temperature LO Alarm	OK
31	Building Temperature LOLO Alarm	OK
32	Post Contact Cl. Residual Bad Signal Alarm	OK
33	Post Contact Cl. Residual HIHI Alarm	OK
34	Post Contact Cl. Residual HI Alarm	OK
35	Post Contact Cl. Residual LO Alarm	OK
36	Post Contact Cl. Residual LOLO Alarm	OK
37	Post Contact Cl. Analyzer Fault Alarm	OK
38	Well Pump Pressure Bad Signal Alarm	OK
39	Well Pump Pressure HIHI Alarm	OK
40	Well Pump Pressure HI Alarm	OK
41	Well Pump Pressure LO Alarm	OK
42	Well Pump Pressure LOLO Alarm	OK
43	Well Level Bad Signal Alarm	OK
44	Well Level HIHI Alarm	OK
45	Well Level HI Alarm	OK
46	Well Level LO Alarm	OK
47	Well Level LOLO Alarm	OK
48	Well Pump Fail to Start Alarm	OK
49	Well Pump Fail to Stop Alarm	OK
50	Well Pump Uncommanded Start Alarm	OK
51	Well Pump Uncommanded Stop Alarm	OK
52	Well Pump No Power Alarm	OK
53	Well Pump Left in Local (30 min) Alarm	OK
54	Well Pump Starter Fault Alarm	OK
55	Well Pump MPL Warning Alarm	OK
56	Well Pump Flow Rate Max Warning Alarm	OK
57	Well Pump Daily Flow Max Warning Alarm	OK
58	Well Pump Shutdown on Interlock Alarm	OK
59	Well Pump E-Stop Pressed Alarm	OK
60	Hypo Pump Fail to Start Alarm	OK
61	Hypo Pump Fail to Stop Alarm	OK
62	Hypo Pump Uncommanded Start Alarm	OK
63	Hypo Pump Uncommanded Stop Alarm	OK
64	Hypo Pump No Power Alarm	OK
65	Hypo Pump Left in Local (5 min) Alarm	OK
66	Hypo Pump Fault Alarm	OK
67	Hypo Pump Speed Deviation Alarm	OK
68	Hypo Pump Tube Runtime HIHI Alarm	OK
69	Hypo Pump Tube Runtime HI Alarm	OK
70	Hypo Pump Left in Manual (10 min) Alarm	OK
71	Hypo Pump Tube Leak Fault Alarm	OK
72	Hypo Pump Shutdown on Interlock Alarm	OK
73	Hypo Pump Bad Signal Alarm	OK
74	UV Fail to Start Alarm	OK
75	UV Fail to Stop Alarm	OK
76	UV Uncommanded Start Alarm	OK
77	UV Uncommanded Stop Alarm	OK
78	UV No Power Alarm	OK
79	UV Left in Local (30 min) Alarm	OK
80	UV Shutdown on Interlock Alarm	OK
81	UV Dose Bad Signal Alarm	OK
82	UV Minor Alarm	OK
83	UV Major Alarm	OK
84	UV Critical Alarm	OK
85	Cooling Valve Fail to Open Alarm	OK
86	Cooling Valve Fail to Close Alarm	OK
87	Cooling Valve Uncommanded Open Alarm	OK
88	Cooling Valve Uncommanded Close Alarm	OK
89	Cooling Valve No Power Alarm	OK
90	QuickPanel Comms Failure Alarm	OK
91	PLC Comms Failure Alarm 1	OK
92	PLC Comms Failure Alarm 2	OK
93	PLC Major Error Alarm	OK
94	PLC Forces On Alarm	OK
95	PLC Read From UV Comm Fail	OK

**Building & Security**

Security Armed **ARMED**

Intrusion Alarm **OK**

Trouble Status **OK**

Door Status **CLOSED**

Building Temp **22.4** DegC

Station Power **OK**

Building Amps **33.3** A **35.0** kW

Station Permissives

Flows & Runtimes

List of Alarms

Hypo Setpoints

Station Setpoints

Interlock Setpoints

CT Calculator

Chlorine Residual

High Interlock **2.50** mg/L

POE Target **1.00** mg/L

Low Interlock **0.50** mg/L

Pen

Well Level

Discharge Flow

Post Chlorine Residual

Pre Chlorine Residual

Vernay Tower Level

Clair Tower Level

Station On **27.5** Hrs

Station Off **0.0** Hrs

SCADA Current Trends & Opportunities  
Halton Region SCADA Seminar - June 21, 2019 - Oakville, ON, Canada

**CITY OF Guelph**  
Making a Difference

82



# Well Permit Values, Warnings and Interlocks

Auto Control Status  
Station OK to Auto Run  
Auto Run Mode  
Control Mode  
Station Auto Enable

Well Pump  
Column lube solenoid opens for 60 sec on startup

On  
50 HP

0.00  
-38.80  
-24.11 m  
-12.50 m Static  
-27.40 m Drawdown  
-36.62 m MPL  
-39.62 m Intake  
-59.40 m Bottom (as of Aug 30, 2017)

PLC Reset

Ack	Date In	Time In

Total Alarms: 0

WWS\_ILCK\_Setpoints.grf

## Water St. Well Interlock Setpoints

### Well Permits

Note: If the MPL shutdown interlock is disabled, it also disables the well level bad signal interlock.

