Creating A New Pressure Zone In A 100-Year Old System

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Outline

- Objectives
- Service area & existing conditions
- Components
- Planning
- Construction
- Commissioning
- Lessons learned

Objectives

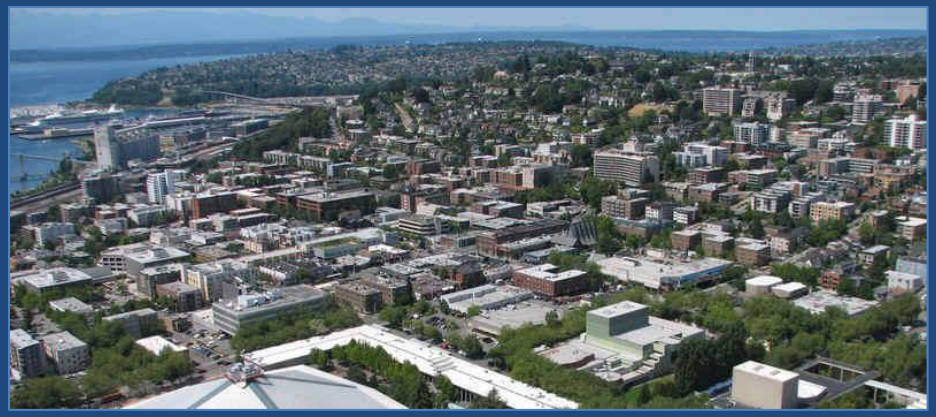
- Increase storage volume from 1.2 MG to 2.0 MG
- Solve low pressure & fire flow problems at highest elevations on Queen Anne Hill
- Maintain existing service levels and supply routes crossing through the project area

SPU Terminology

- District valves - DVs
  - Normally closed valves that create a pressure boundary
- Pressure Zones
  - 530, 580, etc. refer to the nominal hydraulic gradient in the zone
  - QA530 is the part of the 530z in Queen Anne

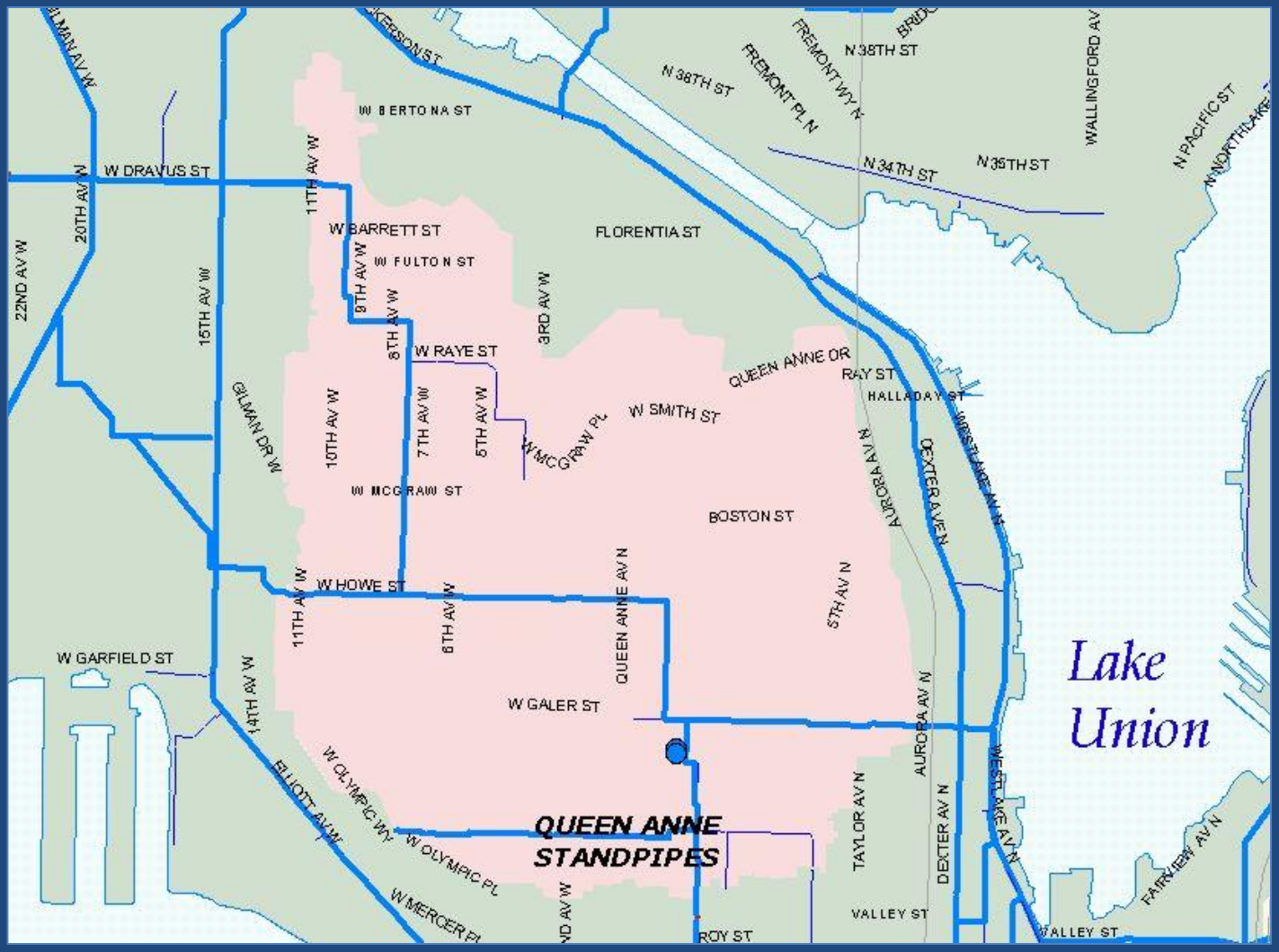
SERVICE AREA & EXISTING CONDITIONS

Queen Anne Neighborhood

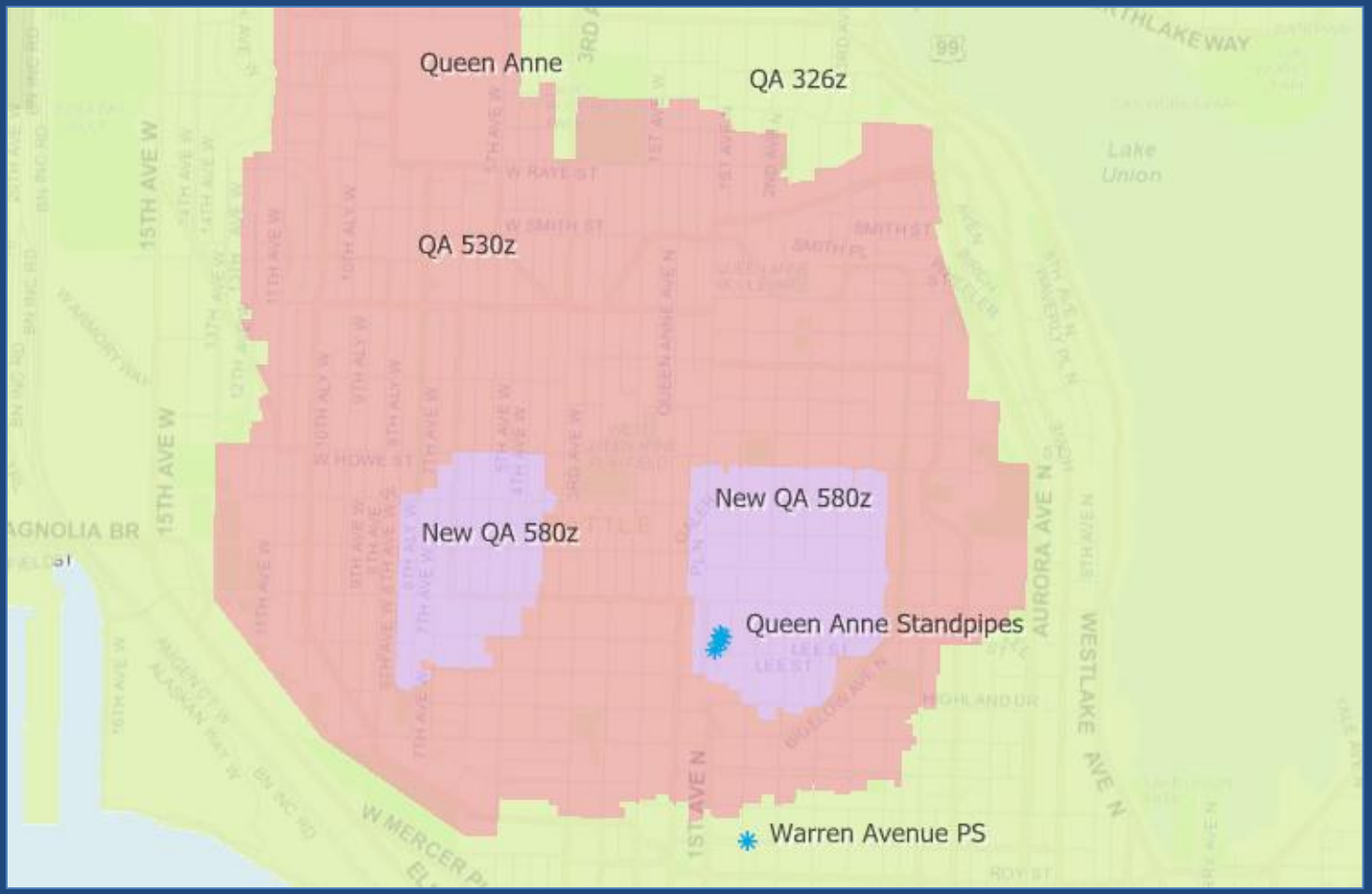


- High density residential
- Neighborhood businesses
- Narrow streets
- Not enough parking
- Infrastructure 1890-1920
- Undersized combined sewers
- Elementary schools
- Residents educated & well-informed

Queen Anne Hill Pressure Zone



New Queen Anne Booster Zone

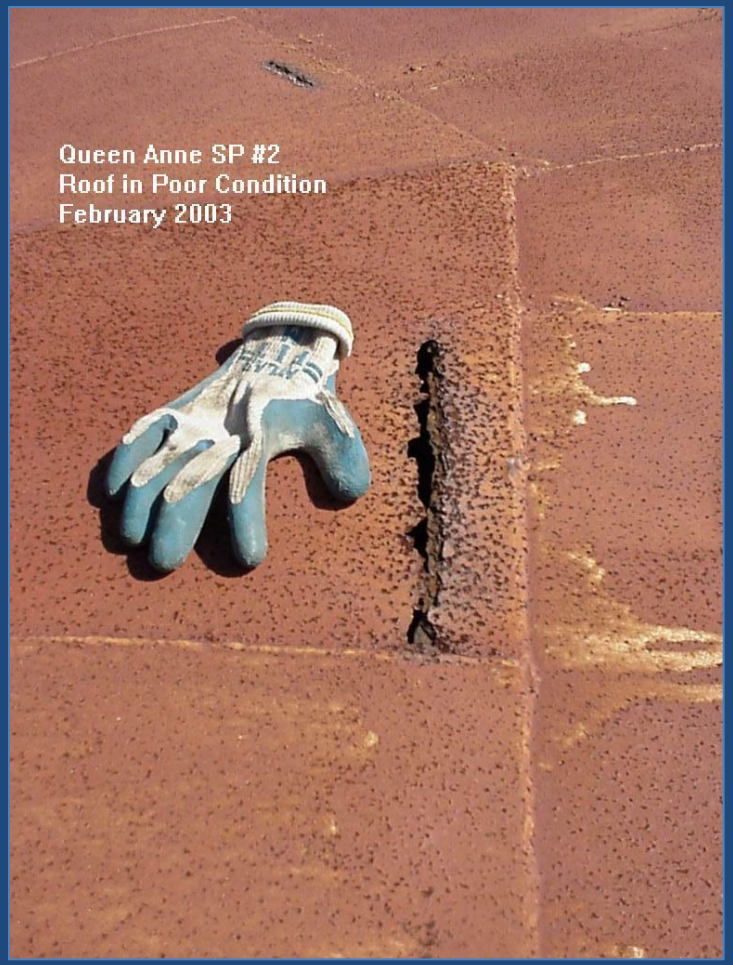


Century-Old Infrastructure

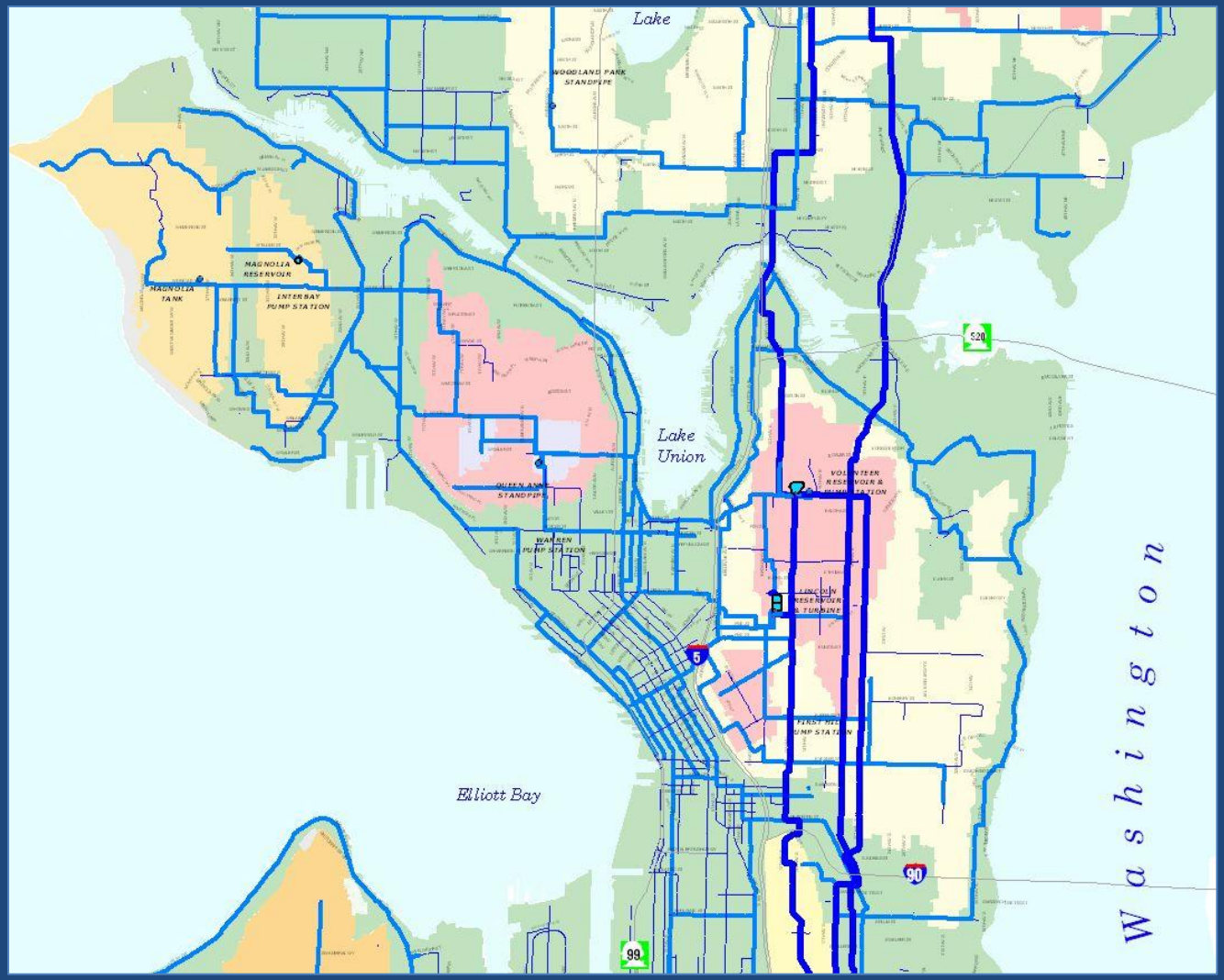
1.2 MG Storage

Unlined 4” – 12” CI pipe

Roof of Queen Anne SP #2



Wheeling Water Through Queen Anne



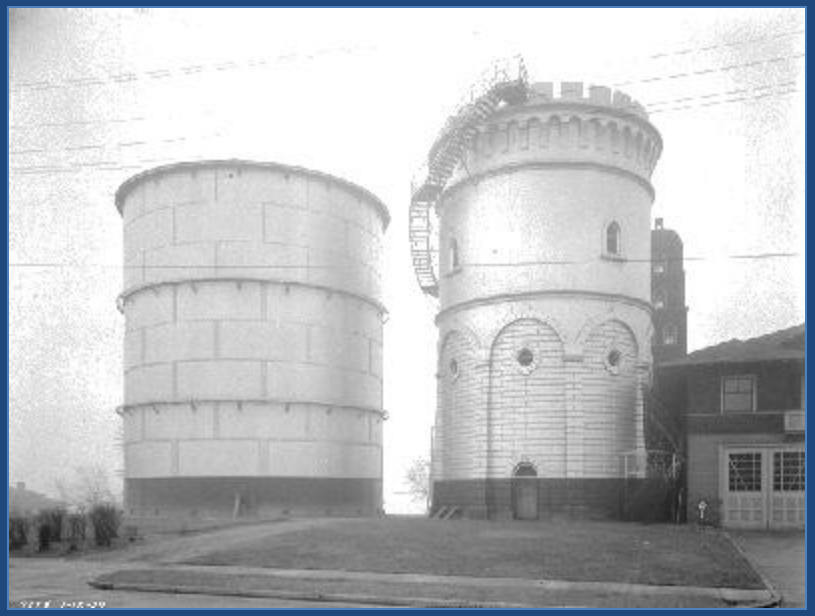
Other Conditions & Constraints

- Fire station operations & one-way traffic
  - Streets too narrow for trucks to easily turn & back in

Landmark Process

QUEEN ANNE WATER TANK NO. 1
(Queen Anne Standpipe No. 1)
HAER No. WA-177

Historic American Engineering Record
National Park Service
Department of the Interior
Seattle, Washington



Queen Anne Hill Standpipes. January 10, 1929. Historic Photo #3207. Seattle Municipal Archives, Photograph Collection.

Note that the fire station has moved from north of SP #1 to south of SP #2.

COMPONENTS

Sub-Projects

- Demolish existing standpipes
- Build new 2 MG standpipe
  - With tank mixing system
- Build new booster pump station

Sub Projects

- Watermain Work
  - Feeder from new pump station
  - Loop dead ends in new zone
  - Isolate 530 feeder from surrounding new 580 zone
  - Existing valves used as district valves
  - Check valve stations
    - No standby power for pump station
      - 580 zone to revert to original pressure

PLANNING

Operating Zone Without Storage

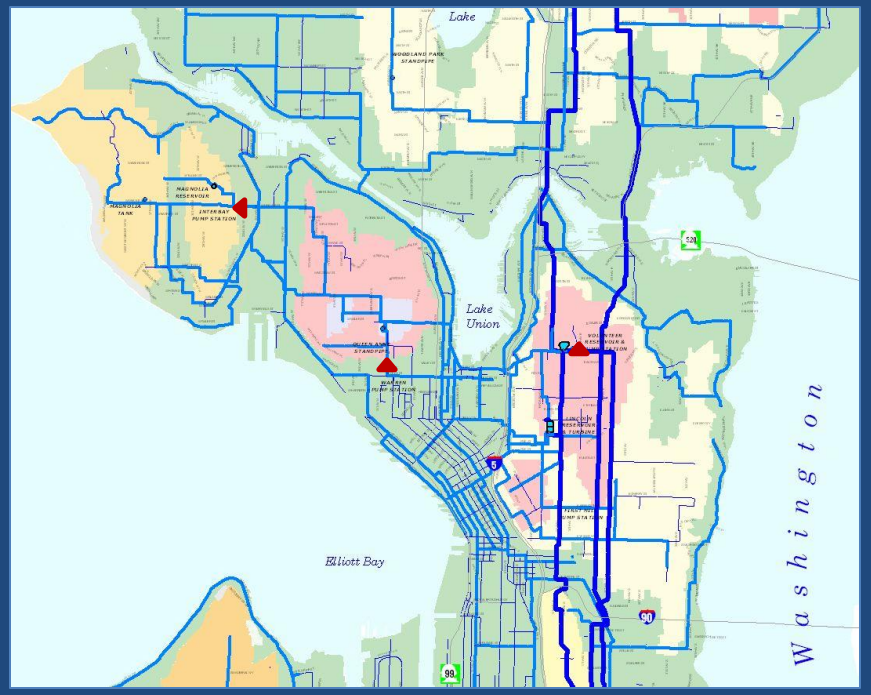
- Warren Avenue PS
  - Throttle flow on #1
  - Add new psi relief loop
- Interbay PS
  - Re-pilot PRV for 480z supply as 530z relief
  - Switch to 100% pump supply for Magnolia
  - Emergency pumping to QA530z

Test The Modifications

- Will these work like we think they will?
- Identify setpoints
  - Temporary relief valves under some conditions
- Night-time
  - Less impact on customers
  - Low flow conditions
- Day-time
  - Higher flows

Impacts on Wheeling Operations

- Disable altitude valve at Volunteer SP
- Gravity supply options to Magnolia converted to pressure relief only for 530z
- Volunteer PS & Warren Ave PS get top priority if they develop problems



Contingency Plans

- Normal configuration
  - What's in service & what's not
  - Valve crew to be in area whenever construction is parallel to or crossing a feeder
- Define unusual conditions and responses, such as:
  - Broken valves or feeder line leaks
  - 8 hr shutdown of feeder crosses
  - Power outages
  - 1-alarm fires

Unusual Conditions	Action Options
Fire – 1 alarm	Dispatch FRC to stand by as per normal SOP for 2 alarm & higher. to coordinate with Seattle Fire Department.
Broken valve in 24"	Suspend all construction parallel to feeder. Timing of further action dependent upon whether valve is broken open or closed.
8-hour shutdown Warren Av N; Galer & Warren Intersection	To be scheduled at night. Monitor other conditions, especially fire dispatches.
Scheduled single feeder shutdown	Monitor other conditions & status of supply facilities. Notify Water System Supervisor if any other status changes or another unusual/emergency condition develops.
Armory Way 530 leak	Schedule shutdown for repair. Suspend construction parallel to feeders.
Dravus 530 leak	Establish alternate relief if Galer is shutdown. Schedule shutdown for repair. line will be secondary relief via the 26th & Crockett RCBV.
Warren Av PS #1 trips off-line; delayed re-start; Galer Street line open.	Use Volunteer PS. If necessary, bleed excess water to Magnolia; avoid overflowing Volunteer SP. Use of P.S. assumes that Volunteer P.S. was either unavailable or insufficient to hold QA 530 zone or Warren and Volunteer were being used in conjunction. Start Warren P#2 and watch zone psi.