	CURRENT VALUE	Warning (60s) STATUS SETPOINT	Shutdown (60s) STATUS SETPOINT	Limit MPL FOR WELL	PROBE DEPTH
Well Level - Max Pumping Level (MPL)	-23.88 m	● -34.00	● -35.00	-36.62	-38.80
Well Pump - Max Flow Rate (FH)	24.62 L/s	● 34.0	● 37.88	37.88	
Well Pump - Max Daily Flow (FQH)	1579 m3	● 6500	● 6546	6546	

### Chlorine Interlock

PRE CONTACT CURRENT VALUE	LOW INTERLOCK	HIGH INTERLOCK
1.25 mg/L	0.50 mg/L	2.50 mg/L

POST CONTACT CURRENT VALUE: 0.99 mg/L

### UV Dose Interlock

CURRENT VALUE	LOW INTERLOCK
0.00 mJ/cm2	42.00 mJ/cm2

The UV has a built in automatic shutdown for low dose. This interlock is an extra shutdown just in case.

### LEGEND

ENABLE DISABLE BUTTON  
ENABLE DISABLE STATUS  
SETPOINT  
IF SPECIAL TIME DELAY  
INTERLOCK/ALARM STATUS (PINK = ACTIVE)

10 MIN 45

● Enabled ● Disabled

### HOW TO RESET THE SHUTDOWN ALARMS

- 1) Well Level MPL shutdown: reset on pump screen
- 2) Well Max Flow Rate shutdown: pump reset or midnight
- 3) Well Max Daily Flow: resets at midnight

7:06:46 PM  
02/10/2018

### Building & Security

Security Armed	ARMED
Intrusion Alarm	OK
Door Status	OK
Door Status	CLOSED
Fighting Temp	22.4 DegC
Station Power	OK
Fighting Amps	33.3 A 35.0 kW

Station Permissives  
Flows & Runtimes  
List of Alarms  
Hypo Setpoints  
Station Setpoints  
Interlock Setpoints  
CT Calculator

Chlorine Residual

High Interlock	2.50 mg/L
POE Target	1.00 mg/L
Low Interlock	0.50 mg/L

Station On 27.5 Hrs  
Station Off 0.0 Hrs



# Well Permits – for all sites

## Well Warnings/Limits

ADMIN

is logged in

MENU

7:18:52 PM  
02/10/2018

Well Level - Max Pumping Level (MPL)					Well Pump - Max Flow Rate (FH)					Well Pump - Max Daily Flow (FQH)					POE / Booster Pumps- Max Daily Flow (FQH)				
Wells	Well Level CURRENT VALUE	Warning (60s) STATUS SETPOINT	Shutdown (60s) STATUS SETPOINT	Limit MPL FOR WELL	Flow Rate CURRENT VALUE	Warning (60s) STATUS SETPOINT	Shutdown (60s) STATUS SETPOINT	Ops Limit (PERMIT / 24 Hrs)	Flow Total Today CURRENT VALUE	Warning (60s) STATUS SETPOINT	Shutdown (1s) STATUS SETPOINT	Limit FROM PERMIT	Flow Total Today CURRENT VALUE	Warning (60s) STATUS SETPOINT	Shutdown (1s) STATUS SETPOINT	Limit FROM PERMIT			
Calico	-35.00 m	● -32.00	● -33.00	-33.50	0.00 L/s	● 55	● 61	61	Calico	0 m3	● 5000	● 5237	5237	0 m3	● 5000	● 5237	5237		
Helmar	-42.18 m	● -44.00	● -45.00	-45.00	11.80 L/s	● 35	● 38	38	Helmar	637 m3	● 3000	● 3273	3273	654 m3	● 3000	● 3273	3273		
Burke	???? m	● ????	● ????	????	????? L/s	● ????	● ????	????	Burke	???? m3	● ????	● ????	????	???? m3	● ????	● ????	????		
Downey	-14.92 m	● -34.00	● -35.60	-35.60	0.00 L/s	● 58	● 61	61	Downey	0 m3	● 5000	● 5237	5237	0 m3	● 5000	● 5237	5237		
Dean	-26.13 m	● -45.00	● -46.50	-46.50	0.00 L/s	● 22	● 27	27	Dean	1057 m3	● 2200	● 2300	2300	1069 m3	● 2200	● 2300	2300		
Emma	???? m	● ????	● ????	????	????? L/s	● ????	● ????	????	Emma	???? m3	● ????	● ????	????	EMMA ST WELL PUMP GOES DIRECT TO SYSTEM. NO BOOSTER PUMP.					
Membro	-16.92 m	● -31.00	● -32.80	-32.80	0.00 L/s	● 60	● 70	70	Membro	0 m3	● 5500	● 6050	6050	0 m3	● 5500	● 6050	6050		
Park 1	NOT INSTALLED	● -48.00	● -45.70	-45.70	56.30 L/s	● 59	● 60	60	Park1	3892 m3	● 5000	● 5150	5150	PARK WELLS FEED ONE RESERVOIR					
Park 2	-29.83 m	● -48.00	● -45.70	-45.70	0.00 L/s	● 59	● 60	60	Park2	1240 m3	● 5000	● 5150	5150	PARK HAS ONLY ONE POE (FEED BY TWO BOOSTER PUMPS)					
Park 1+2					56.27 L/s	● 110	● 119	119	Park1+2	5131 m3	● 9000	● 10000	10000	5225 m3	● 9000	● 10300	10300		
Water Street	-24.01 m	● -34.00	● -35.00	-34.00	24.57 L/s	● 34	● 38	34	Water	1585 m3	● 6500	● 6546	6500	WATER ST WELL PUMP GOES DIRECT TO SYSTEM. NO BOOSTER PUMP.					
Queensdale	-42.56 m	● -48.00	● -50.30	-50.30	0.00 L/s	● 55	● 61	61	Queen	735 m3	● 5000	● 5237	5237	713 m3	● 5000	● 5237	5237		
Paisley	-22.88 m	● -28.00	● -30.20	-30.20	9.84 L/s	● 30	● 37	37	Paisley	686 m3	● 3000	● 3200	3200	3810 m3	● 11000	● 12000	13738		
University	-30.48 m	● -42.00	● -44.70	-54.10	0.00 L/s	● 0	● 0	38	Univer	1641 m3	● 3000	● 3300	3300	1627 m3	● 5000	● 5108	5108		
Carter 1	-5.39 m	● -7.00	● -8.40	-8.40	41.27 L/s	● 48	10 MIN 49	50	Carter1	2869 m3	● 3000	● 3273	3273	WoodsPOE					
Carter 2	-3.77 m	● -8.00	● -9.10	-9.10	27.19 L/s	● 38	10 MIN 45	50	Carter2	1890 m3	● 3000	● 3273	3273	28094 m3	● 60000	● 65000	65000		
Carter 1+2					68.46 L/s	● 76	10 MIN 76	76	Carters	4759 m3	● 6200	● 6546	6546	HOW TO RESET THE SHUTDOWN ALARMS					
Arkell 1	-6.04 m	● -9.00	● -10.00	-10.00	0.00 L/s	● 35	● 38	38	Arkell1	0 m3	● 3000	● 3273	3273	1) Well Level MPL shutdown: reset on pump screen					
Arkell 6	-19.80 m	● -32.00	● -32.20	-32.20	86.02 L/s	● 100	● 111	111	Arkell6	5797 m3	● 9300	● 9600	9600	2) Well Max Flow Rate shutdown: pump reset or midnight					
Arkell 7	-20.02 m	● -28.00	● -29.90	-29.90	84.17 L/s	● 100	● 111	111	Arkell7	5741 m3	● 9300	● 9600	9600	3) Well Max Daily Flow: resets at midnight					
Arkell 8	-21.22 m	● -28.00	● -29.50	-29.50	0.00 L/s	● 100	● 111	111	Arkell8	1989 m3	● 9300	● 9600	9600	4) POE / Booster Max Daily Flow: resets at midnight					
Arkell 14	-13.00 m	● -28.80	● -29.90	-29.90	0.00 L/s	● 100	● 111	111	Arkell14	795 m3	● 9300	● 9600	9600	LEGEND					
Arkell 15	-8.27 m	● -11.00	● -12.80	-12.80	84.82 L/s	● 100	● 111	111	Arkell15	5830 m3	● 9300	● 9600	9600	10 MIN 45 ENABLE DISABLE BUTTON ENABLE DISABLE STATUS SETPOINT					
6+7+8+14+15					254.96 L/s	● 300	● 333	333	Arkells	20146 m3	● 25000	● 28800	28800	IF SPECIAL TIME DELAY INTERLOCK/ALARM STATUS (PINK = ACTIVE)					
Glen Collector					119.93 L/s	● 250			Glen	8347 m3	● 25000			Note: Arkell total flow interlocks only affect Auto Control					

Ack	Date In	Time In	Time Last	Node	Tagname	Status	Value	Description
✓	02/10/2018	10:55:14.273	10:55:14.273	WDSCADA	DOBG00100EPF	CFN	ALARM	Downey Well Pump Power Monitor
✓	29/09/2018	12:54:05.987	12:54:05.987	WDSCADA	MEBG00100EPF	CFN	ALARM	Membro Well Pump Disconnect Off
✓	29/09/2018	12:54:05.921	12:54:05.921	WDSCADA	MEBG00100EOL	CFN	ALARM	Membro Well Pump Overload Alarm
✓	29/09/2018	12:54:05.921	12:54:05.921	WDSCADA	MEBG00100EGA	CFN	ALARM	Membro Well Pump General Alarm
✓	29/09/2018	12:54:01.935	12:54:01.935	WDSCADA	MEBG00100EPF	CFN	ALARM	Membro Booster Pump Disconnect Off

Total Alarms: 46

Filter: Off

Sort: Time In, Descending

Run



# Logging flow to System vs. Waste – for water balance calcs.

## System VS Waste Flow

ADMIN1  
ADMIN is logged in

MENU

7:20:50 PM  
02/10/2018

		TODAY				YESTERDAY			TODAY						YESTERDAY				
Station	Current (L/s)	All Flow (m3)	Going To	System (m3)	Waste (m3)	All Flow (m3)	System (m3)	Waste (m3)	Station	Current (L/s)	All Flow (m3)	Going To	System (m3)	Waste (m3)	Recirc (m3)	All Flow (m3)	System (m3)	Waste (m3)	Recirc (m3)
Arkell 1	0.00	0	SYSTEM	0	0	338	338	0	Burke Booster	???	???		???	???	???	???	???	???	???
Arkell 6	86.01	5807	SYSTEM	5808	0	6486	6486	0	Calico Booster	0.00	0	SYSTEM	0	0	0	0	0	0	0
Arkell 7	84.18	5751	SYSTEM	5751	0	7344	7344	0	Dean Booster	16.15	1071	SYSTEM	1071	0	0	1340	1340	0	0
Arkell 8	0.00	1989	SYSTEM	1989	0	1575	1575	0	Downey Booster	0.00	0	SYSTEM	0	0	0	0	0	0	0
Arkell 14	0.00	795	SYSTEM	795	0	1328	1328	0	Helmar Booster	9.90	655	SYSTEM	655	0	0	814	0	0	0
Arkell 15	84.74	5840	SYSTEM	5840	0	7323	7323	0	Membro Booster	0.00	0	SYSTEM	0	0	0	0	0	0	0
Burke Well	???	???		???	???	???	???	???	Park Booster	62.20	5232	SYSTEM	5232	0	0	6558	6558	0	0
Carter Wells	41.26	4766	WASTE	0	4763	5910	0	5908	Queensdale Booster	12.58	714	SYSTEM	714	0	0	889	889	0	0
Calico Well	0.00	0	SYSTEM	0	0	0	0	0	University Booster	25.05	1630	SYSTEM	1630	0	0	1992	1993	0	0
Dean Well	0.00	1057	SYSTEM	1057	0	1336	1336	0	Woods Booster	373.32	28139	SYSTEM	28139	0	N/A	35677	35677	0	N/A
Downey Well	0.00	0	SYSTEM	0	0	0	0	0											
Emma Well	???	???		???	???	???	???	???											
Helmar Well	11.70	638	SYSTEM	638	0	799	0	0											
Membro Well	0.00	0	SYSTEM	0	0	0	0	0	System	Current (L/s)	All Flow (m3)	Going To	System (m3)	Waste (m3)	Recirc (m3)	All Flow (m3)	System (m3)	Waste (m3)	Recirc (m3)
Paisley Well	9.87	687	SYSTEM	687	0	851	851	0	System Well*	401.11	43184	N/A	38420	4760	N/A	54360	47653	5908	N/A
Park Well #1	56.40	3897	SYSTEM	1240	0	4862	1541	0	System Booster*	594.09	37413	N/A	37413	0	0	47270	46456	0	0
Park Well #2	0.00	1240	SYSTEM	3898	0	1541	4862	0											
Queensdale Well	0.00	735	SYSTEM	735	0	873	873	0											
University Well	0.00	1641	SYSTEM	1641	0	1836	1836	0											
Water St. Well	24.62	1587	WASTE	1588	0	961	961	0											
Glen Collector	119.81	8358	SYSTEM	8358	0	10309	10309	0	*Note: Burkes is currently not included in the System Totals										