Contingency Plans

- Define emergency conditions, indications & responses, such as:
  - QA530 psi gage out of service
  - Unscheduled shutdowns
  - Multiple alarm fires
  - Sustained high or low pressure
  - Pumps trip off and won’t restart

Emergency	Action Options
530 psi gage out of service	Dispatch WSO or FRC to monitor psi gages on hydrants. Dispatch comm techs to restore gage to service.
Galer Street break	Indicated by no pressure at QA MW Bldg. psi monitor & Warren Av PS discharge pressure. Dispatch FRC, notify Fire via ORC that zone is dry. Isolate break, Water Supply staff to begin implementing refill & recovery.
Warren PS power outage	Indicated by pump off light, low zone psi alarm, no discharge flow. Start Volunteer PS, close 26 & Crockett if open. For long-term outage, transport generator & wire it up (4 hours minimum to wire generator.)
Unscheduled feeder shutdown	Suspend construction parallel to feeders. Dispatch crew to repair immediately.
Warren PS #1PRV outage	Use Volunteer PS. Monitor 530z psi, if necessary open valves to Magnolia. For long-term outage, set additional hydrant PRVs.
Fire – 2 alarm or greater	Dispatch FRC as per normal procedure. FRC to stay in close contact with WSCC as hydrants are opened & closed. Monitor very closely for pressure spikes with hydrant operations. SFD & WSCC to coordinate.
High pressure sustained	Verify correct pump size for demand. Attempt to bleed excess pressure without draining zone. Dispatch for stuck pump control valve. Based upon testing conducted by Water Supply, the failure of the PRV on the discharge of Warren P#1, i.e. PRV fails in the full open position allowing P#1 to pump at or near rated capacity of 4,000 gpm is not likely to cause an over-pressurization situation as long as the 8” PRV at Interbay is open.

Valve Inventory

- Inspect hundreds of valves
  - Which are needed for shut downs?
  - Which are to be district valves?
  - Do they still exist?
  - Are there valves out there that aren't mapped?
  - Does this valve need to be replaced?
    - Leaky DVs bleed water out of new zone

Valve Inventory

- Document location & condition
  - Tagged in field
  - Mapped
- Exercising schedule
  - Very old & crusty
- Repair
  - Or replace

Shutdowns

- Sequencing work
  - New mains, temporary cut & caps, connections
    - Usually short shutdowns
  - Replace in same location & temporary mains
    - More shutdowns
    - Temp mains require disinfection & bacti samples
  - Service transfers

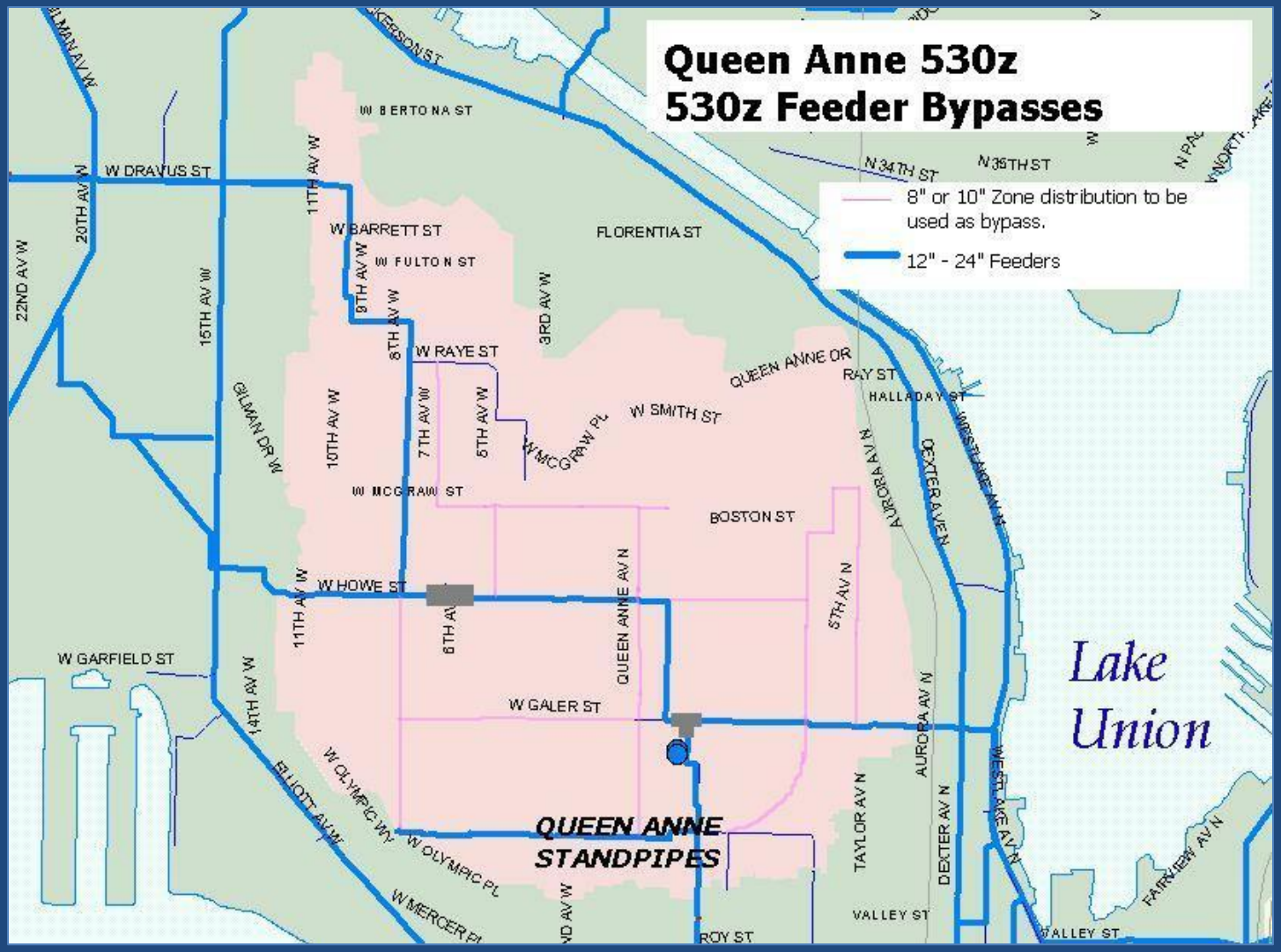
Key Sequencing Considerations

- How long mains will be out of service
  - Hours, weeks or months?
- Fire flow & access to working hydrants
  - Number of streets in a row off or on temporary
- Number of times customers will be shut off

Identify Conflicts & Constraints

- Go through maps & plans, identify
  - Alternate supply routes
    - Upstream & downstream impacts of outages
  - Likely extent & duration of outage
    - Will those be acceptable?
  - Distance by roadway to nearest working hydrants
    - In this area, keep under 800’
- Include this info in schedule review comments & approval

Alternate Supply Routes



Main Shutdown Spreadsheet

- Feeder shutdowns
  - Plan set page
  - SPU map page
  - Specific valves to be closed
  - Other lines required to be in service during shutdown

Watermain Plan Sheet	Segment & Mapbook Page	Valve	Other Lines Required to Be In Service
W7, W4	20" & 24" Warren Av N - Queen Anne SP to Galer (p35 & 35A)	20"V 20'W 100'N in Warren Av north of Lee (also shown as V#9 on page 35A)	24" Galer open from 5 Av N to EM of Warren Av
		16" V#3 (p 35A) on Queen Anne SP inlet line at base of tanks	8" Warren Av open from Galer to Howe
	Both feeds to western 530z are interrupted. Fire flow very bad.	24"V 20'S 1'W in Galer @ WM of Warren	8" Howe open from Warren Av N to 1 Av N
	Shutdowns must be as short as possible and at night whenever possible.	24"V 20' 6'W from S in Galer @ EM of Warren	12" Prospect open from 5 Av N to 8 Av W.
			8" 8 Av W open from Prospect to Howe.
			8" Bigelow Pl N open from Prospect to Galer.
			8" Queen Anne Av N open from Prospect to Galer, and from Galer to Howe.

QA Main Shutdown Spreadsheet

- Critical conflicts tab
  - Mains crossing under feeder backbones

Drawing	Feeder	Crossing
W1	24" 1 Av N	New 8" Howe
W2	24" 1 Av N	New 12" in Garfield
W5	24" Galer	New 8" at 2 Av N
W6	24" Galer	New 8" at 3 Av N

  - Water supply critical conflicts (next slide) – work may not proceed at the same time on any of these

Water Supply Critical Conflicts (work at these locations may not proceed simultaneously if one of these mains is shut down)	
Location	Projected Dates of WM Construction as of 12/19 Submittal
Location 1 East (24" 1 Av N)	Feb 20 to Apr 9
Location 4 East (24" Warren Av)	**Apr 17 to Jun 24**
Location 3 West (24" West Howe)	**Apr 19 to May 20**
Location 5 East (24" Galer)	Jul 6 to Sep 2
Location 6 East (20" Warren Av - parallel construction only - no crossings or connections)	Jun 7 to Jul 13
May be critical depending upon timing of C&C and connections	
Location 7 West (connect to 8" in 8 Av W)	Jun 20 to Jun 21
Location 10 West (7 Av W CV station)	Jul 20 to Jul 27
Location 6 West (connect 3 Av W to Galer)	25-Jun
Location 3 East (connect 4 Av N to Howe)	14-May

QA Main Shutdown Spreadsheet

- Cuts & caps tab

Plan Sheet	General Location	Cut & Cap Needed	Schedule (estimated based on 2/14 submittal)	completed as of 4/19
Sht (W7)	Warren Av N - Lee to Galer	1- 24" WM	Feb 20-21	yes
Sht (W10)	N Howe St - 2 Av N to 4 Av N	1- 8" WM	~ March 30	yes
Sht (W12)	W Blaine - 6 Av W to 8 av W	2- 6" WM	~ mid March	
Sht (W15)	W Garfield - 4 Av W to 6 Av W	2- 6" WM	~ early April	
Sht (W32)	3 Av W - Garfield to Galer	2 - 10" WM	first week of April	

QA Main Shutdown Spreadsheet

- Field verification tab

Location	Verify	Findings	Date & Name
1 Av N and Galer	Is there a 24" line valve 80'N of Galer? (p28 & 29)		
1 Av W & Galer	Is there a 6" valve on the SM of Galer?	yes	Muto
2 Av W & Galer	Is there a 6" valve on the SM of Galer?	yes	Muto
Intersection of 8 Av W & W Galer	Verify location of 2" line south of Galer is on east side of 8 Av W.		
24" West Howe - 2 Av W to 7 Av W	Do 24" valves have bypasses?		

Director's Briefings

- Construction
- Water supply operations during construction
- Water quality
- Communication plan
  - Contact
  - Description
  - Risks & risk management
  - Follow up & next steps

CONSTRUCTION


ELDER


DEERE
Genie GTH-5519
Genie

Tracking Watermain Progress

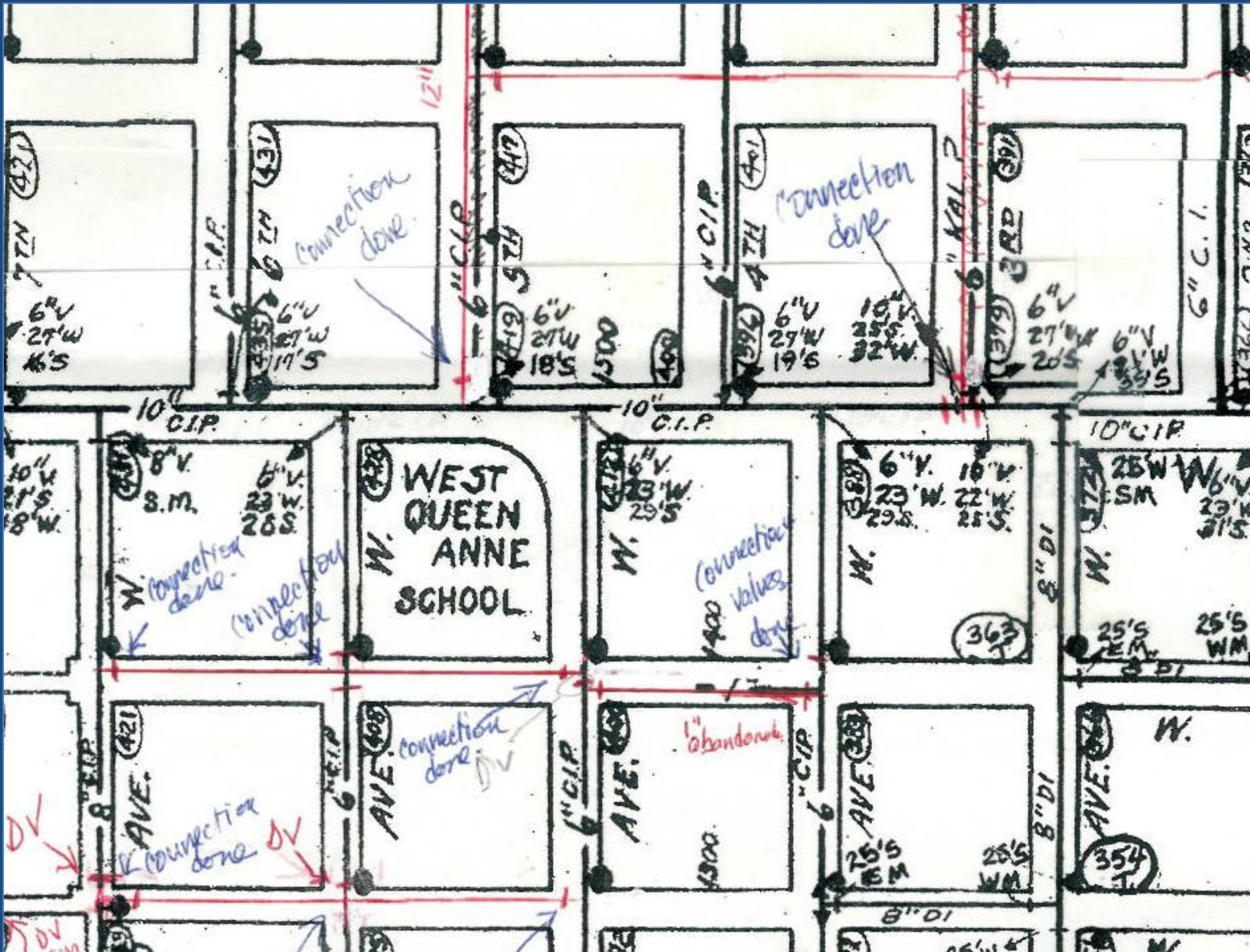
- Site meetings
  - Contractor
  - SPU pipe crew
  - SPU valve crew
- Changes to plan
  - Plans don’t always show what’s really there
- Review proposed shutdowns

Tracking Watermain Progress

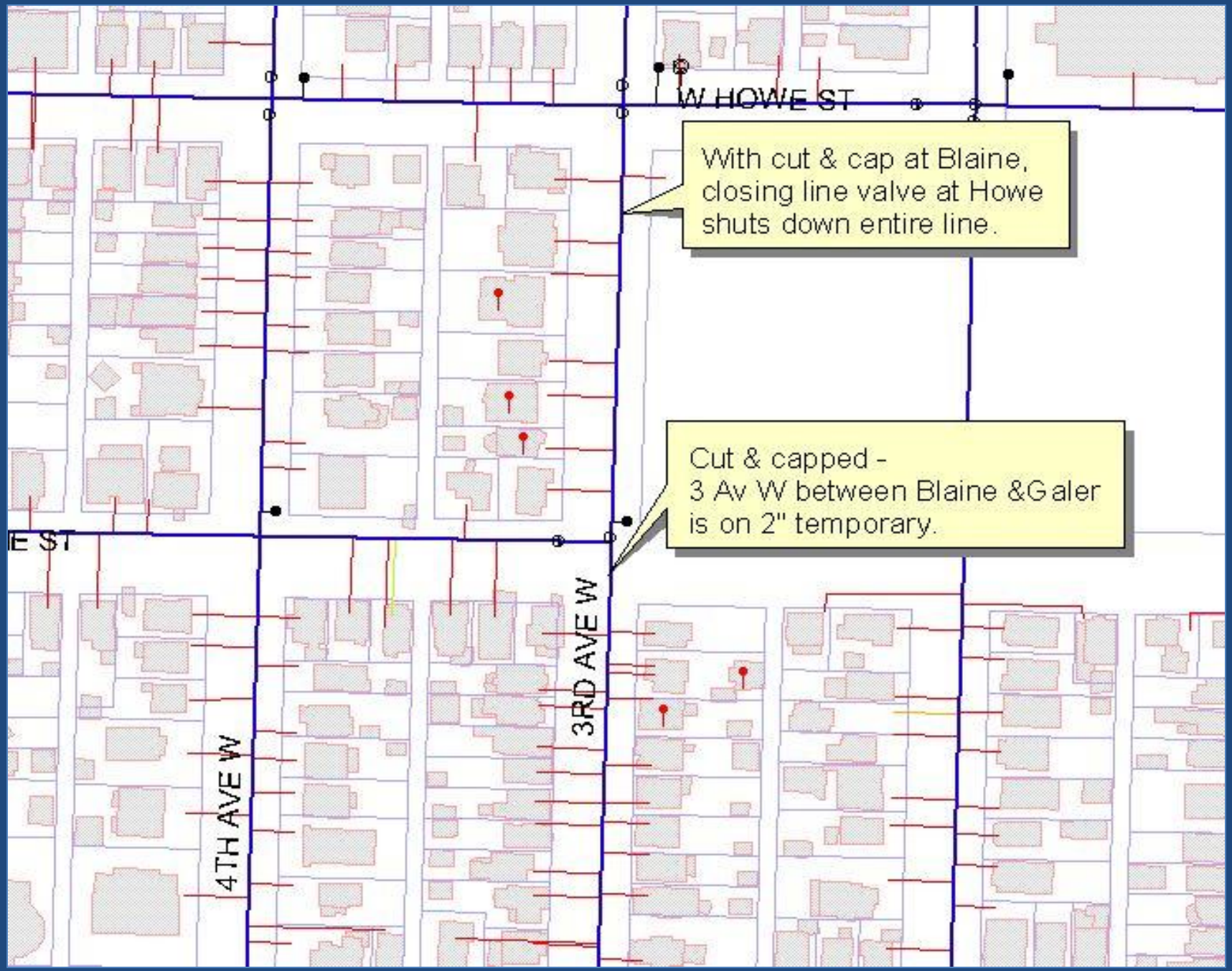
- Will this shutdown do exactly what we think it should?
  - Mock shutdown useful
    - All other necessary connections completed
    - Valves in correct position
    - Affected services accurately identified
    - Supply to remainder of area relatively unaffected
    - No surprise loss of monitoring or control