\*Note: Burkes is currently not included in the System Totals

W - To Waste, S - To System, R - To Recirculation

Ack	Date In	Time In	Time Last	Node	Tagname	Status	Value	Description
✓	02/10/2018	10:55:14	273	10:55:14	273 WDSCADA DOBG00100EPF	CFN	ALARM	Downey Well Pump Power Monitor
✓	29/09/2018	12:54:05	987	12:54:05	987 WDSCADA MEBG00100EPF	CFN	ALARM	Membro Well Pump Disconnect Off
✓	29/09/2018	12:54:05	921	12:54:05	921 WDSCADA MEBG00100EOL	CFN	ALARM	Membro Well Pump Overload Alarm
✓	29/09/2018	12:54:05	921	12:54:05	921 WDSCADA MEBG00100EOL	CFN	ALARM	Membro Well Pump Overload Alarm

Total Alarms: 46

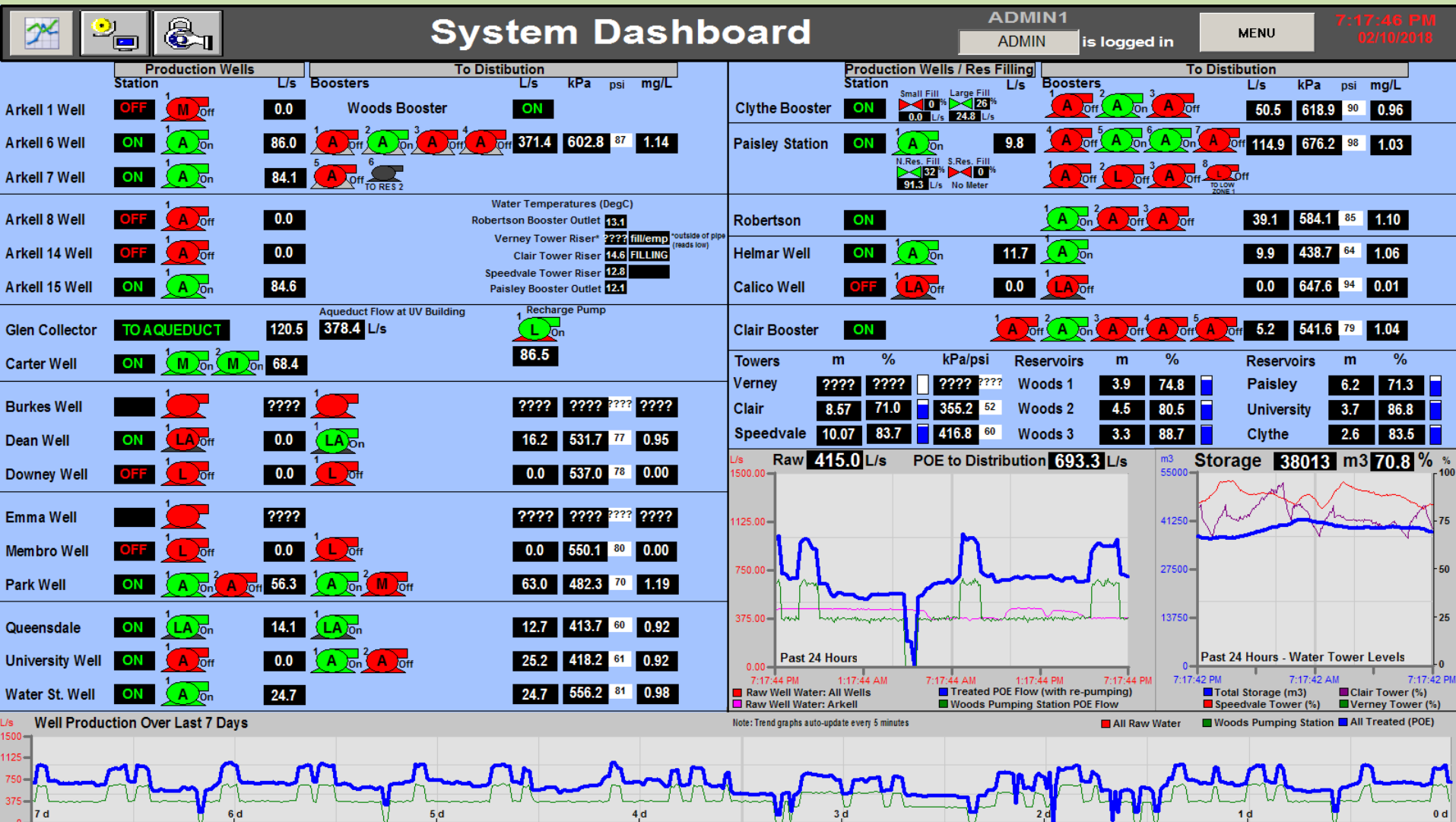
Filter: Off

Sort: Time In, Descending

Run



# Dash Board Displays – entire system status at a glance





# Dash Board Displays - Weather



## Water Temperature and Weather

ADMIN1

ADMIN

is logged in

MENU

7:21:51 PM

02/10/2018

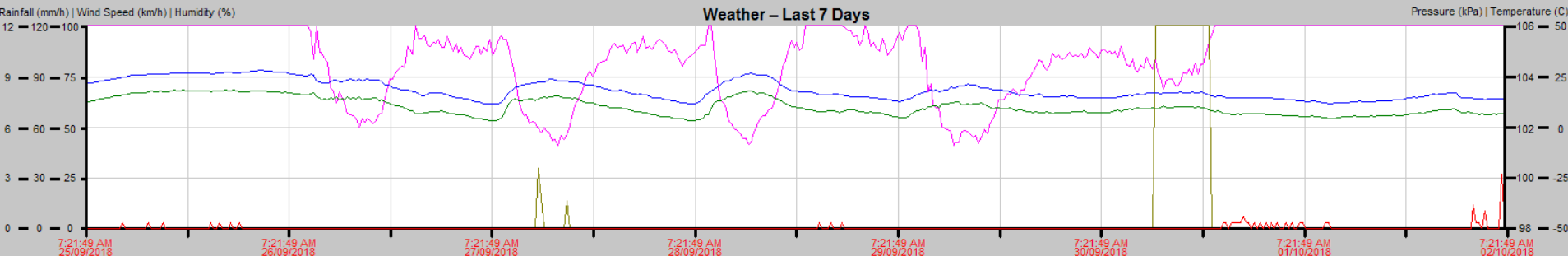
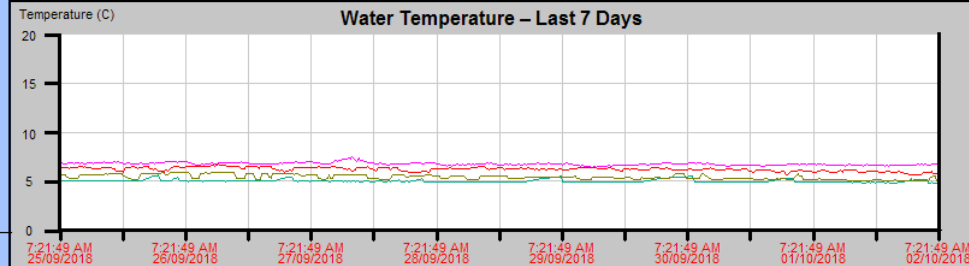
Station Weather		Days Ago									
		Current	Today	1	2	3	4	5	6	7	
Arkell 6	Barometric Pressure	101.7 kPa	Max	102.2	102.9	102.8	102.2	102.3	102.1	102.3	kPa
			Min	101.5	102.2	102.4	102.1	101.6	101.7	102.1	kPa
Arkell 8	Outside Temperature	11.68 DegC	Max	13.63	9.98	10.41	14.20	19.84	16.49	19.45	19.28 DegC
			Min	7.25	5.73	6.54	5.30	3.66	3.46	7.35	14.20 DegC
	Rainfall	0.00 mm/h	Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 mm
Arkell 15	Barometric Pressure	92.7 kPa	Max	94.2	92.5	91.7	96.1	97.0	94.4	91.2	91.8 kPa
			Min	91.4	90.0	88.4	86.9	85.5	84.0	83.8	89.5 kPa
	Humidity	100.0 %	Max	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0 %
			Min	91.53	100.0	68.50	40.23	39.47	39.13	49.00	100.0 %
	Outside Temperature	11.35 DegC	Max	14.31	8.71	10.52	13.02	18.30	15.81	18.38	18.47 DegC
			Min	5.95	4.23	6.17	4.64	2.88	3.05	6.56	12.15 DegC
	Rainfall	0.00 mm/h	Total	18.50	13.25	5.50	0.75	3.25	0.00	1.75	9.75 mm
	Wind Speed	0.0 km/h	Max	104.9	58.3	177.0	0.0	0.0	177.0	177.0	177.0 km/h
			Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 km/h
Woods	Barometric Pressure	97.6 kPa	Max	100.3	102.3	100.8	100.2	100.9	100.3	98.5	98.9 kPa
			Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 kPa
	Outside Temperature	20.53 DegC	Max	22.78	16.75	21.47	21.47	27.02	24.05	28.08	27.12 DegC
			Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 DegC
	Rainfall	0.00 mm/h	Total	17.50	12.50	1.75	1.00	3.25	0.00	1.75	7.50 mm

### Water Temperatures

Clair Tower Temp	14.64	DegC
Paisley POE Temp	12.19	DegC
Robertson POE Temp	13.22	DegC
Speedvale Tower Temp	12.80	DegC
Verney Tower Temp	????	DegC

### Frozen Services Alarms

Name	Status/Setpoint	Delay	Timer
Robertson LO Alarm	6.00 DegC	60.0 min	0.0
Robertson LOLO Alarm	4.00 DegC	60.0 min	0.0