Tracking Watermain Progress

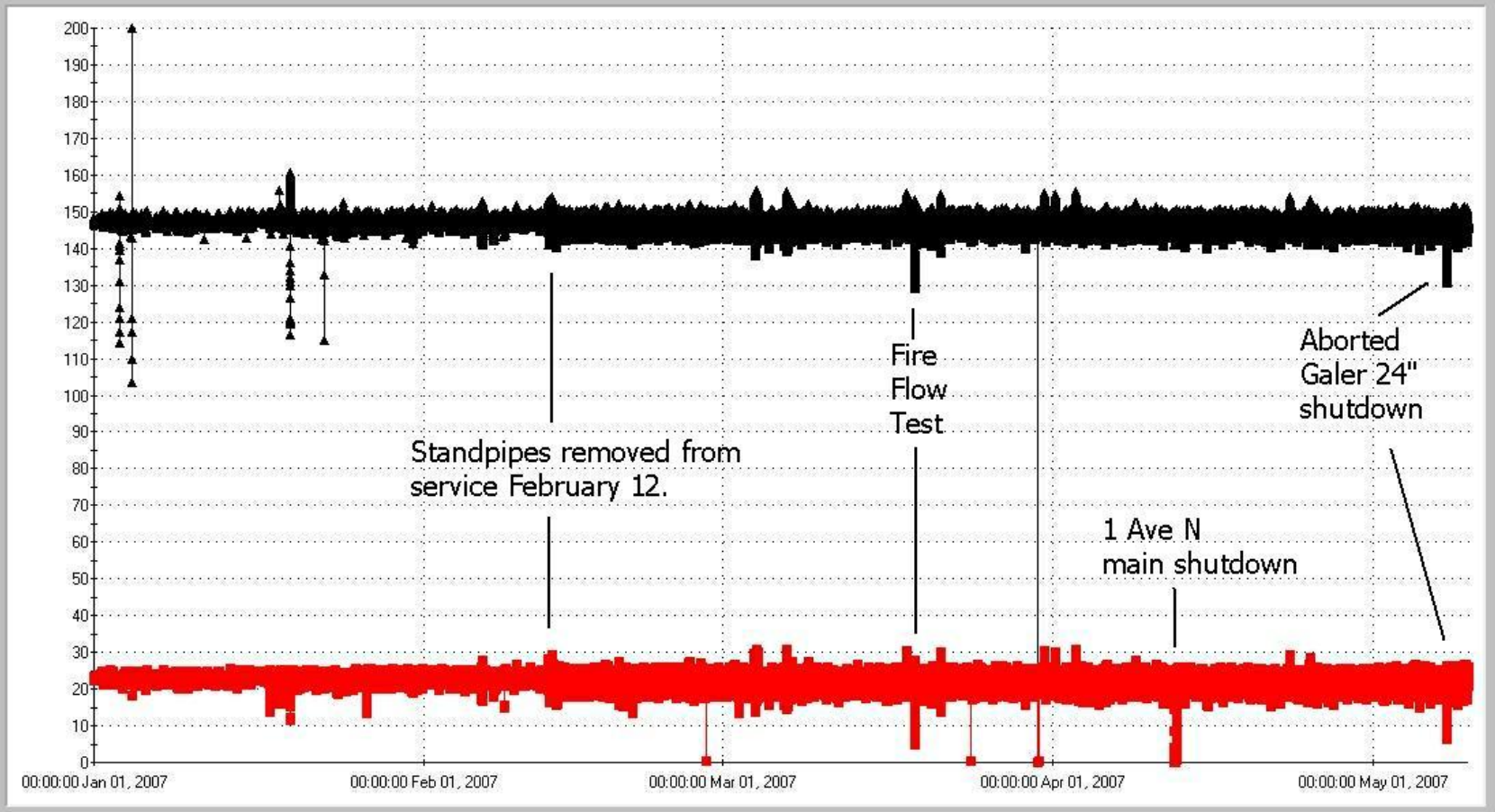
- Weekly meetings with contractor to confirm progress, update schedule, identify developing conflicts
- Monitor sequence of work to maintain supply & fire flow
- Update maps
- Evaluate impact of changed operating conditions on system



WEST
QUEEN
ANNE
SCHOOL
Connection done
Connection done
connection done.
connection done
connection valves done
connection done
connection done
1" abandoned
10" C.I.P.
10" C.I.P.
10" CIP
8" DI
8" DI
8" DI
363
354


W HOWE ST
With cut & cap at Blaine, closing line valve at Howe shuts down entire line.
Cut & capped - 3 Av W between Blaine &Galer is on 2" temporary.
E ST
3RD AVE W
4TH AVE W

Queen Anne 530z Pressures



Tracking Watermain Progress

- Fire Department coordination
  - Access issues
    - Project wrapped around their station
  - Temporary protocols
    - SPU notified of all fire dispatches
    - SFD notified of fire flow issues
  - General updates
    - They can help with neighborhood outreach

Customer Service

- Traffic disruption, noise
- Water service interruption
- Anticipated water quality impacts due to flow reversals & flushing activities

Public Outreach

- Outside PR firm hired
  - Community meetings
  - Mailings
  - School field trips
  - Neighborhood newspapers
- Worked with SPU operations, engineering, PIO staff, & contractors to develop materials

Public Outreach

Standpipe

Standpipe

Booster Pump Station

- "Pump station in a can" was a first for SPU
- One lesson learned
  - Specified pumps were rated for irrigation duty, not for 24/7 water supply

SCADA

- Field work
  - New pressure, flow & level sensors
  - New pumps, controls & station data
  - Electrical, communications, RTUs / PLCs
- SCADA database
  - Delete old I/O points
  - Add new I/O points
  - Control schemes programmed according to concept of operation

COMMISSIONING

SCADA

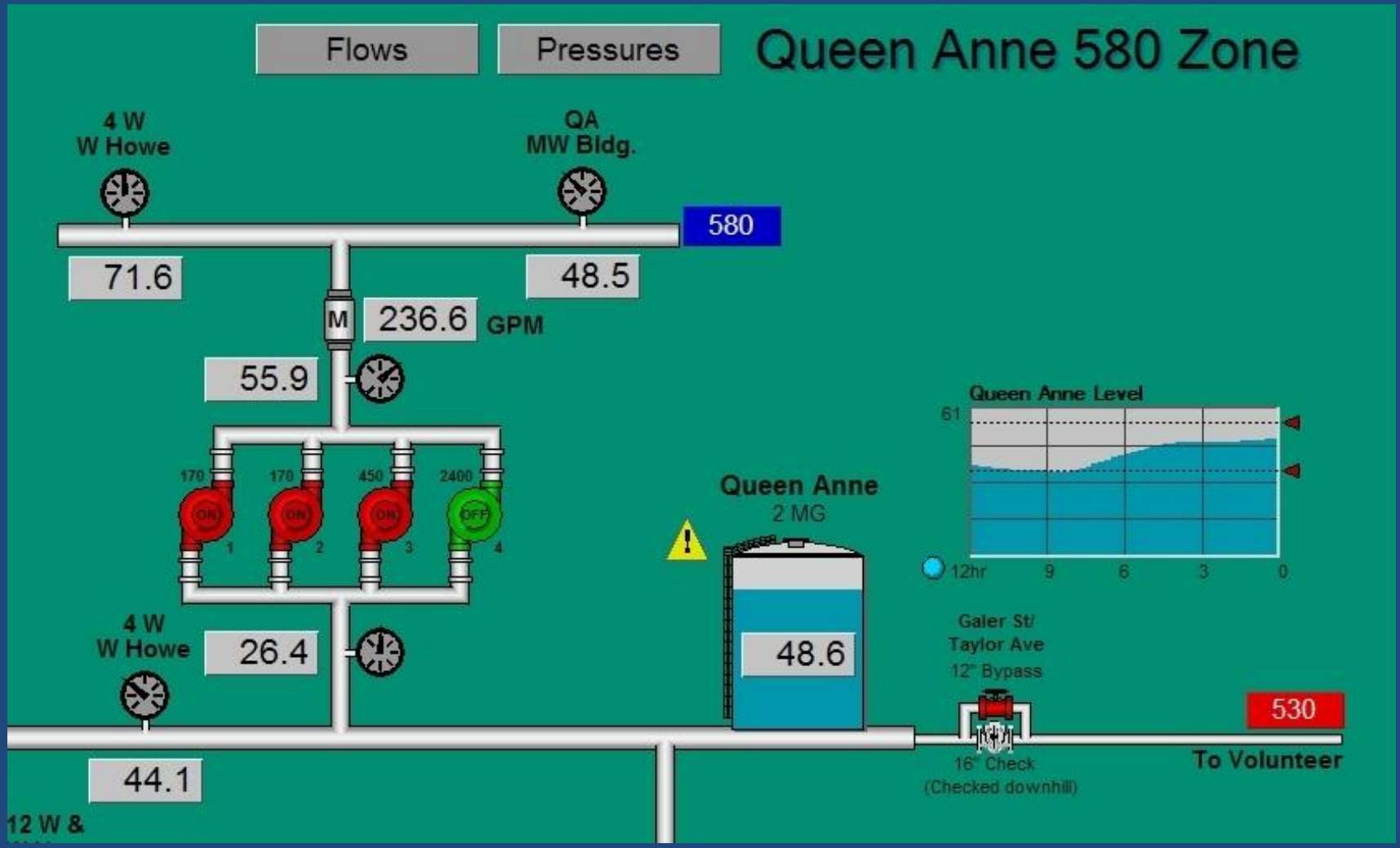
- Graphics/HMI
  - What data to display
  - I/O points directed correctly

- Needs to be done first
  - How do you know when to stop filling if you don't have level information?

Tabular Data Display

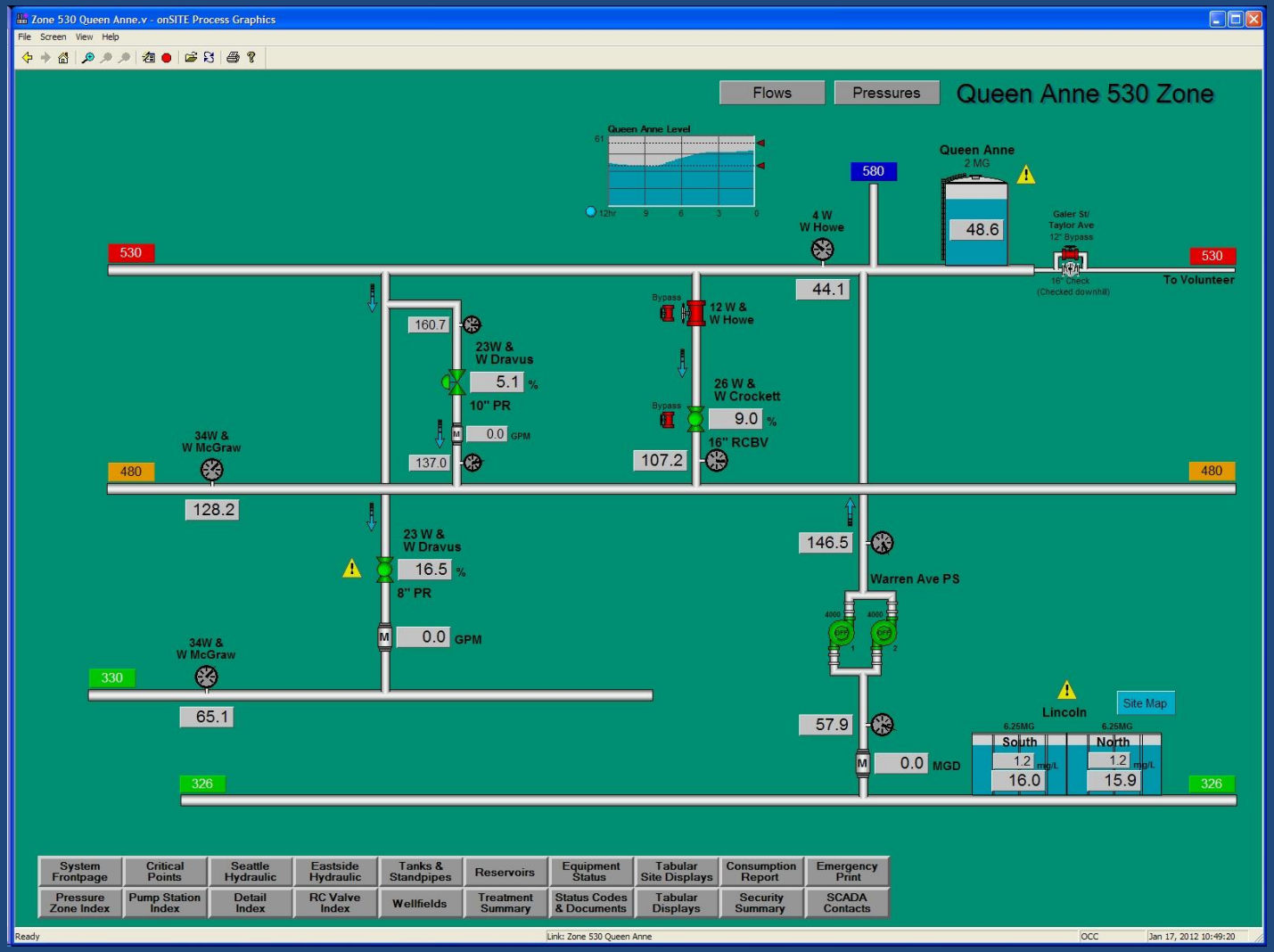
	Tag	Description	Remote Tag	INPUT	Output	UNITS	State	Minimum	Maximum	ALARM	LABEL0	LABEL1
1	QA_PS_SUCTION_PSI	Queen Anne PS Suction Pressure			26.38	PSI		0.00	160.00			
2	QA_PS_DISCH_PSI	Queen Anne PS Discharge Pressure			52.63	PSI		0.00	160.00			
3	QA_PS_FLOW	Queen Anne PS Outlet Flow			199.20	GPM		0.00	5000.00			
4	QA_PS_P1_LOR_REMOTE	Queen Anne PS P1 LOR Switch			1.00		Remote				Not Remote	Remote
5	QA_PS_P1_RUN	Queen Anne PS P1 Variable Freq. Drv. Running			1.00		Running				Not Running	Running
6	QA_PS_P1_VFD_FAIL	Queen Anne PS P1 Variable Freq. Drv. Failed			0.00		Not Failed				Not Failed	Failed
7	QA_PS_P2_LOR_REMOTE	Queen Anne PS P2 LOR Switch			1.00		Remote				Not Remote	Remote
8	QA_PS_P2_RUN	Queen Anne PS P2 Variable Freq. Drv. Running			1.00		Running				Not Running	Running
9	QA_PS_P2_VFD_FAIL	Queen Anne PS P2 Variable Frequency Drive			0.00		Not Failed				Not Failed	Failed
10	QA_PS_P3_LOR_REMOTE	Queen Anne PS P3 LOR Switch			0.00		Not Remote				Not Remote	Remote
11	QA_PS_P3_RUN	Queen Anne PS P3 Variable Freq. Drv. Running			0.00		Not Running				Not Running	Running
12	QA_PS_P3_VFD_FAIL	Queen Anne PS P3 Variable Freq. Drv. Failed			0.00		Not Failed				Not Failed	Failed
13	QA_PS_P4_LOR_REMOTE	Queen Anne PS P4 LOR Switch			1.00		Remote				Not Remote	Remote
14	QA_PS_P4_RUN	Queen Anne PS P4 Reduced Voltage Starter Running			0.00		Not Running				Not Running	Running
15	QA_PS_P4_RVS_FAIL	Queen Anne PS P4 Reduced Voltage Starter Failed			0.00		Not Failed				Not Failed	Failed
16	QA_PS_RELIEF_V_CLOSED	Queen Anne PS Pressure Relief Valve			1.00		Closed				Not Closed	Closed
17	QA_PS_FLOOD_ALM	Queen Anne PS Flood Switch			1.00		No Flood				Flood	No Flood
18	QA_PS_SMOKE_ALM	Queen Anne PS Smoke Alarm			1.00		No Smoke				Smoke	No Smoke
19	QA_PS_TEMP_ALM	Queen Anne PS High Temperature Alarm			1.00		Normal				High Temp	Normal
20	QA_PS_VAULT_HATCH	Queen Anne PS Vault Hatch Switch			0.00		Open			Alarm	Open	Closed
21	QA_PS_INTRU_DET	Queen Anne PS Intrusion Switch			0.00		Enabled				Enabled	Disabled
22	QA_PS_PHASE_FAIL_ALM	Queen Anne PS Phase Fail Alarm			0.00		Normal				Normal	Fail
23	QA_PS_INTRU_ALM	Vault Security Status			1.00		Intrusion alarm			Alarm	Normal	Intrusion alarm
24	QA_PS_DISCH_PSI_H	QA PS Discharge pressure history		53	51.94							
25	QA_PS_FLOW_H	QA PS discharge flow rate history		199	206.04							
26	QA_PS_P1_CAPACITY	Pump #1 capacity			170.00	GPM		0.00	9000.00			
27	QA_PS_P2_CAPACITY	Pump #2 capacity			170.00	GPM		0.00	9000.00			
28	QA_PS_P3_CAPACITY	Pump #3 capacity			450.00	GPM		0.00	9000.00			
29	QA_PS_P4_CAPACITY	Pump #4 capacity			2400.00	GPM		0.00	9000.00			
30	QA_PS_SUCTION_PSI_H	QA PS Suction pressure history		26	26.38							