Ack	Date In	Time In	Time Last	Node	Tagname	Status	Value	Description
✓	02/10/2018	10:55:14.273	10:55:14.273	WDSCADA	DOBG00100EPF	CFN	ALARM	Downey Well Pump Power Monitor
✓	29/09/2018	12:54:05.987	12:54:05.987	WDSCADA	MEBG00100EPF	CFN	ALARM	Membro Well Pump Disconnect Off
✓	29/09/2018	12:54:05.921	12:54:05.921	WDSCADA	MEBG00100EOL	CFN	ALARM	Membro Well Pump Overload Alarm
✓	29/09/2018	12:54:05.921	12:54:05.921	WDSCADA	MEBG00100EFA	CFN	ALARM	Membro Well Pump General Alarm

Total Alarms: 39




Filter: Area In "A01,A06,A07,A08,A14,A15,ADV,AKS,AKW,BK" Sort: Time In, Descending

Run

Pen	Value	Unit	High	Low	Average
A15 Current Rainfall	0.00	mm/h	27.00	0.00	0.29
A15 Barometric Pressure	88.18	kPa	96.51	83.80	89.45
A15 Humidity	92.12	%	100.00	40.93	85.43
A15 Wind Speed	0.00	km/h	177.03	0.00	6.96
A15 Temperature	9.83	DegC	18.29	3.09	10.16
Woods Temperature	17.87	DegC	28.00	11.46	18.35