Graphic Display

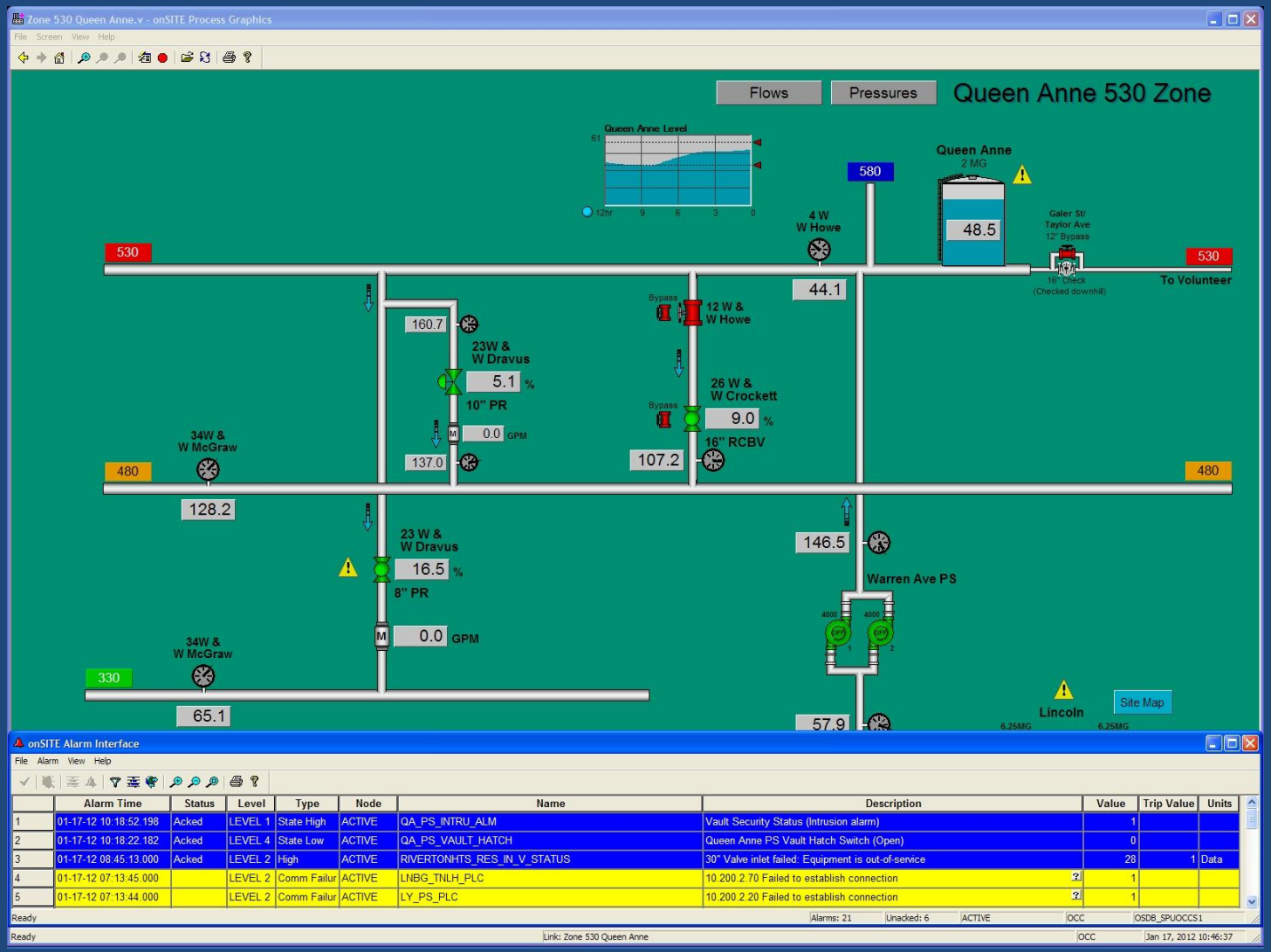


Pressure & Flow Trend Display

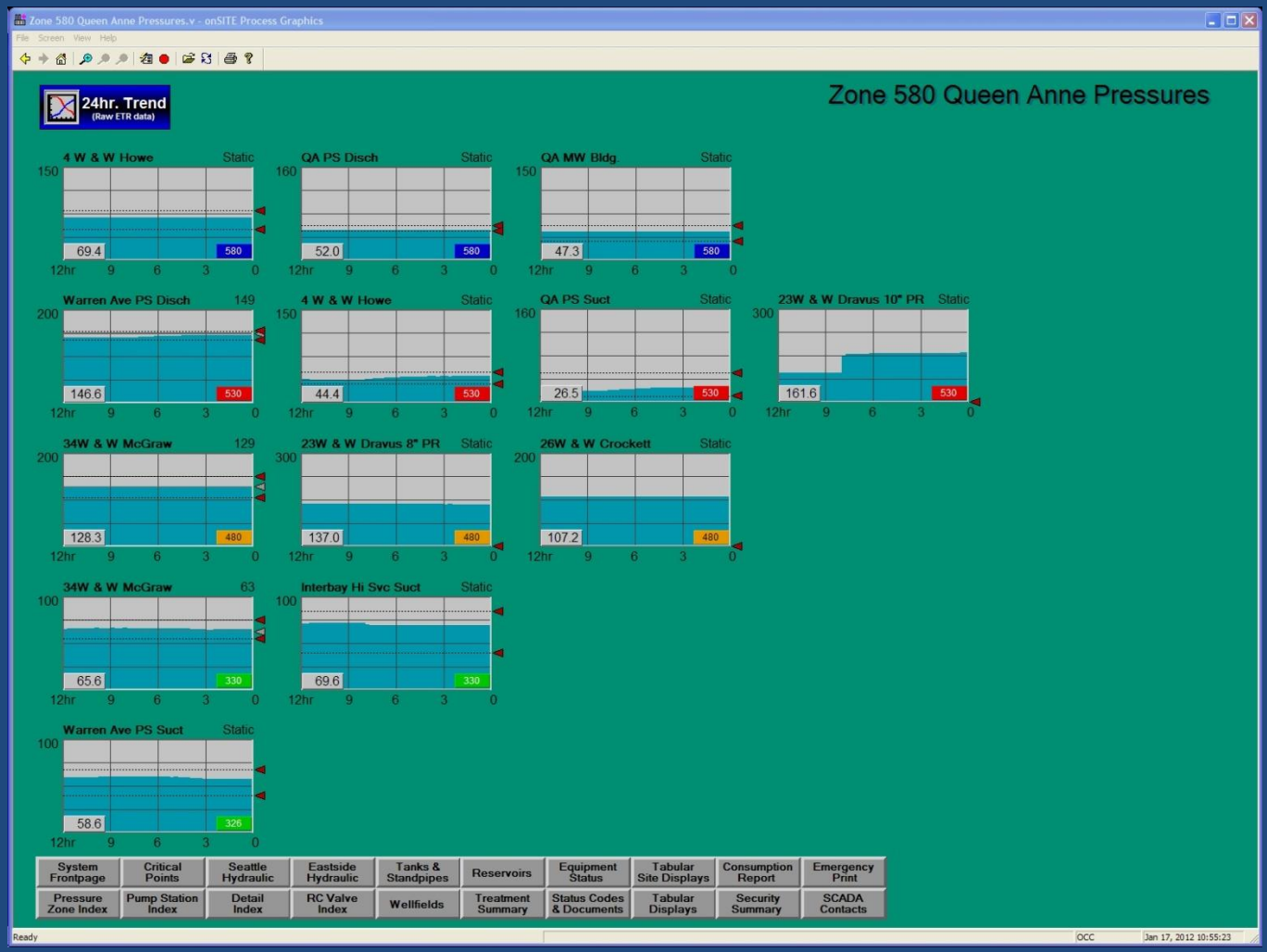
Queen Anne-Magnolia Overview



Same Screen With Alarm Display



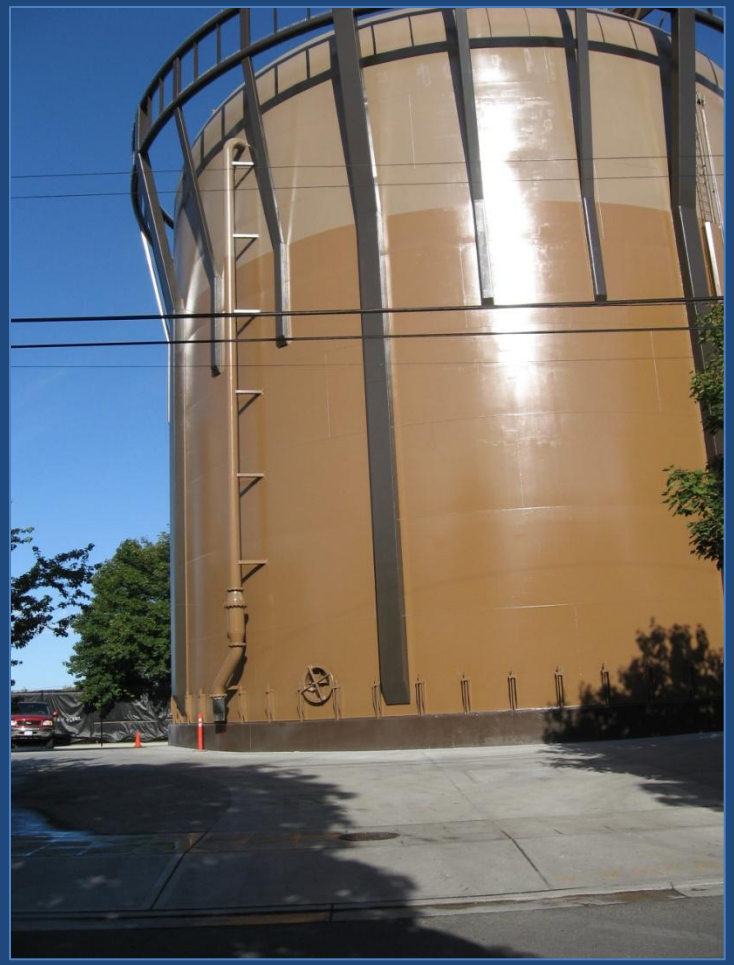
12-Hour Pressure Trends



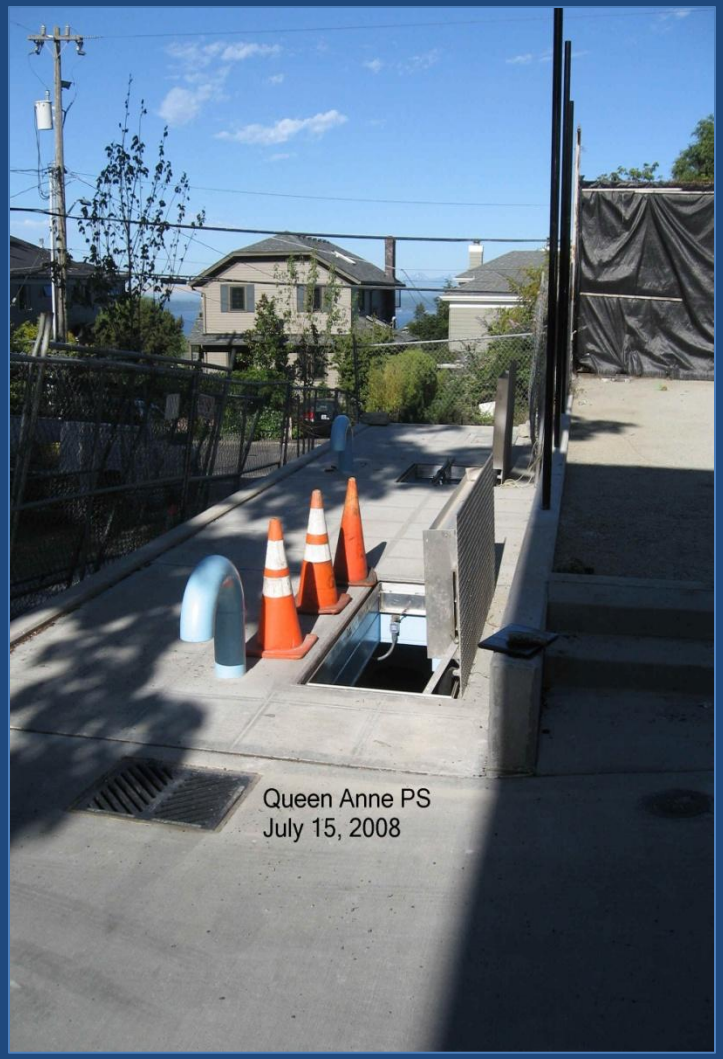
Watermains

- Pressure & bacti tests
- Valves & check valves tested
- All district valves left open

Standpipe



Pump Station

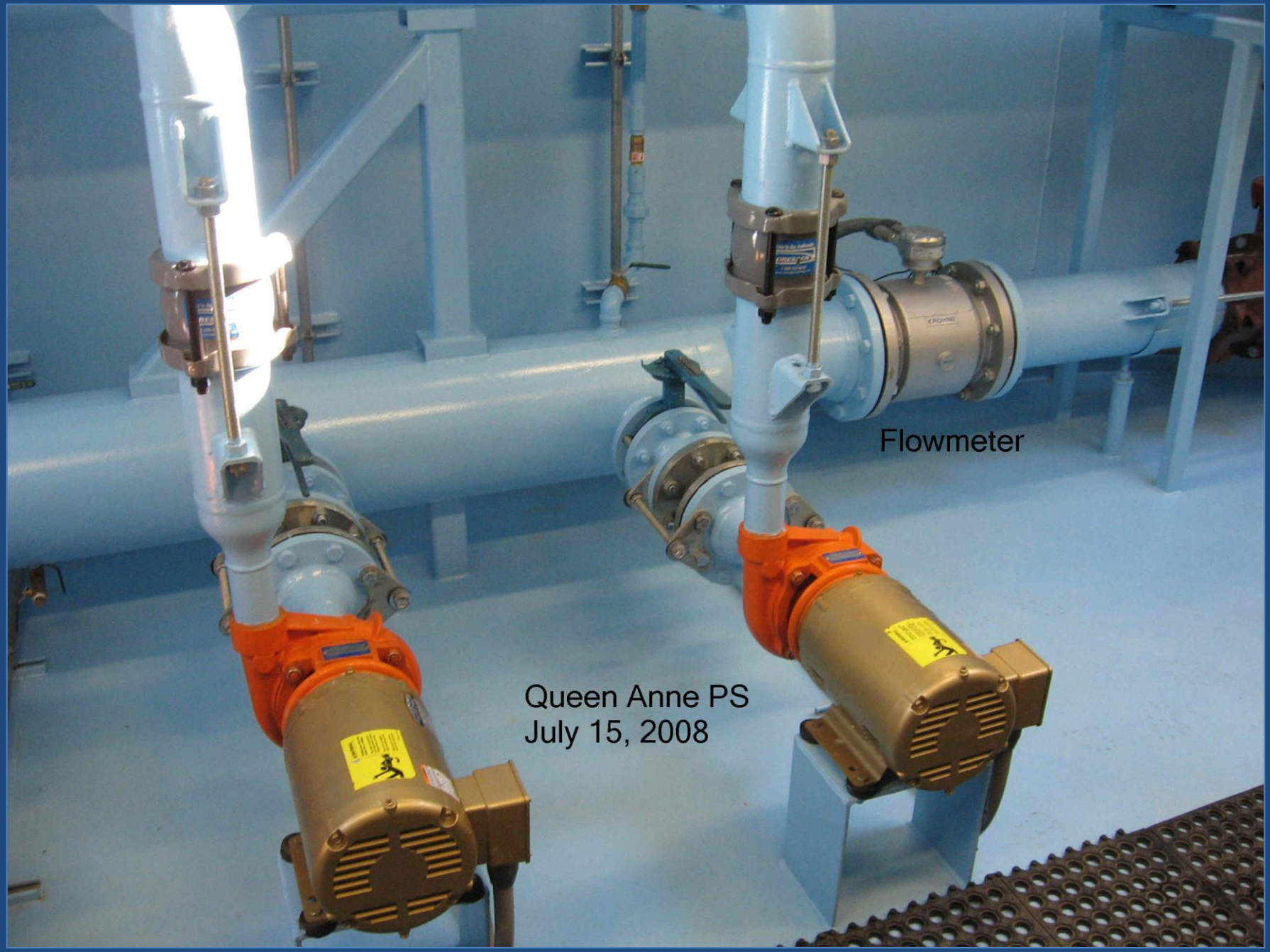


- System testing
- Acceptance testing
- Shut station down when testing completed
  - Need to coordinate when new zone will be activated


Queen Anne PS
July 15, 2008

7-Day System Testing

- Uses water or other process media to simulate actual conditions
- Manual & automatic modes
  - proper control sequences
  - interlocks
  - software logic & controllers
- Pumps fought each other, needed tweaking
- Tripped off line for unknown reasons

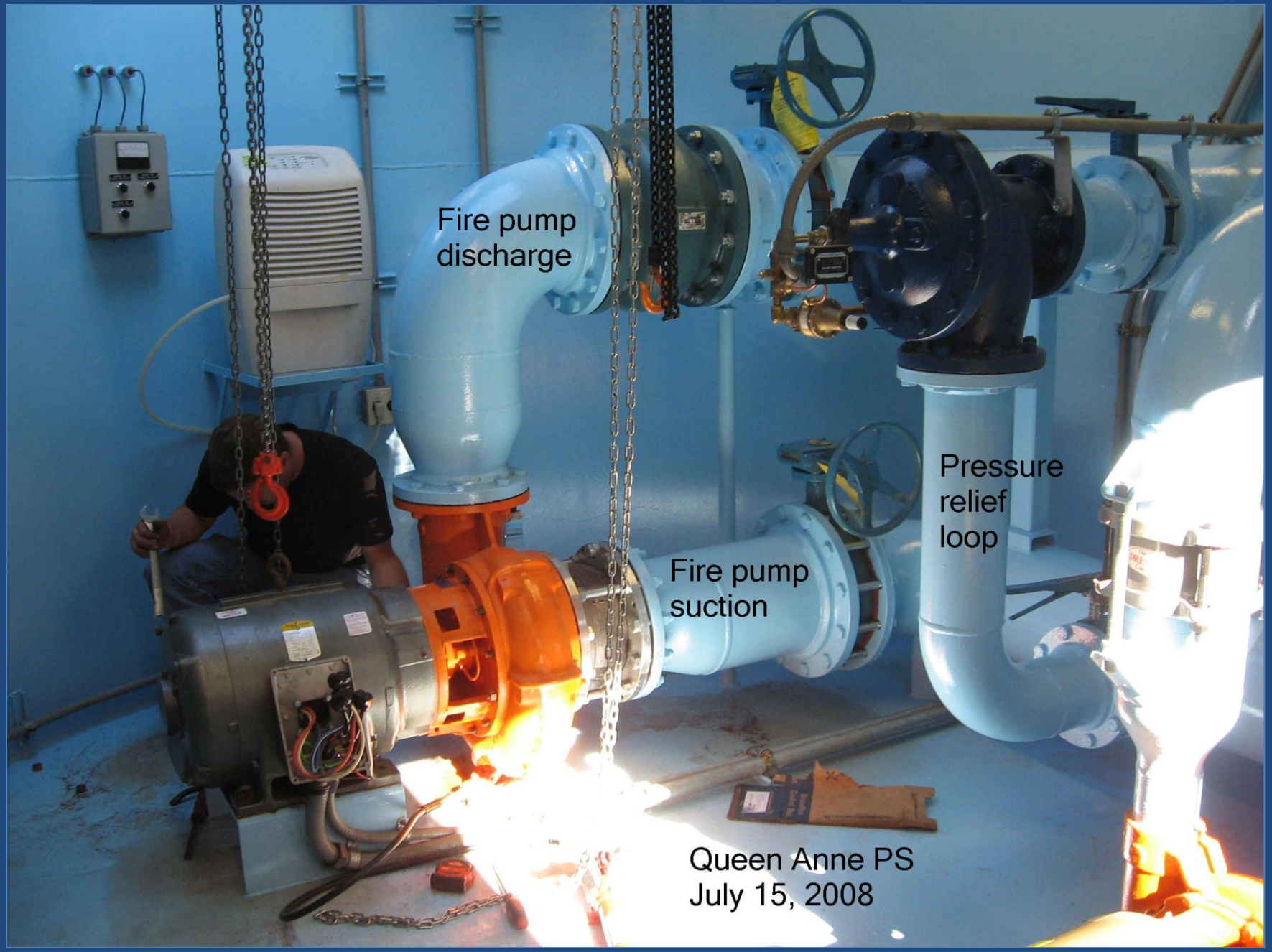

Flowmeter
Queen Anne PS
July 15, 2008

8-Day Acceptance Testing

- Continuous operation at rates directed by owner
- All other testing successfully completed
- Any malfunction resets the clock to zero
- Equipment lubed & maintained during test
- Strainers, filters, screens cleaned or replaced

8-Day Acceptance Testing

- Fire flow test required artificial demand
- Constraints
  - Tuberculated pipe
  - Poor combined sewers
  - Steep hills
- Needed the right combination of clean pipe & adequate drainage


Fire pump
discharge
Pressure
relief
loop
Fire pump
suction
Queen Anne PS
July 15, 2008

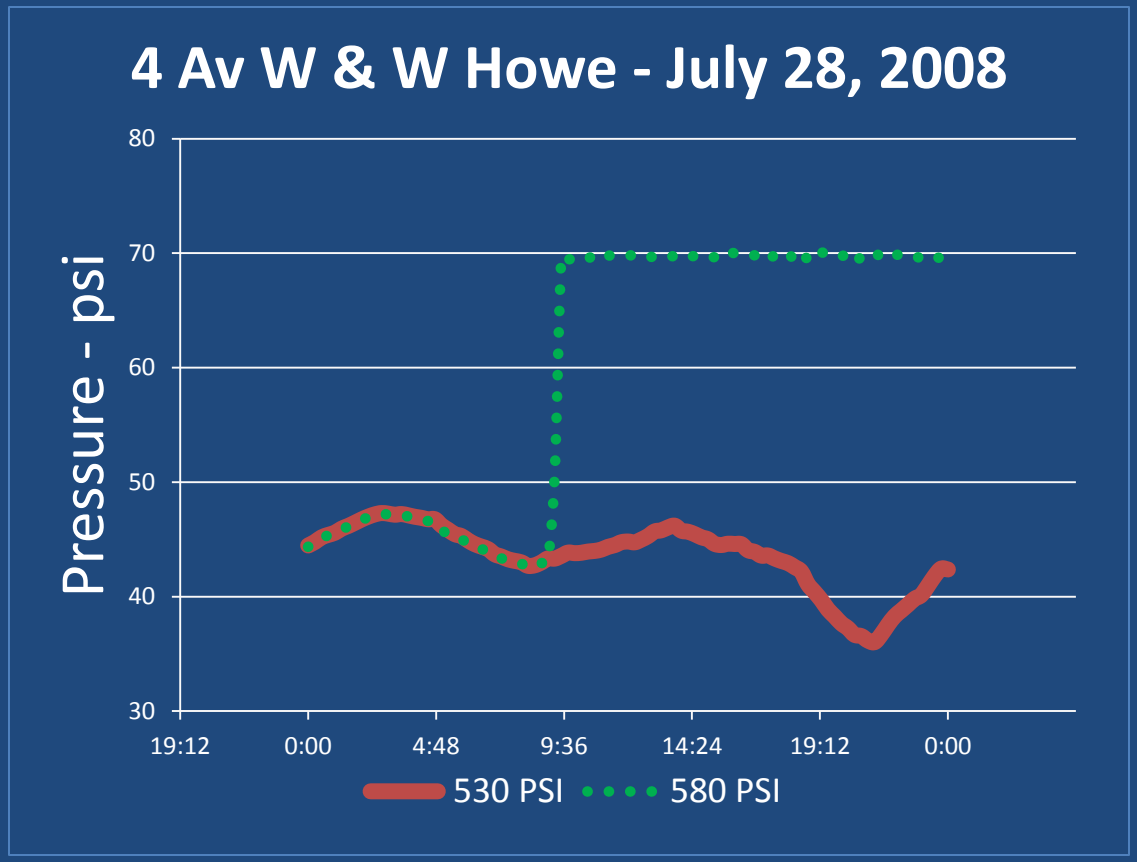
Plan To Isolate The New Zone

- District valves
  - Double-check against maps
    - Verify all the connections between zones are located; many weren't
  - Re-exercise valves
    - Tubercules re-formed in last 9 months
  - Close, verify no leak-by
    - They are 80-100 years old

Plan To Isolate The New Zone

- Valve verification is slow process
  - Can't leave valves closed overnight
- Isolated in stages
  - Current maps critical
    - Fire flows change as valves are closed
    - Flow reversals generate WQ complaints
    - Did we get them all?

Start Up



- Notify customers
- Monitor flow & psi
  - Do they match model?

Lessons Learned

- Risks successfully managed by engineering, operations & management staff working together
  - Bring operating staff in very early in project
- Measure 3 or 4 times, cut once
- Stay on top of work
  - If you get behind, it can snowball

Lessons Learned

- Communications strategies are key
  - Contractors
  - Design engineers
  - Other agencies
  - Your own crews
  - Executives
  - Public

Questions?

Cheryl Capron, Seattle Public Utilities

206.386.1265

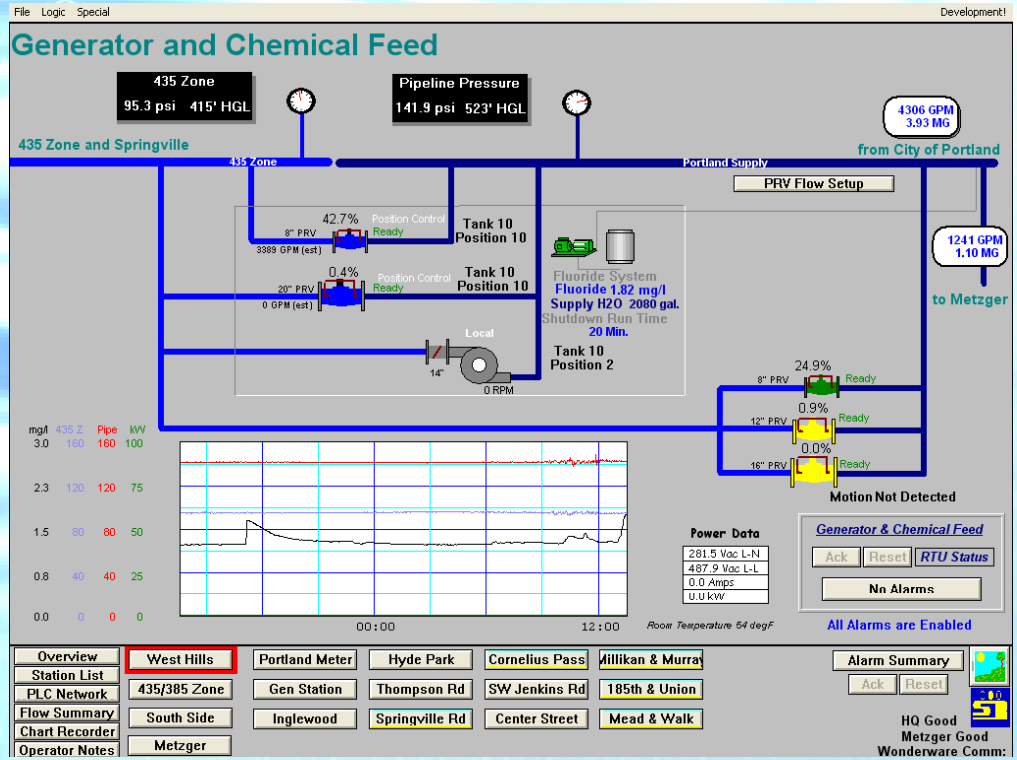
cheryl.capron@seattle.gov

Tualatin Valley Water District

TVWD SCADA Upgrades to Optimize Operations

Overcoming 20 Years of "We've Always Done It That Way"

PNWS-AWWA
Pre-Conference Seminar
May 2, 2012



Tualatin Valley Water District

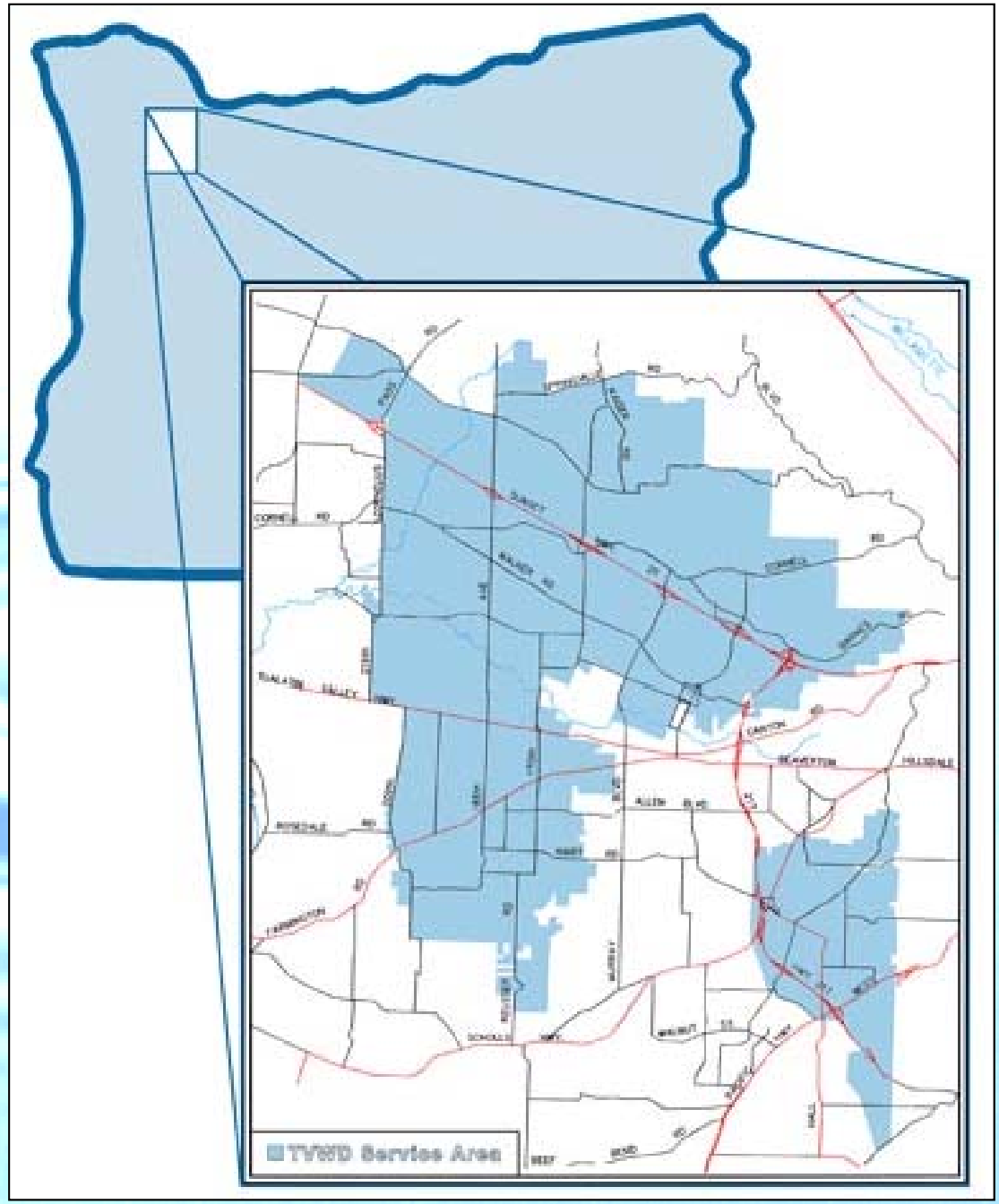
Presentation Overview

- About TVWD
- SCADA Upgrade Project
  - Objectives
  - Outcomes
- Conclusions

Tualatin Valley Water District

TVWD Overview

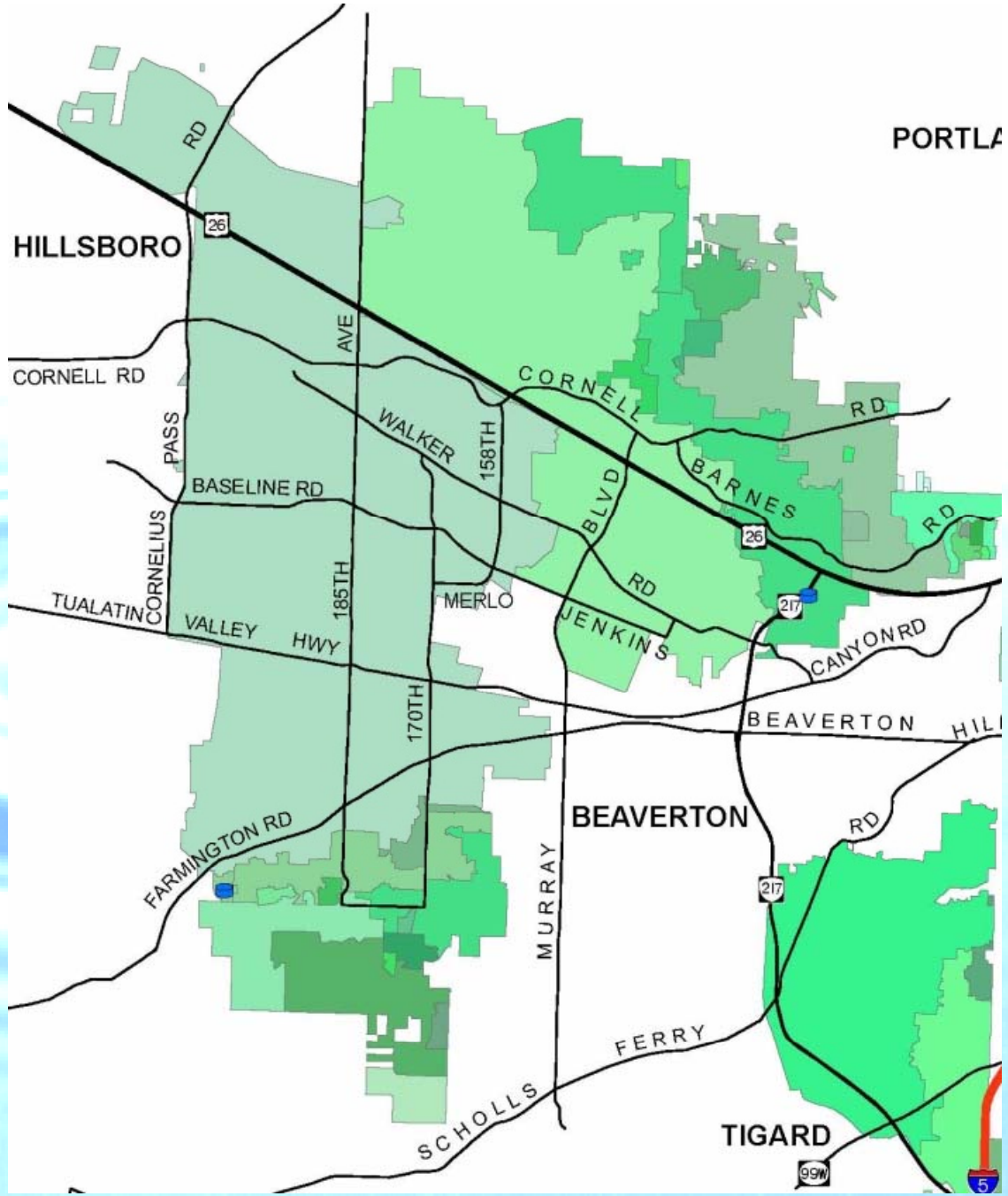
- Unincorporated areas of Washington County and portions of Beaverton, Hillsboro and Tigard
- Second largest water provider in Oregon
  - 200,000 population
  - 57,000 connections
  - 45 square miles
  - 95% residential
  - Industrial, commercial = 25% of demand



Tualatin Valley Water District

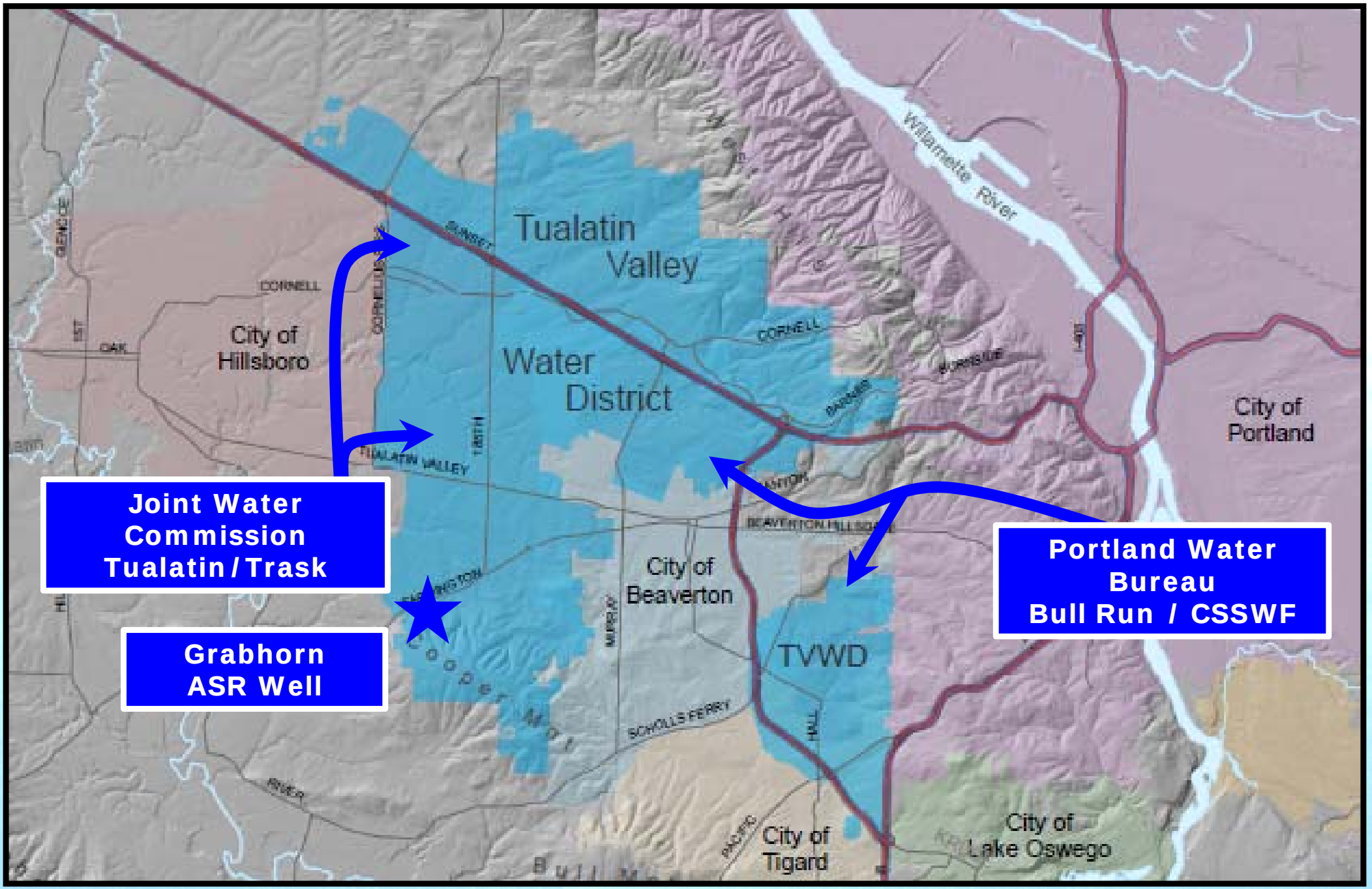
TVWD Overview

- Water system:
  - 24 reservoirs
  - 65 MG storage
  - 12 pump stations
  - 23 pressure zones
  - 760 miles of pipelines
- 2010 demands:
  - ADD: 21 MGD
  - MDD: 40 MGD



Tualatin Valley Water District

TVWD Supplies



Supply Challenges & Opportunities

- Portland Water Bureau – Base Supply
  - Supply owned by Portland Water Bureau
  - 10-year agreement between TVWD and PWB
  - Minimum purchase of 13.2 MGD (not negotiable)
  - Peak 3-day and peak season peaking factors
  - 5-year residual impact of "excess peaking factors"
  - Rate:
    - 2010-11: $0.844 / ccf

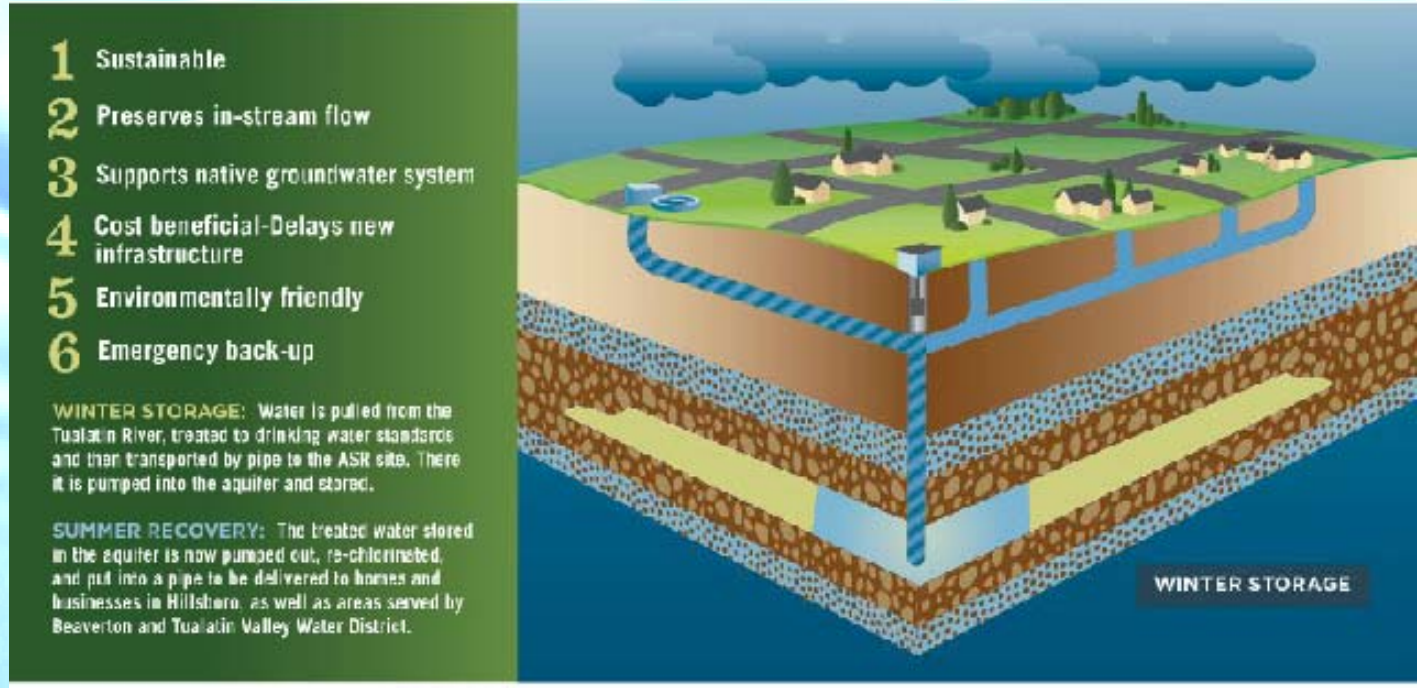
Supply Challenges & Opportunities

- Joint Water Commission Supply
  - Ownership agreement between TVWD & Cities of Beaverton, Forest Grove & Hillsboro
  - TVWD ownership capacity = 12.5 MGD
  - Rates:
    - 2010-11: $0.372 / ccf