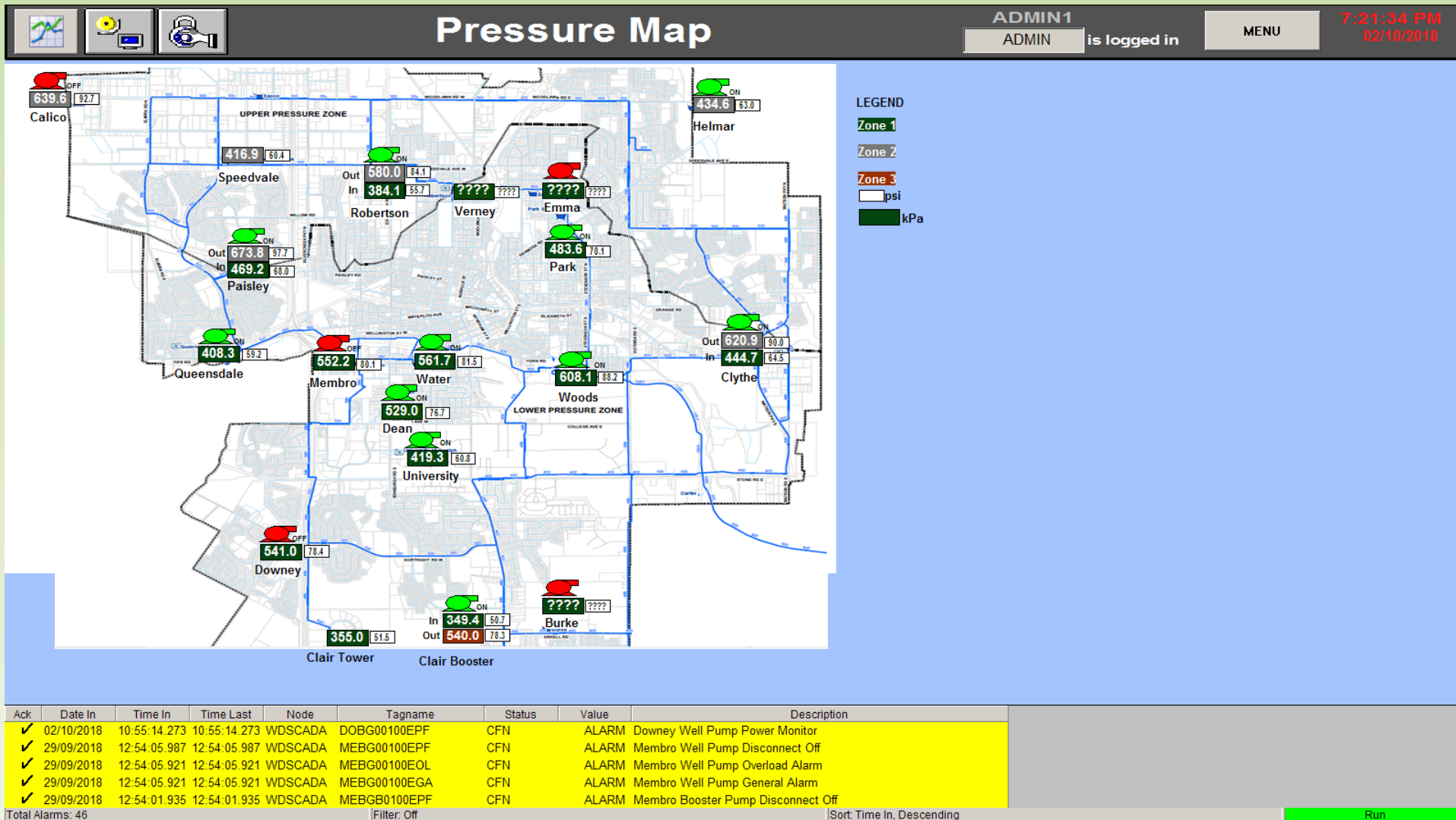


# Dash Board Displays – Which Sites have Power?

  			Hydro Status										ADMIN is logged in		MENU		7:21:05 PM 02/10/2018												
Left Panel															Right Panel														
Site Name	Has Power	ATS	Panel	Generator	PLC UPS	Secondary UPS	Site Name	Has Power	ATS	Panel	Generator	PLC UPS	Battery Status	Secondary UPS															
Arkell Well 6	ON	ATS	Standalone	ON	OFF	AUTO-START AUTO-STOP	Arkell Well 7 & 1 <sup>1</sup>	ON	ATS	Standalone	ON	OFF	AUTO-START AUTO-STOP	Arkell Well 8 <sup>2</sup>	ON	MTS	ON	Plug	Output Select BATTERY STATUS OK 117 100% Min										
Arkell Well 14	ON	ATS	Standalone	ON	OFF	AUTO-START AUTO-STOP	Arkell Well 15	ON	ATS	Standalone	ON	OFF	AUTO-START AUTO-STOP	Arkell Diversion <sup>13</sup>	ON	n/a	ON	Powered by Well 15 Generator	Output Select BATTERY STATUS OK 117 100% Min										
Carter Wells <sup>3</sup>	ON	MTS	ON	Plug	MAN-START MAN-STOP	Burkes Well <sup>4</sup>	MTS	MTS	Standalone	ON	Plug	MAN-START MAN-STOP	Calico Well	ON	n/a	ON	n/a	Output Select BATTERY STATUS OK 117 100% Min											
Clythe Booster Station	ON	ATS	ON HYDRO	ON	Standalone	AUTO-START AUTO-STOP	Dean Well	ON	n/a	ON	n/a	ON	Downey Well	ON	ATS	Standalone	ON	Plug	Output Select BATTERY STATUS OK 117 100% Min										
Emma Well <sup>5</sup>	MTS	MTS	ON	Plug	???	???	Helmar Well <sup>6</sup>	ON	n/a	ON	n/a	ON	Clair Booster Station	ON	ATS	ON HYDRO	ON	OFF	Output Select BATTERY STATUS OK 117 100% Min										
Gazer Mooney SPS	n/a	n/a	n/a	n/a	n/a	n/a	Edinburgh Well	n/a	n/a	n/a	n/a	n/a	Verney Tower	n/a	n/a	n/a	n/a	n/a	Output Select BATTERY STATUS OK 117 100% Min										
1. Arkell Well 7 generator running status is the ATS emergency power selected status. 2. Arkell Well 8 hydro status is the PLC Panel power status, downstream of the MTS 3. Carter Wells hydro status is the PLC Panel power status, downstream of the MTS 4. Burkes Well hydro status is the PLC Panel power status, downstream of the MTS 5. Emma Well hydro status is the PLC Panel power status, downstream of the MTS 6. Helmar Well PLC panel and Hydro power status comes from Power Monitor relay 7. Clair Truck Fill PLC Panel power is fed from the Clair Booster PLC Panel UPS															8. Paisley Station pumps 1 & 7 are upstream of ATS. Generator coverage for pumps 2-3-4-5-6. 9. University generator running status is the ATS emergency power selected status 10. Water St. Well hydro status is the PLC Panel power status, downstream of the MTS 11. Woods Booster ATS and Generator feeds the entire Woods site (Main Bldg, Chlorine, Bldg, UV Bldg, Trailers) 12. Clair Tower is powered from Clair Booster Station (which has an auto-starting generator) 13. Arkell Diversion is powered by Well 15.														
SCADA Server Racks															Legend														
Clair Server Rack ON HYDRO OK 133 Min Rack 23 DegC 40 Humid Room 21 DegC 40 Humid															Woods Server Rack ON HYDRO OK 751 Min Rack 28 DegC 15 Humid Room 25 DegC 30 Humid														
Hydro OK — ON HYDRO OK ###% — Charge left															UPS on Battery   — Runtime left														
Total Alarms: 46															Filter: Off														
Sort: Time In, Descending															Run														