Tualatin Valley Water District

Supply Challenges & Opportunities

- Aquifer Storage & Recovery (ASR) Supply
  - Owned exclusively by TVWD
  - Injection during winter; recover during summer
  - Recharged with JWC water purchased prior winter
  - Recovery capacity ~ 3 MGD * 100 days (300 MG)
  - Production Cost:
    ~ $0.16 / ccf



Tualatin Valley Water District

SCADA Upgrade Objectives

- Security - SCADA system and business network
  - External & internal threats to system & data security
- Reliability - SCADA system & system operations
  - Hardware, software & communications
  - Staffing & support
- Upgrade crew office & control room
  - Security, technology & space utilization
- Enhance access to data by District staff
  - Ability to generate standard & ad-hoc reports
  - Enhanced operational efficiency
  - Optimized supply operations

Tualatin Valley Water District

Upgrade Project Approach

- Project scoping (2007)
- Consultant selection / award (2009)
- Project implementation (2010-2011)
  - 5-Year Master Plan
  - SCADA Upgrade Design
  - Control Room Upgrade
  - Communications Assessment
- Keep system operational (the whole time)

SCADA Master Plan

- Project Team
  - Westin Engineers
  - HDR Architects
  - S&B Inc / Stead & Associates
  - TVWD –
    - Engineering, Distribution, IT, Buildings & Grounds

Westin HDR Tualatin Valley Water District

SCADA Master Plan

- Five Year Master Plan / SCADA Upgrades
  - Phase 1 Upgrades
    - Upgrade security; new firewall & verification procedures
    - Standardize hardware & configuration
    - Replace computers, MTU & server upgrade
    - Continue use of existing OS
  - Phase 2 Upgrades
    - Replace two legacy RTUs
    - Evaluate replacement of software / OS
  - Phases 3-5
    - Depends on replacement of software / OS

Tualatin Valley Water District

SCADA Communications

- Evaluate options to existing analog leased-line
  - Seismic / emergency reliability
  - Bandwidth
  - Cost; capital and O&M
- Options:
  - Leased Line
    - Analog
    - DSL
    - Frame Relay
    - T1
  - Private Wireless (radio)
    - 900 MHz Unlicensed Spread Spectrum
    - Licensed Radio (VHF, UHF, 900 MHz)
  - Cellular
    - Sprint & Verizon Options

SCADA Communications

- Alternatives Screening

	Analog	DDS	Frame Relay	DSL	T1
Monthly Service Cost (approx.)	$25 - $75	$140 - $160	$100 - $150	$50 - $90	$220
Equipment Cost (approx.)	$100 - $200	$300 - $500	$500 - $1,000	$100	$500 - $1,000
Bandwidth	1,200 bps-56 Kbps	2,400 bps-56 Kbps	56 Kbps–1.5 Mbps	1.5 Mbps	1.5 Mbps
Equipment Type	Analog Modem	CSU/DSU	FRAD or Router	DSL Modem	Router
Latency	Low	Low	Low	Low	Low

	Licensed VHF	Licensed UHF	Licensed 900 MHz	900 MHz Spread Spectrum
Transmit Power	20-50 watts	2-75 watts	5 watts	1 watt
laximum Data Rate	19.2 Kbps	38.4 Kbps	38.4 Kbps	1 Mbps
Range	High	Medium	Low	Low
pact of Obstructions	Low	Medium	High	High
pport for Report-by-Exception?	Yes, but with a limited number of manufacturers.	Yes, but with a limited number of manufacturers.	Yes, but with a limited number of manufacturers.	Yes
port for Peer-to-Peer?	Yes, but with a limited number of manufacturers.	Yes, but with a limited number of manufacturers.	Yes, but with a limited number of manufacturers.	Yes
C License Required	Yes	Yes	Yes	No
Interference	Licensed on secondary basis to public safety users.	Licensed on secondary basis to public safety users.	Exclusive use in 90-mile radius.	No limit to the number of users. Technology designed to support multiple users.
hannel Availability	Limited in urban areas.	Limited in urban areas.	Limited in urban areas.	Unlimited

- Short List of Options
  - Analog LL, DSL, 900 MHz Spread Spectrum & Cellular

Tualatin Valley Water District

SCADA Communications

	Analog Leased Lines	DSL	900 MHz Spread Spectrum	Cellular
Equipment & Parts Cost/Site	$100 - $200	$100	$9,425	$1,500
Recurring Cost/Site	$12 - $75	$50 - $90	$0	$10
Installation Cost/Site	$200	$100	$9,550	$800
System Life-Cycle Cost	$191,426	$279,939	$740,070	$119,645

- DSL: increased bw, reliability unchanged, added cost
- 900 MHz: increased bw, better reliability*, significant cost
- Cellular: same bw*, reliability unchanged, same cost
- No change at this time - revisit if changes in:
  - Leased line obsolescence / support
  - Cost of technology

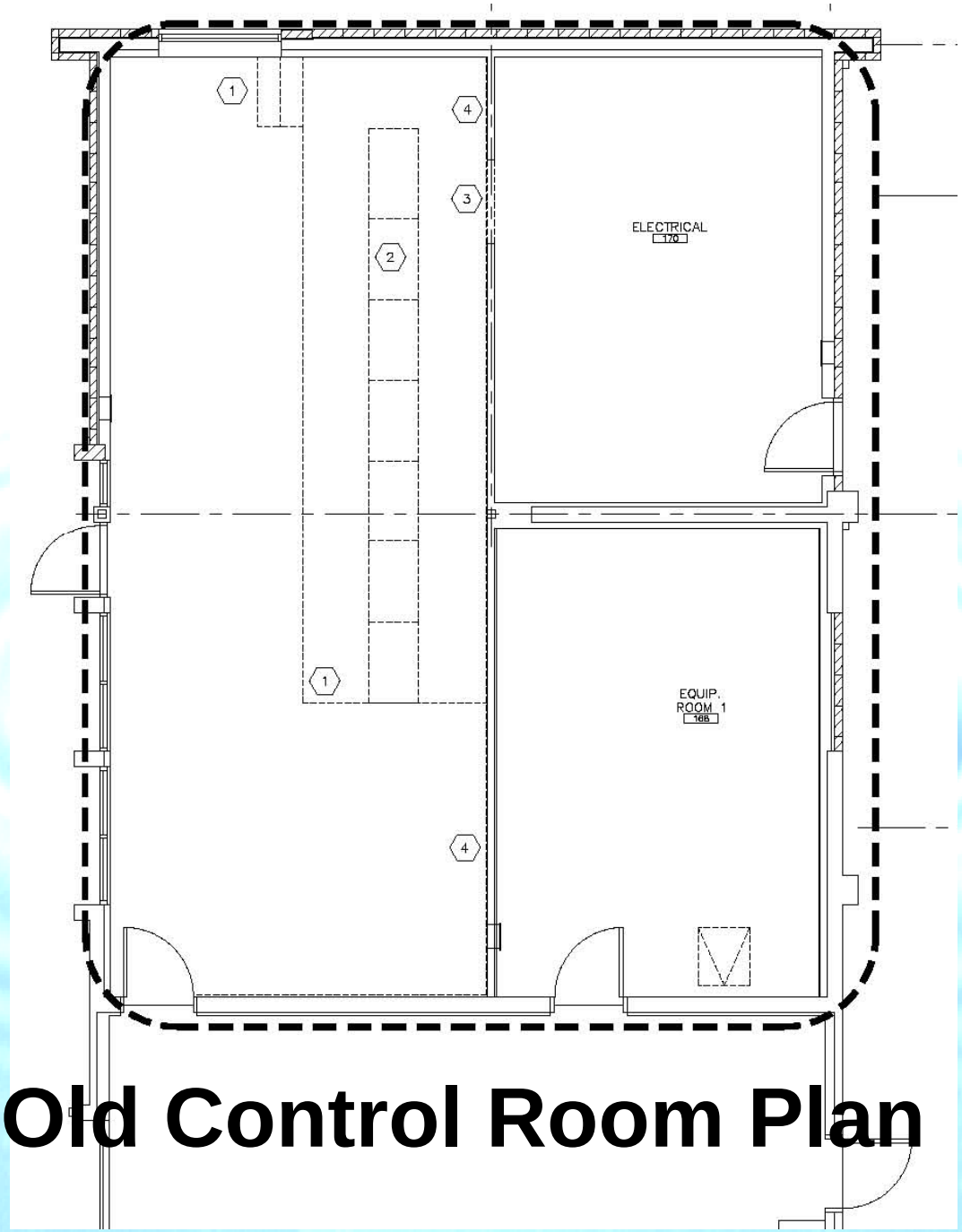
Tualatin Valley Water District

Control Room Upgrade

- Objectives
  - Enhance utilization of existing space; fit in existing bldg
  - Improve ventilation / reliability of Server Room
  - Improve security, fire protection & safety
- Staff participation in space planning
- Key Improvements
  - Eliminate existing control panels, recorders & raised floor
  - Create new, secure Control Room and office space
  - Improved security, lighting, ventilation, traffic flow
- Buildings & Grounds construction oversight

Tualatin Valley Water District

Control Room Upgrade

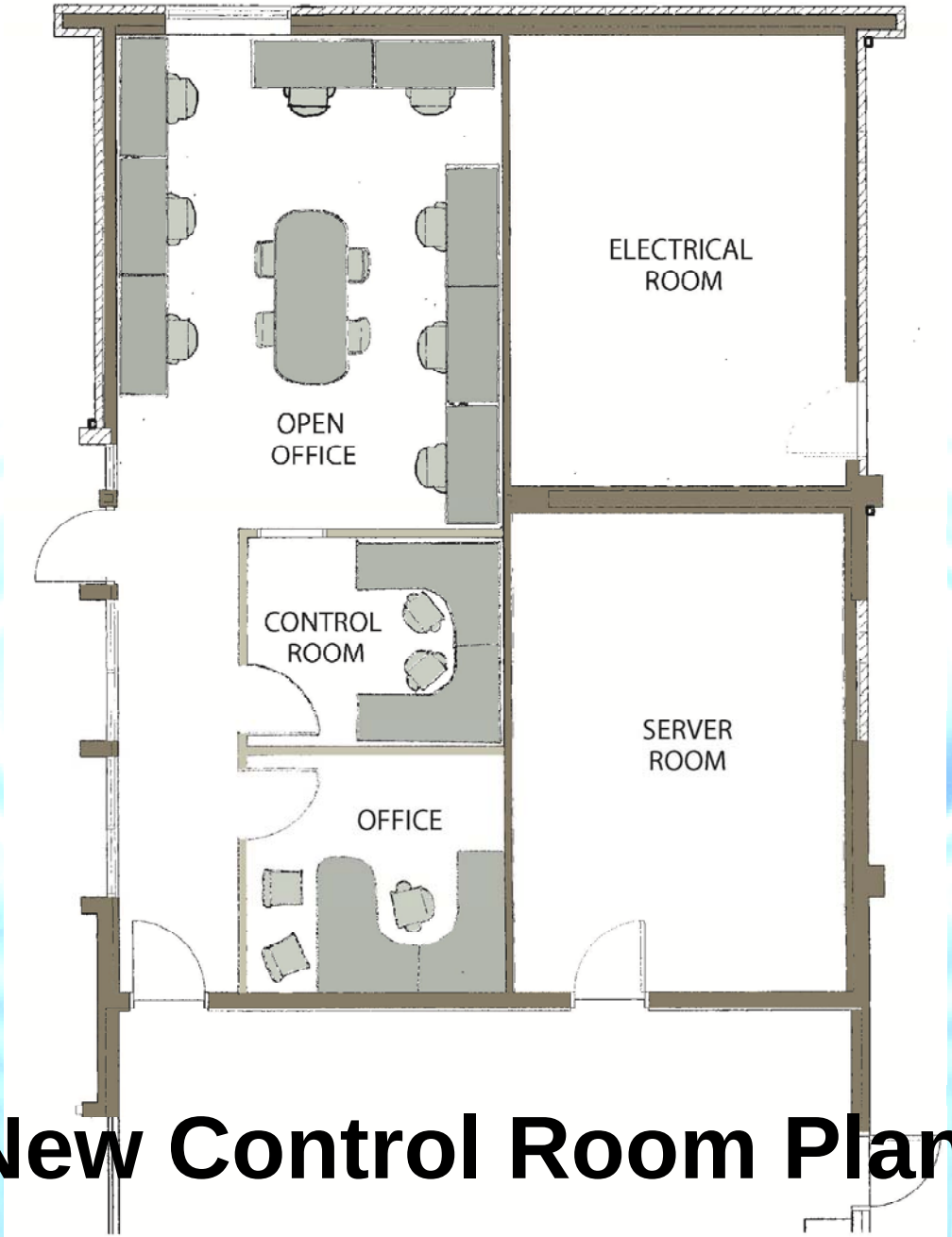


Old Control Room Plan


BAY 5
BAY 6
PUSH-INS
Before
11.04.2010

Tualatin Valley Water District

Control Room Upgrade



New Control Room Plan

Tualatin Valley Water District

SCADA & Control Room

Tualatin Valley Water District

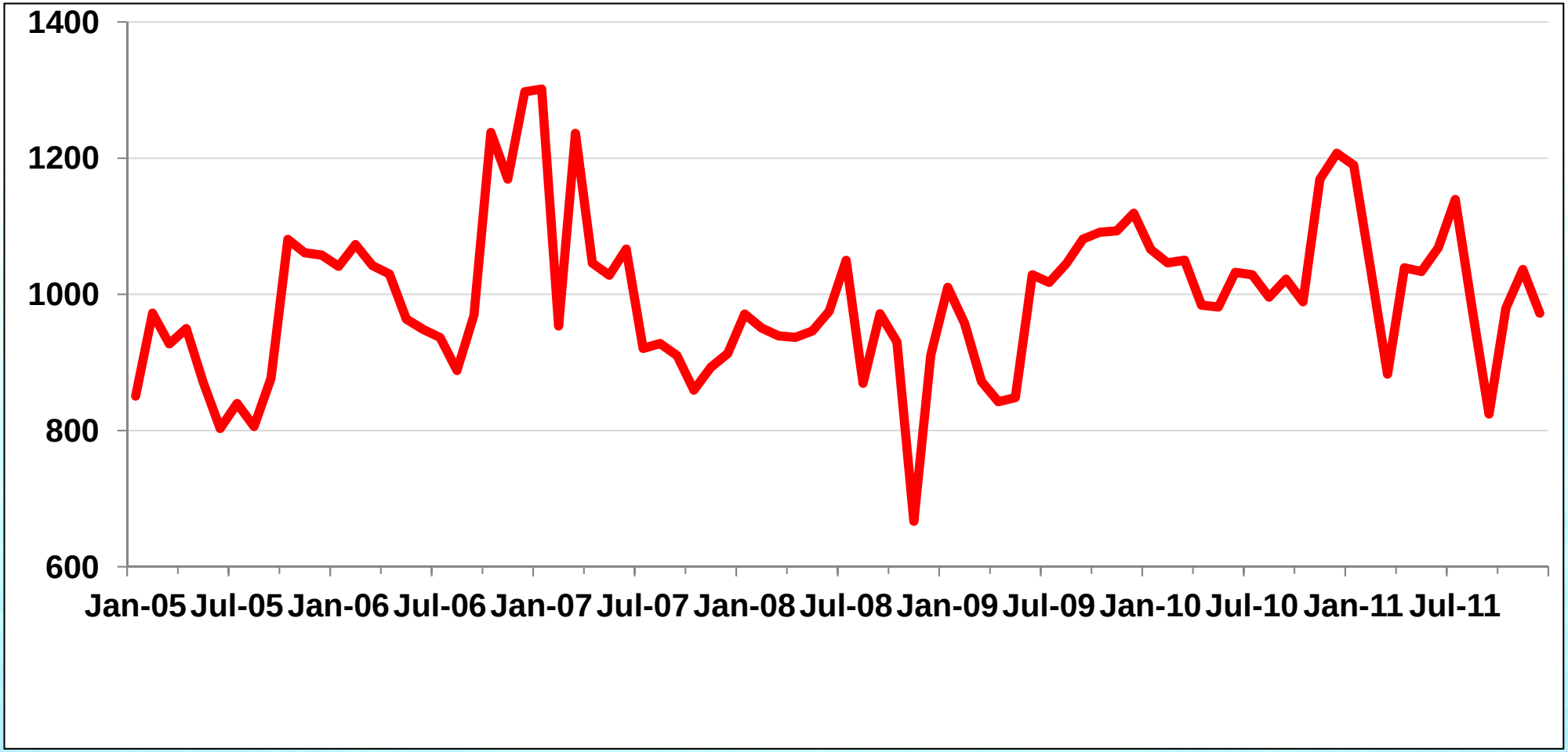
SCADA & Control Room

Tualatin Valley Water District

SCADA & Control Room

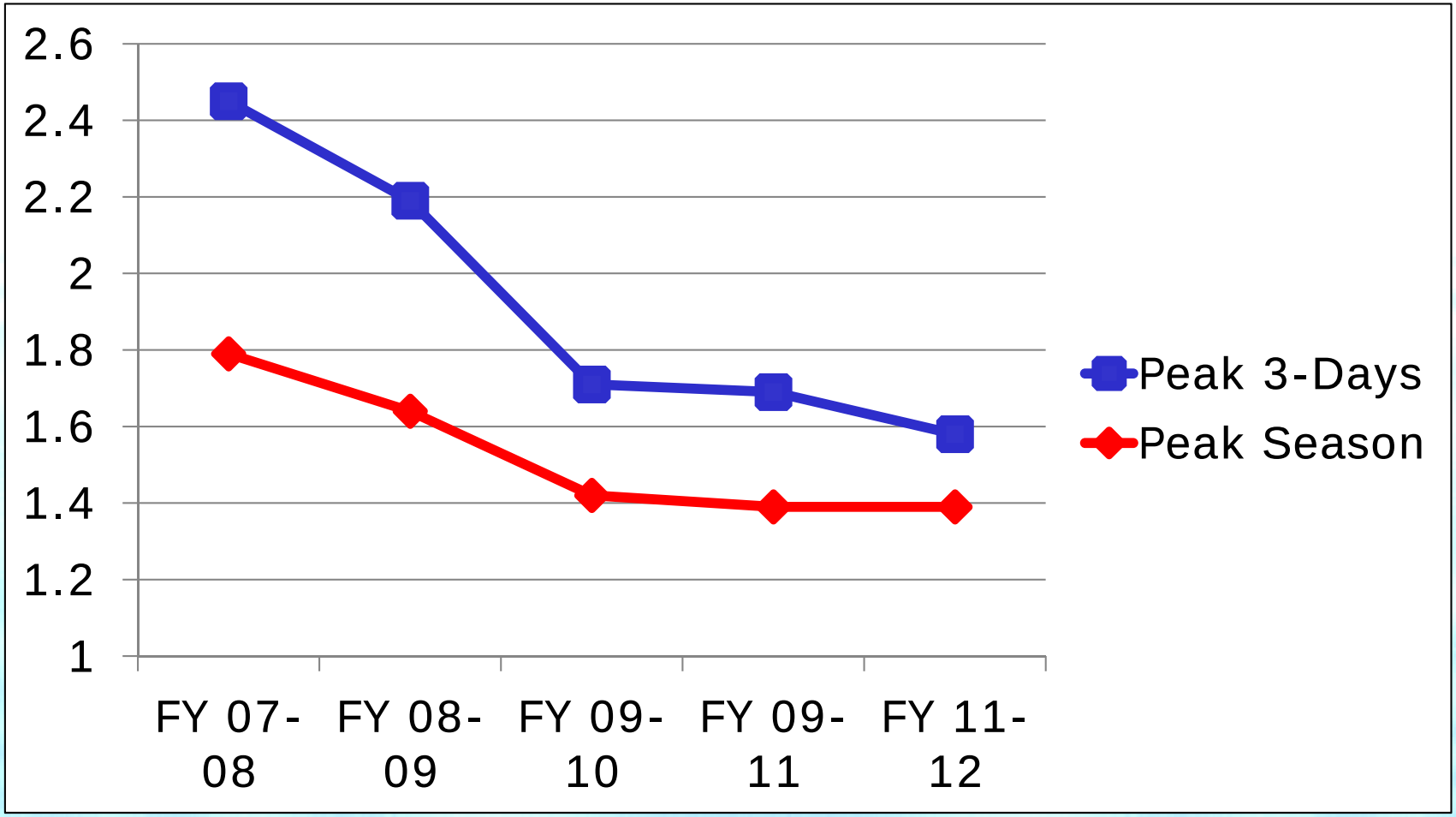
- Pumping Energy Efficiency

  kWh / MGD for 5 largest pump stations



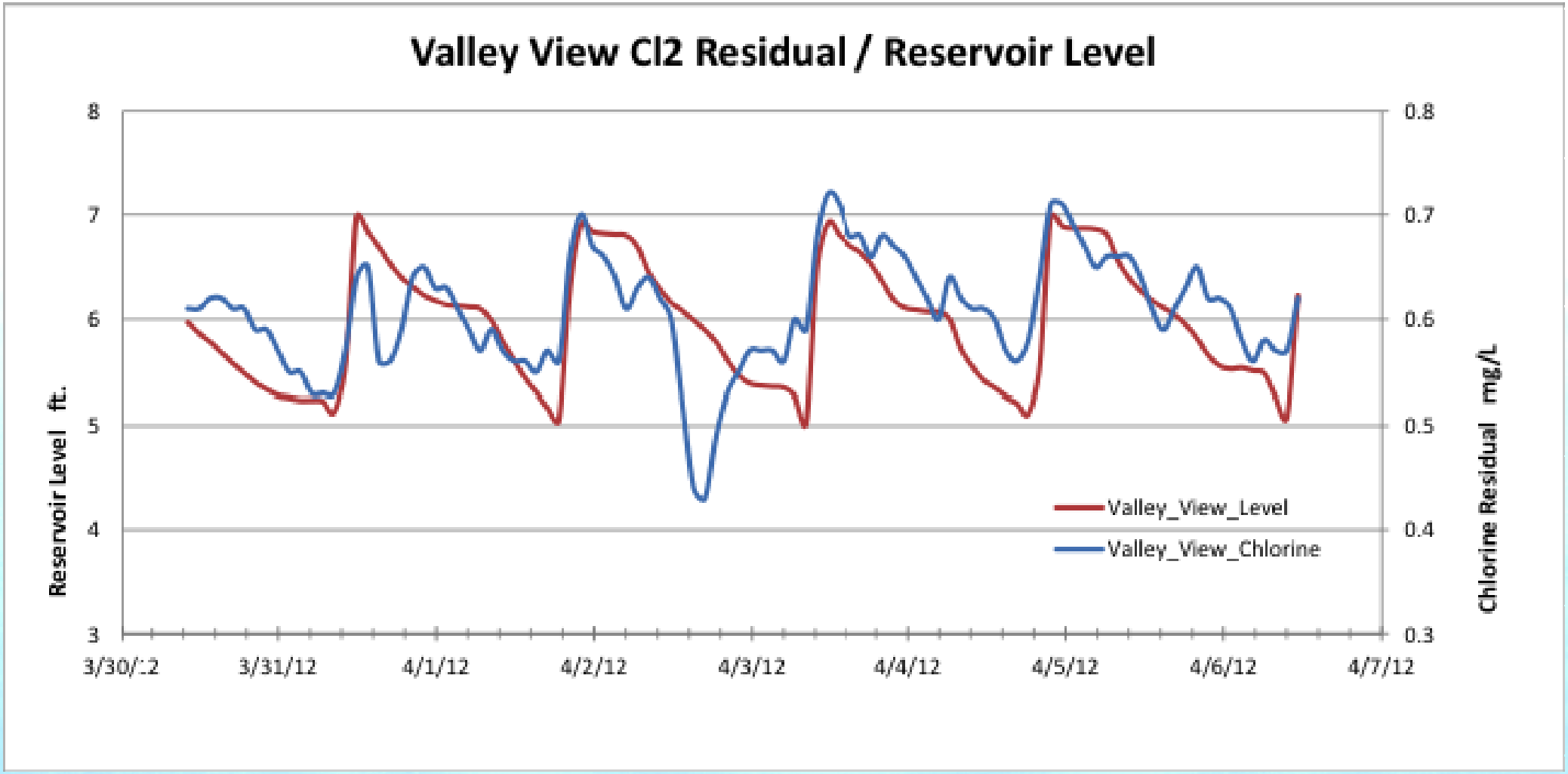
Water System Operations

- Portland Peaking Factors



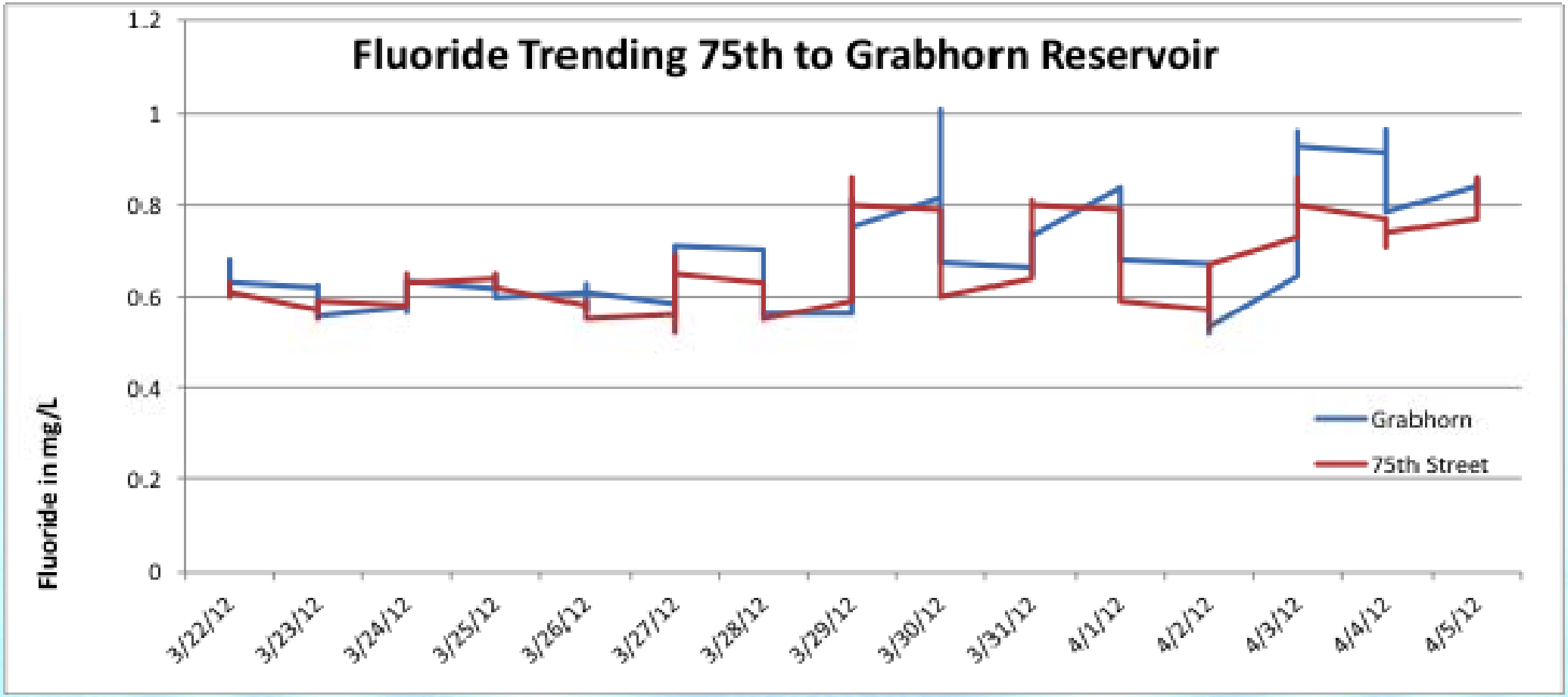
Water System Operations

- Water Quality



The chart above demonstrates the relationship between the fill cycle of the Valley View Reservoir and the chlorine residual.

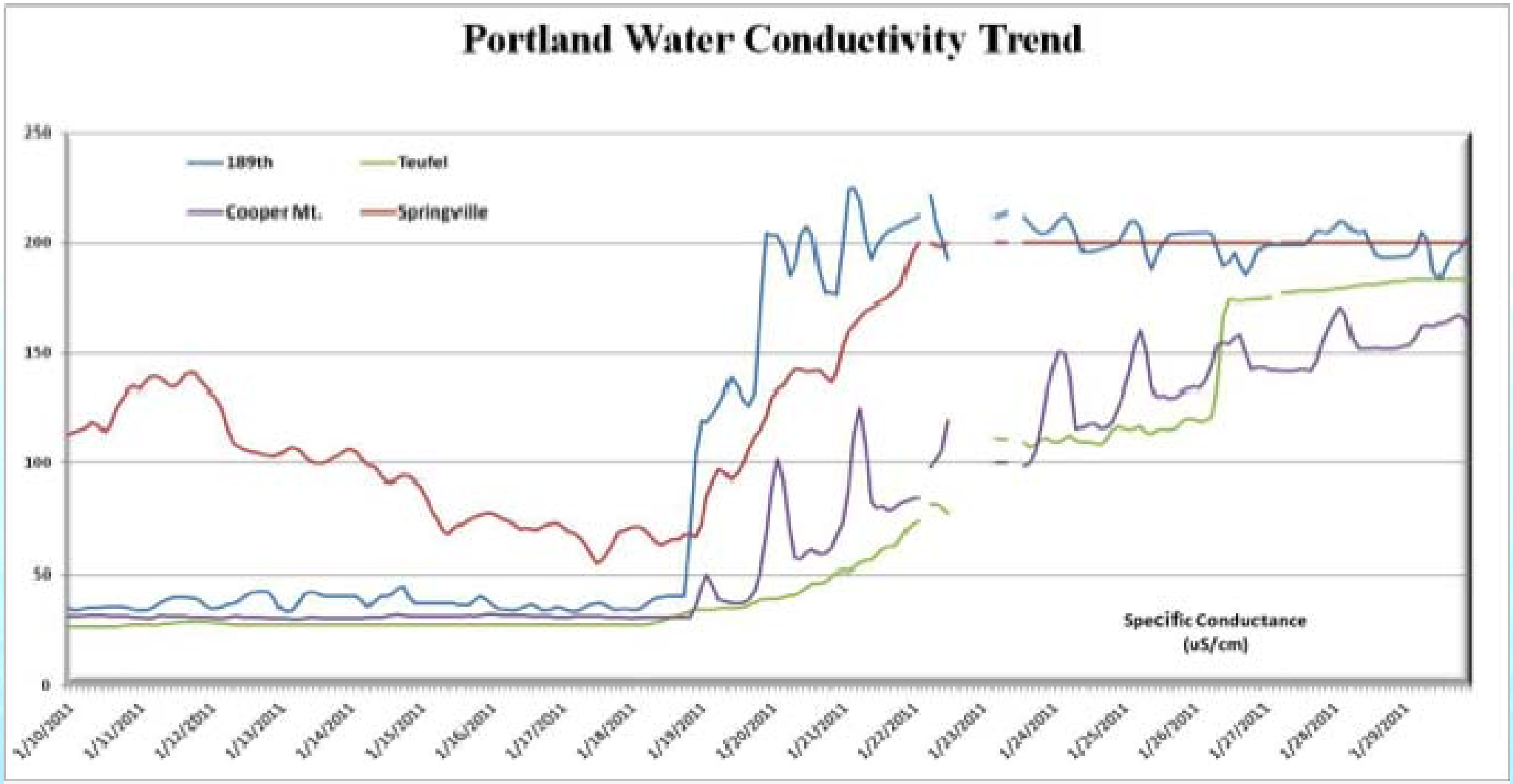
- Water Quality



This chart illustrates the fluoride residual trend from the 75th street fluoride station to the Grabhorn Reservoir. Higher readings at Grabhorn indicate variances in analyzer performance at either site.

Water System Operations

- Water Quality



The data in this graph displays the effects of groundwater on TVWD's distribution system.
The Portland Water Bureau activated wells in the Columbia Southshore Well Field late in the day on 1.16.11.

Conclusions

- Begin with the end in mind
- Multi-discipline team provides key benefits
  - Inside & outside “subject matter experts”
  - Cost savings through collaboration
  - Knowledge & ability to provide ongoing support
- Just because you can doesn’t mean you should
- You can’t always get what you want ...
- Properly equipped and informed staff …
  - Look for opportunities to enhance operations
  - Break down silos to maximize benefits
- Space affects safety, security & culture
  - Happy operators are effective operators

Tualatin Valley Water District

Murray, Smith & Associates, Inc.

READ 'EM AND WEEP:

Decision Path and Implementation of Advanced Metering Infrastructure

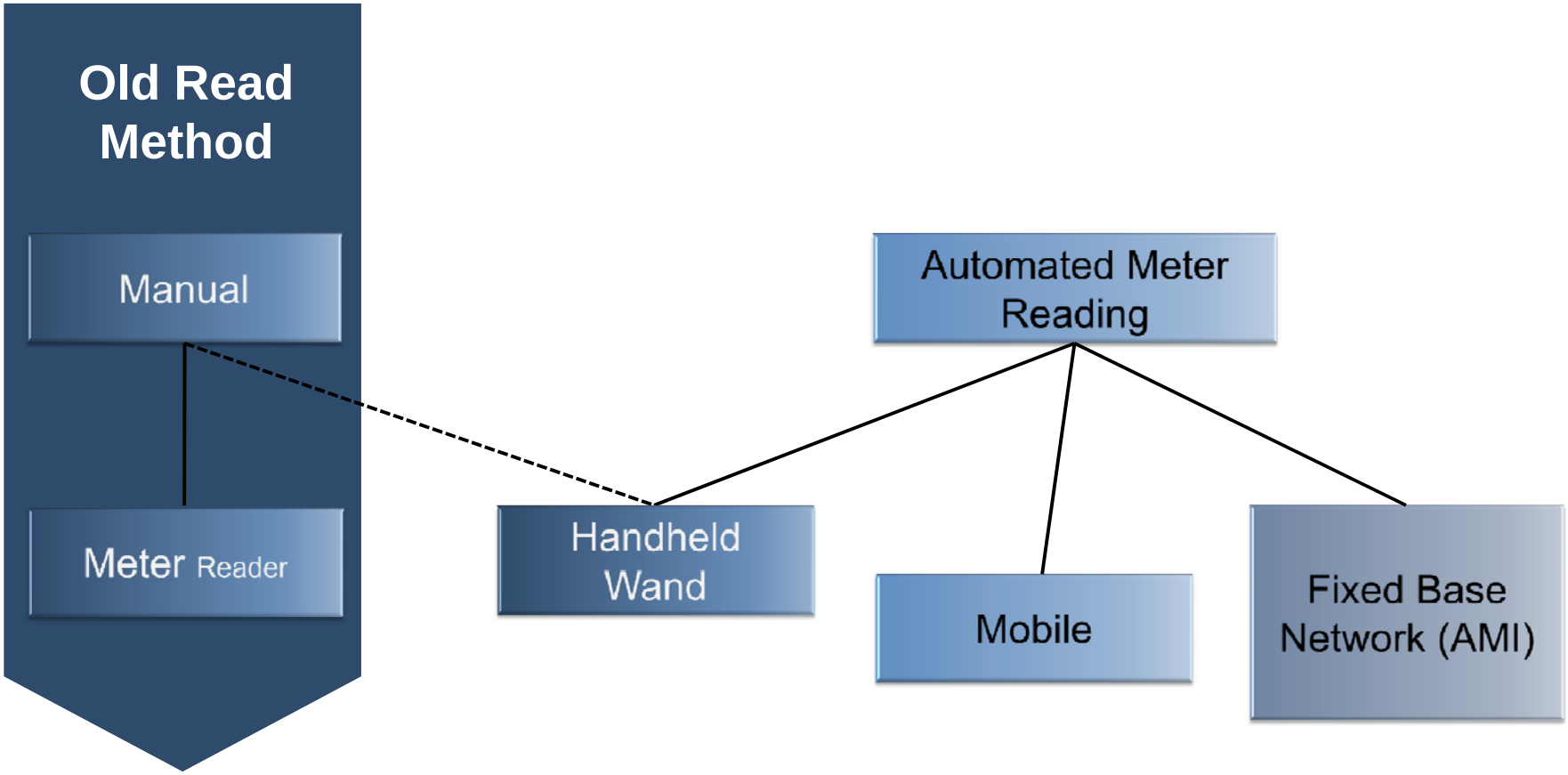
May 2, 2012

Presented by: Shawn Kohtz, P.E.
Murray, Smith & Associates, Inc.

OVERVIEW

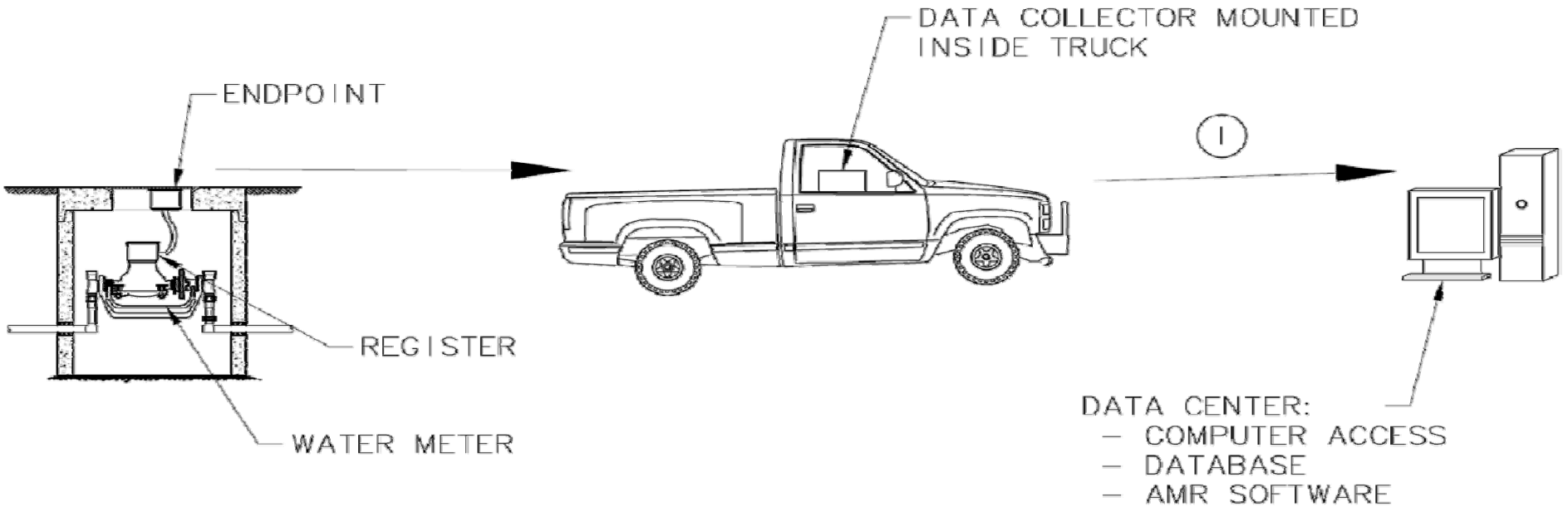
- **High Level Review and System Benefits**
- AMR Financial Model and Examples
  - City of Nampa
  - City of Meridian
- Project Implementation

Water Meter Reading Overview



Manual or Touch-Read Meter Reading

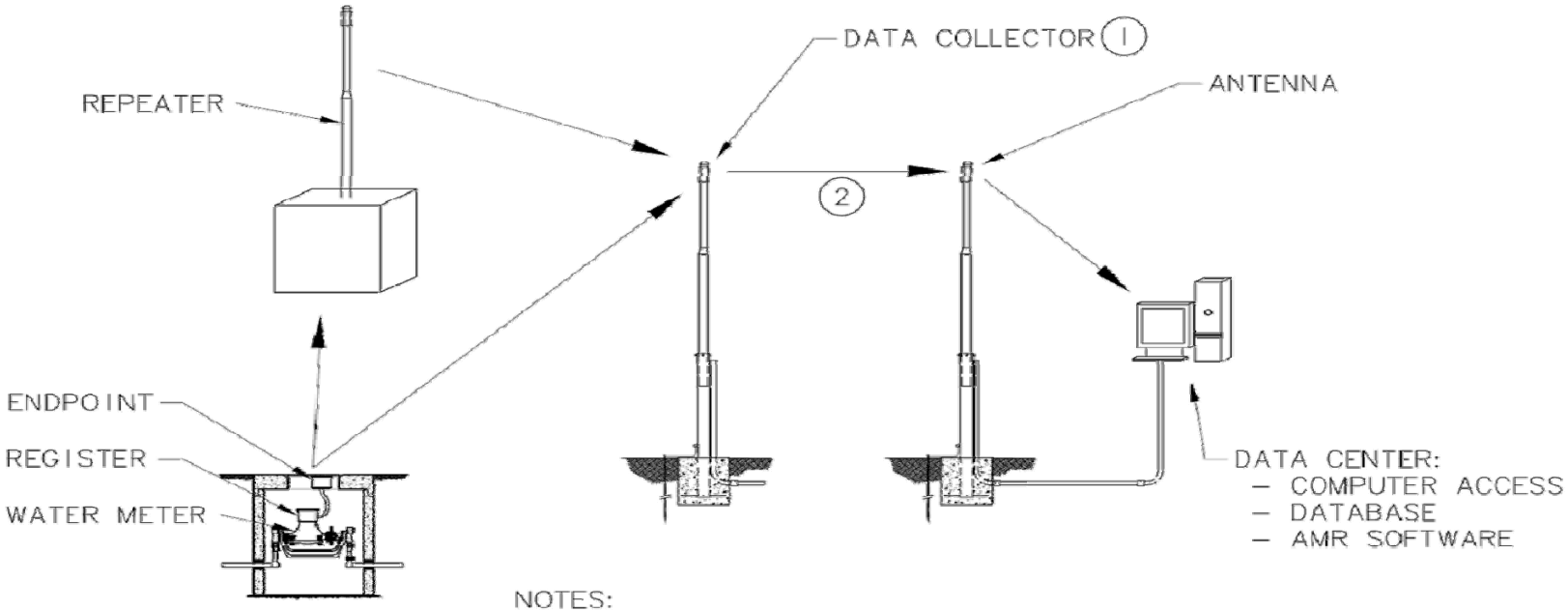
Mobile Automated Meter Reading



NOTES:

1. DATA IS DOWNLOADED FROM TRUCK COMPUTER TO CENTRAL DATABASE AT THE END OF A WORKDAY

Fixed Base Advanced Metering Infrastructure: AMI



NOTES:

(1) COLLECTORS MAY BE MOUNTED ON WATER TOWERS, LIGHT POLES, BUILDINGS OR OTHER CITY–OWNED INFRASTRUCTURE. COLLECTORS MAY BE POWERED BY ELECTRICAL SERVICE OR SOLAR PANELS.