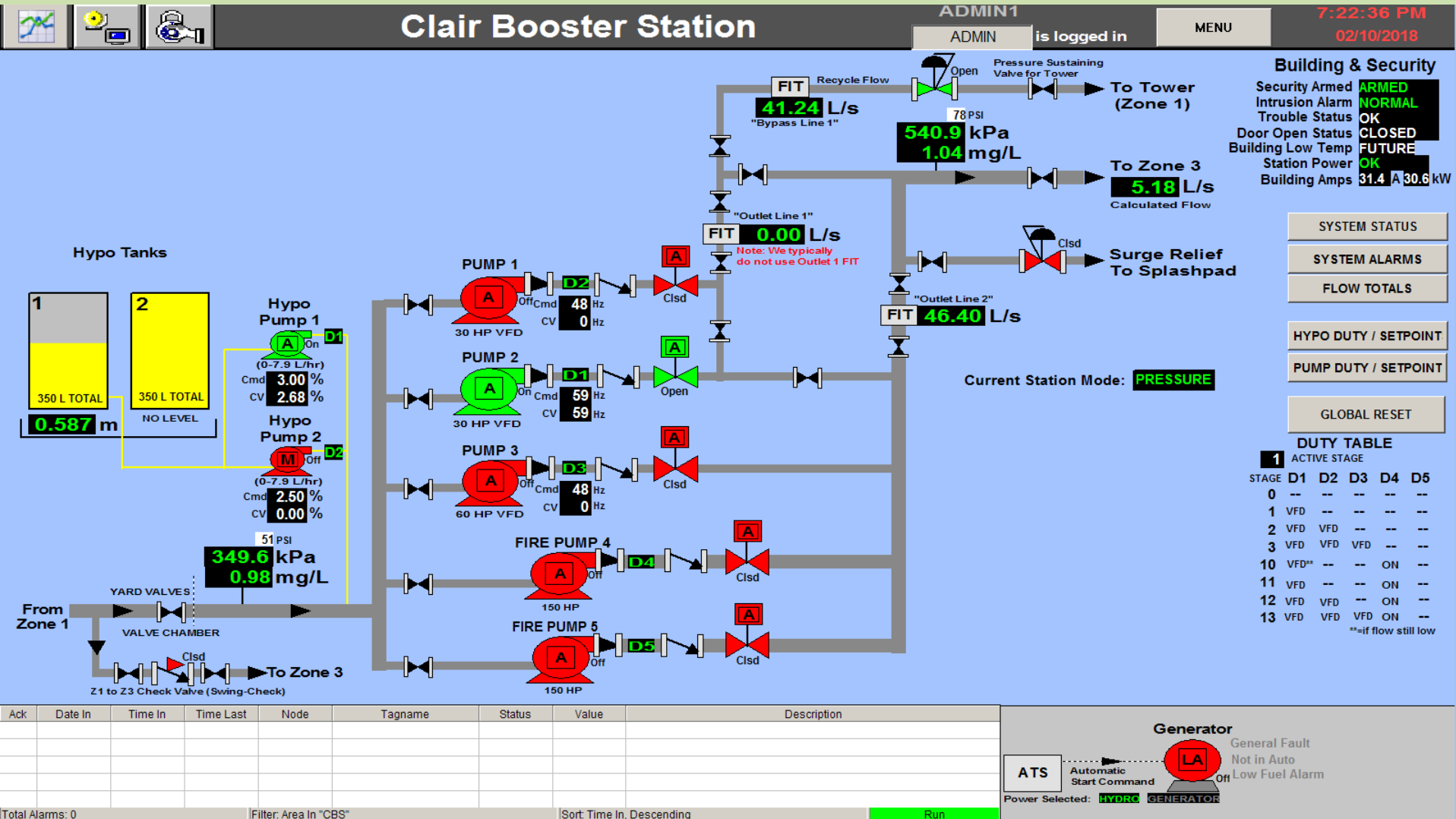


# Dash Board Displays – Pressures Across City





## A More Complex Site: VFDs, Duty Numbers, etc.



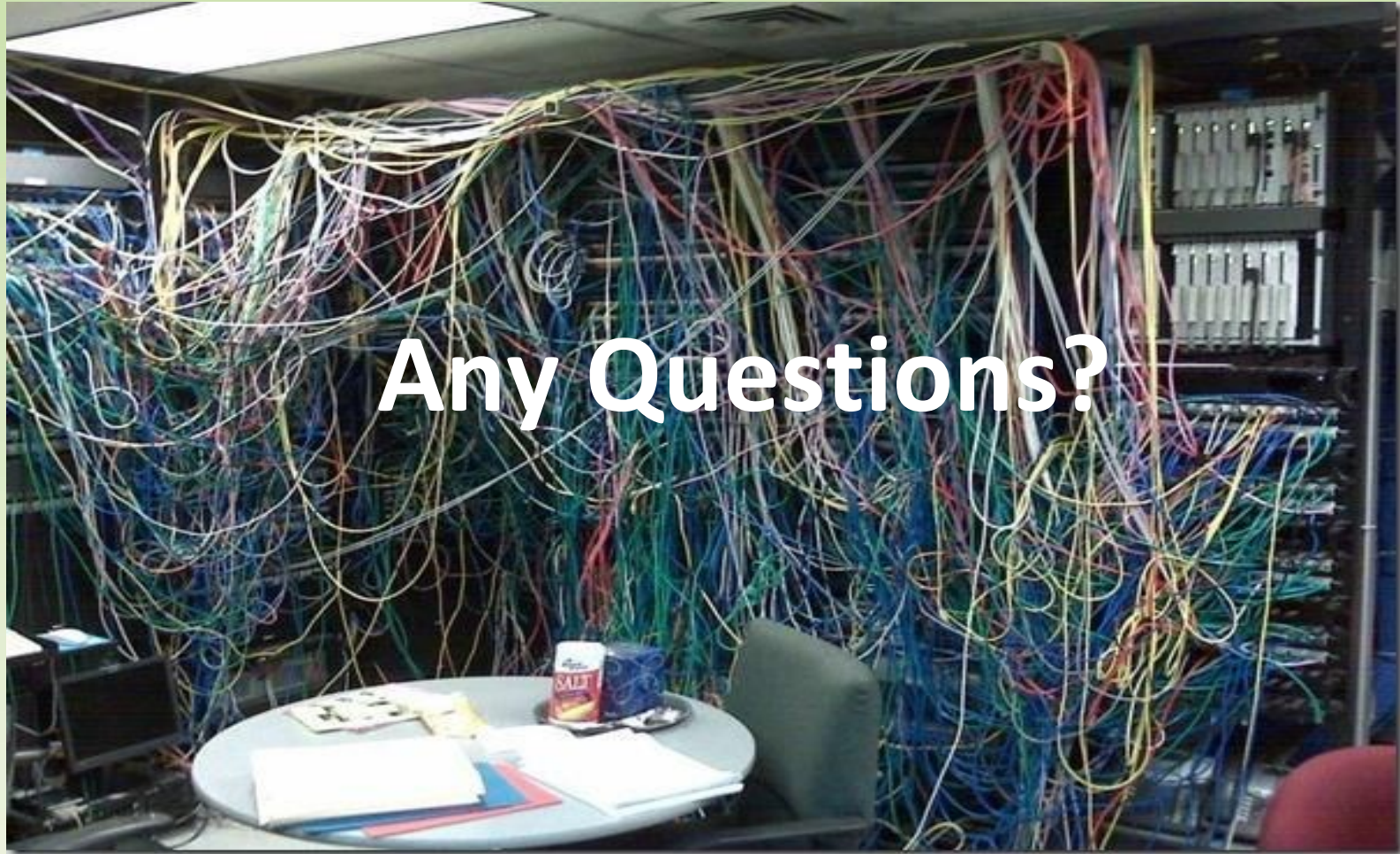


# Build on What you Have

- SCADA is essential for both Operations and Compliance
- Operators Need Situational Awareness to Operate Effectively
- Use the SCADA HMI to show the whole picture to operators
- SCADA Alarms systems must be rationalized/documentated
- Pay attention to data integrity by investing in data redundancy
- SCADA networks are key to robust SCADA systems
- Cyber Security is requires a multi-pronged approach
- When upgraded SCADA systems, leverage what you have
- Take advantage of new technology and ideas



# Wrap-Up



\* Not a high performance SCADA System