(2) DATA BACKHAUL MAY OCCUR BY A NUMBER OF DIFFERENT METHODS INCLUDING CELLULAR, WI–FI, SCADA COMMUNICATIONS, DIRECT CABLE OR OTHER MEANS.

Data Capabilities

- Rapid Meter Data Collection
  - Current read method (1 read every one or two months)
  - Fixed Base AMI meter reads are (up to 720 reads per month or 1 per hour) available in near real time

Benefits of Fixed Base AMI

- Enhanced Customer Service Support
- Real Time Leak and Backflow Detection*
- Lower Operating Costs
- Engineering and Operations Support*
- Water Conservation Support*
- Cash Flow

Benefits of Automated Meter Reading

- Enhanced customer service support

Benefits of Automated Meter Reading

- Real time leak and backflow detection

Leaks can be detected before a major issue occurs

Separate irrigation system

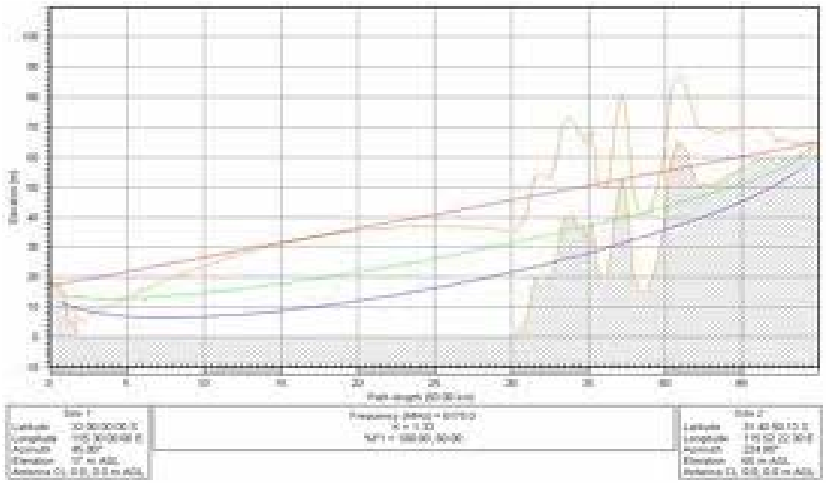
Benefits of Automated Meter Reading

- Lower operating costs
  - Personnel, Vehicles, Equipment
  - Reduced Field Services
  - Quick ID of Meter Tampering
  - Eliminate Human Errors

Reduced Personnel, Vehicles, Oversight, & Equipment

Benefits of Automated Meter Reading

- Engineering and Operations Troubleshooting Support
- Water and Sewer Master Planning Support



Benefits of Automated Meter Reading

- Water Conservation Support
  - Water usage tracking
  - Time-of-use rate structures

Benefits of Automated Meter Reading

- Ability to switch to monthly billing

Drawbacks of Fixed Base AMI

- Capital Costs of AMI Infrastructure
- System Implementation

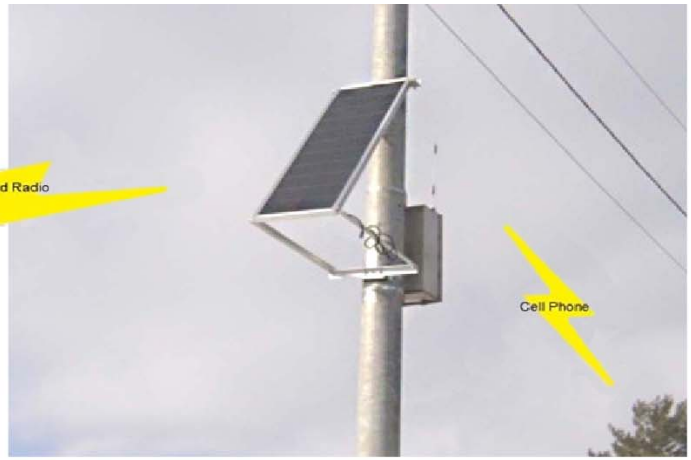
OVERVIEW

- High Level Review and System Benefits
- **AMR Financial Model and Examples**
  - City of Nampa
  - City of Meridian
- Project Implementation

Meter and Endpoint Discussion

- Place Endpoints Only and Wire to Existing Meters
- Replace Meter or Meter Register
- Antenna Mount

Data Collector Discussion



Financial Model

- Model Basis: Comparison to Current Operations
- Review Model (spreadsheet)

Unaccounted Benefits in Financial Model

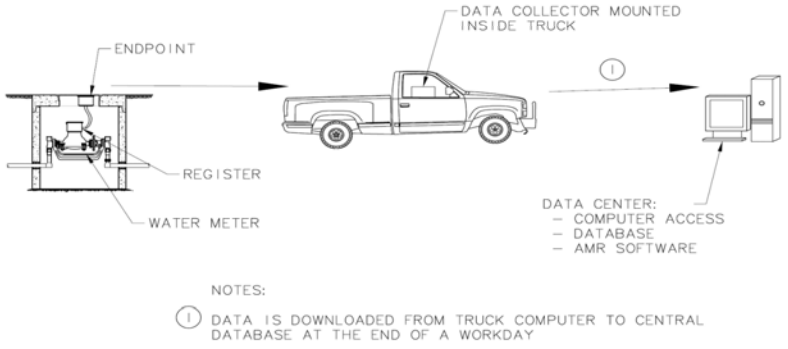
- Real Time Leak and Backflow Detection
- Engineering and Operations Troubleshooting
- Water and Sewer Master Planning Data Support
- Water Conservation Support in Future
- No Need to Access Property
  - Improved Safety
  - Reduced Liability

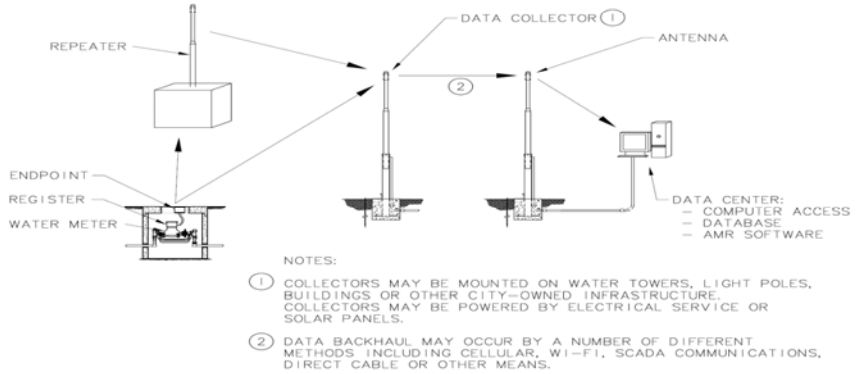
City of Meridian Analysis

AMR

Mobile AMR: nearly fully implemented

Fixed Base (AMI)





Financial Models

Scenario	Implementation Timeframe	Guiding Assumptions	NPV	Payback Period
1	1 Year	Conservative	($3,800,000)	> 15 Years
2	1 Year	Optimistic	($3,100,000)	> 15 Years
3	15 Years	Conservative	$29,000	15 Years
4	15 Years	Optimistic	$481,000	12 Years

Analysis Conclusions

- Financial Model Slightly Favors Fixed Base AMI System Selection if implement over current replacement cycle
- Topography Advantageous for data collector coverage
- Value of Engineering and Operations Troubleshooting Data
- Future value of water conservation capabilities
- Real Time Leak and Backflow Detection
- Consider Automated Valves for Delinquent Accounts

Implementation Decisions

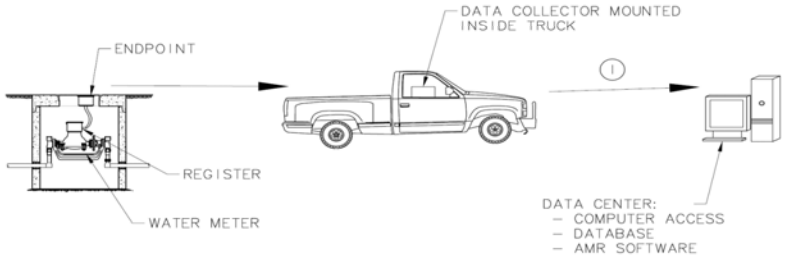
- Implement AMI System Throughout 15-Year Replacement Cycle
- Extend Useful Life of Meters/Endpoints to 20 years
  - Endpoint battery life
- Implement Data Collectors Throughout City in Early Project Phase

City of Nampa Analysis

AMR

Mobile AMR:

Fixed Base (AMI)



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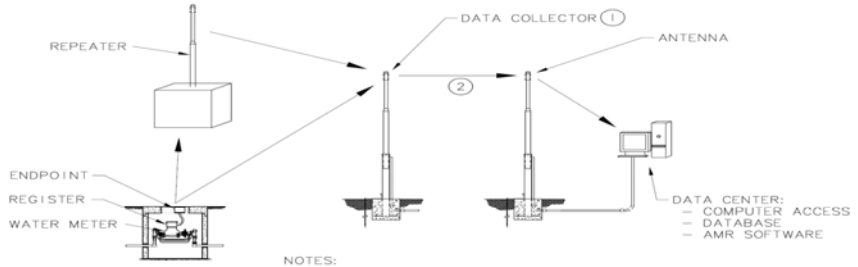

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2. DATA BACKHAUL MAY OCCUR BY A NUMBER OF DIFFERENT METHODS INCLUDING CELLULAR, WI-FI, SCADA COMMUNICATIONS, DIRECT CABLE OR OTHER MEANS.

Financial Model Overview:

Mobile AMR and Fixed Base AMI Relative to Current

Mobile AMR Financial Analysis:

Change in Net Present Value	**($2,147,000)**
Payback Period	> 20 Years

Fixed Base AMI Financial Analysis:

Change in Net Present Value	**$158,000**
Payback Period	19 Years

Financial Model Overview:
AMI Sensitivity Analysis

Conservative Analysis:

Change in Net Present Value	**($79,000)**
Payback Period	> 20 Years

Optimistic Analysis:

Change in Net Present Value	**$1,084,000**
Payback Period	16-17 Years

Analysis Conclusions

- Financial model favors fixed base AMI system selection with implementation as rapidly as possible for greatest returns
- If rapid meter replacement program is incorporated, additional benefits realized due to meter age

OVERVIEW

- High Level Review and System Benefits
- AMR Financial Model and Examples
  - City of Nampa
  - City of Meridian
- **Project Implementation**

Under Construction

- MSA prepared specifications and contract documents and bid the first phase of an AMI system in Nampa
- First-year installation:
  - Data collector coverage for 1/3 of the City
  - Endpoints and meters installed at 3,700 accounts out of total 28,000 accounts
  - Ongoing annual installation with a budget of $500,000 per year


CONSOLIDATED


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elster
C700
3/4"
CUBIC FEET
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WATER
METER
INDIA

Key Implementation Measures

- Staff Buy-In
  - Operations
  - Billing/Customer Service
  - IT
- Plans/Specs: Cutting Edge Technology
  - Each system is different and has its own benefits and drawbacks
- Incorporation of New Accounts Into Existing System

Acknowledgements

- City of Nampa Staff and Council
- City of Meridian Staff and Council

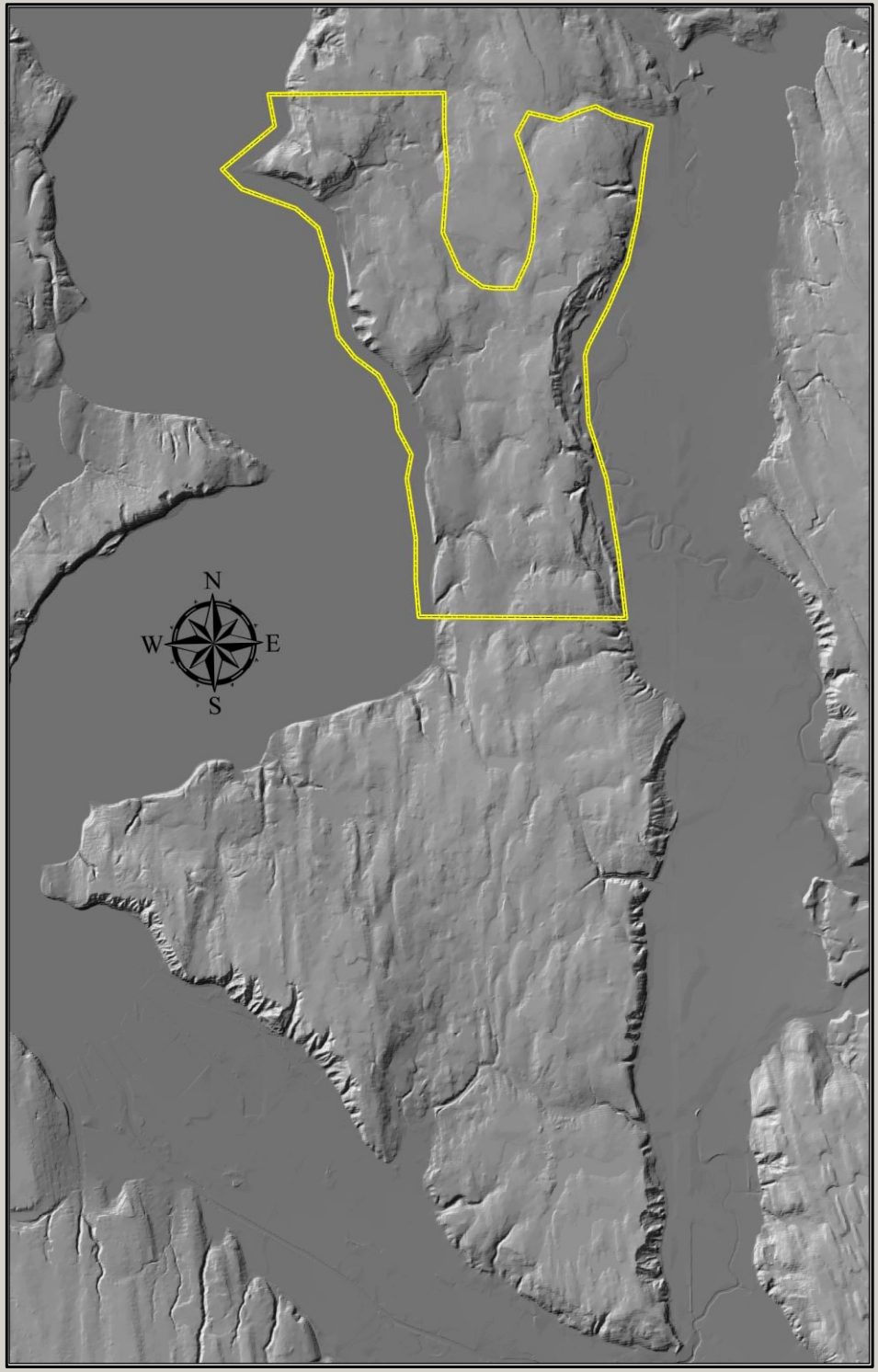
Questions?

Hidden Valley Water Service

Highline Water District

Geotechnical Decision-Making in Steep and Unstable Ground

Bill Laprade, LEG, Senior Vice President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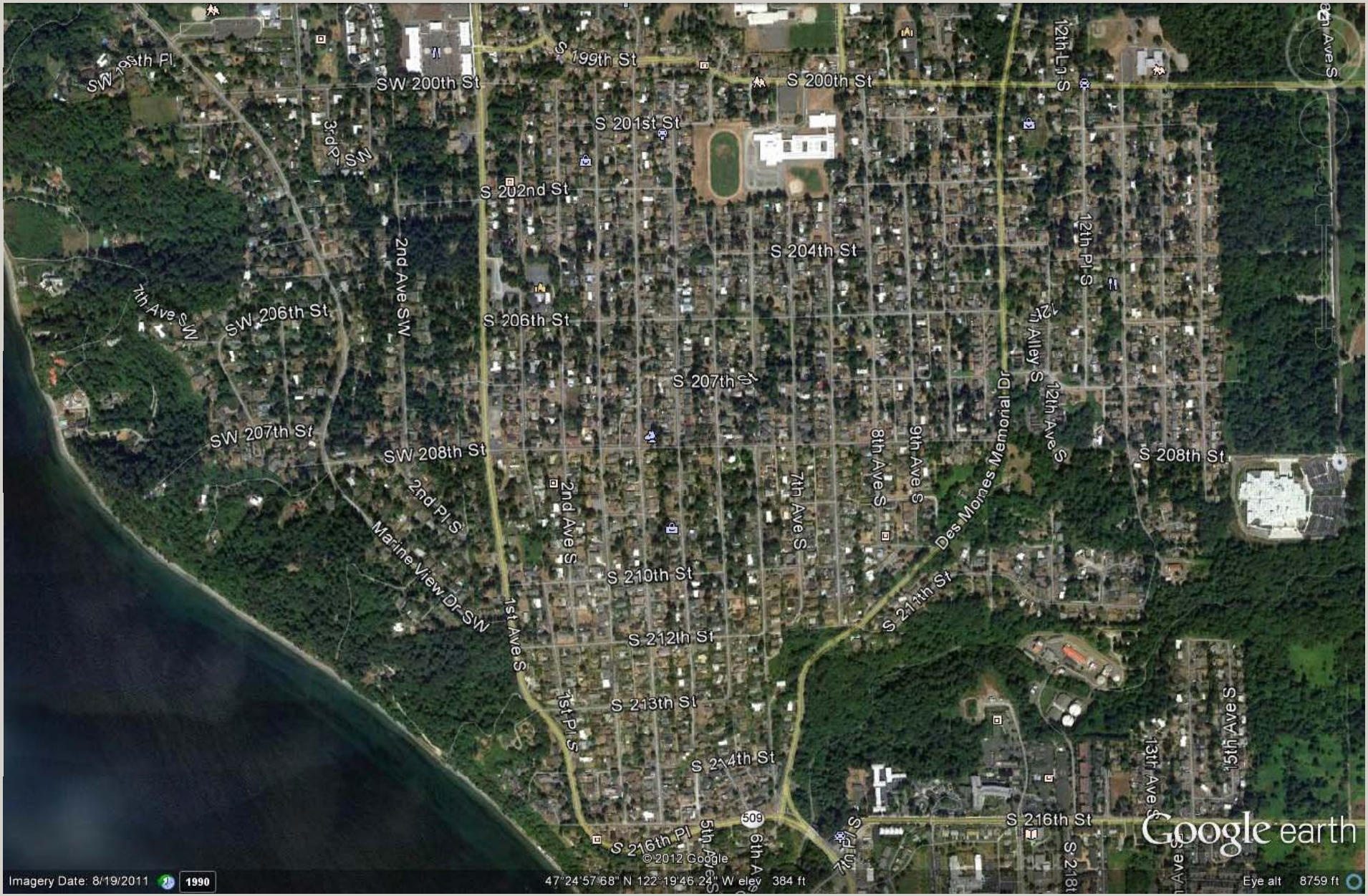
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©2012 Google
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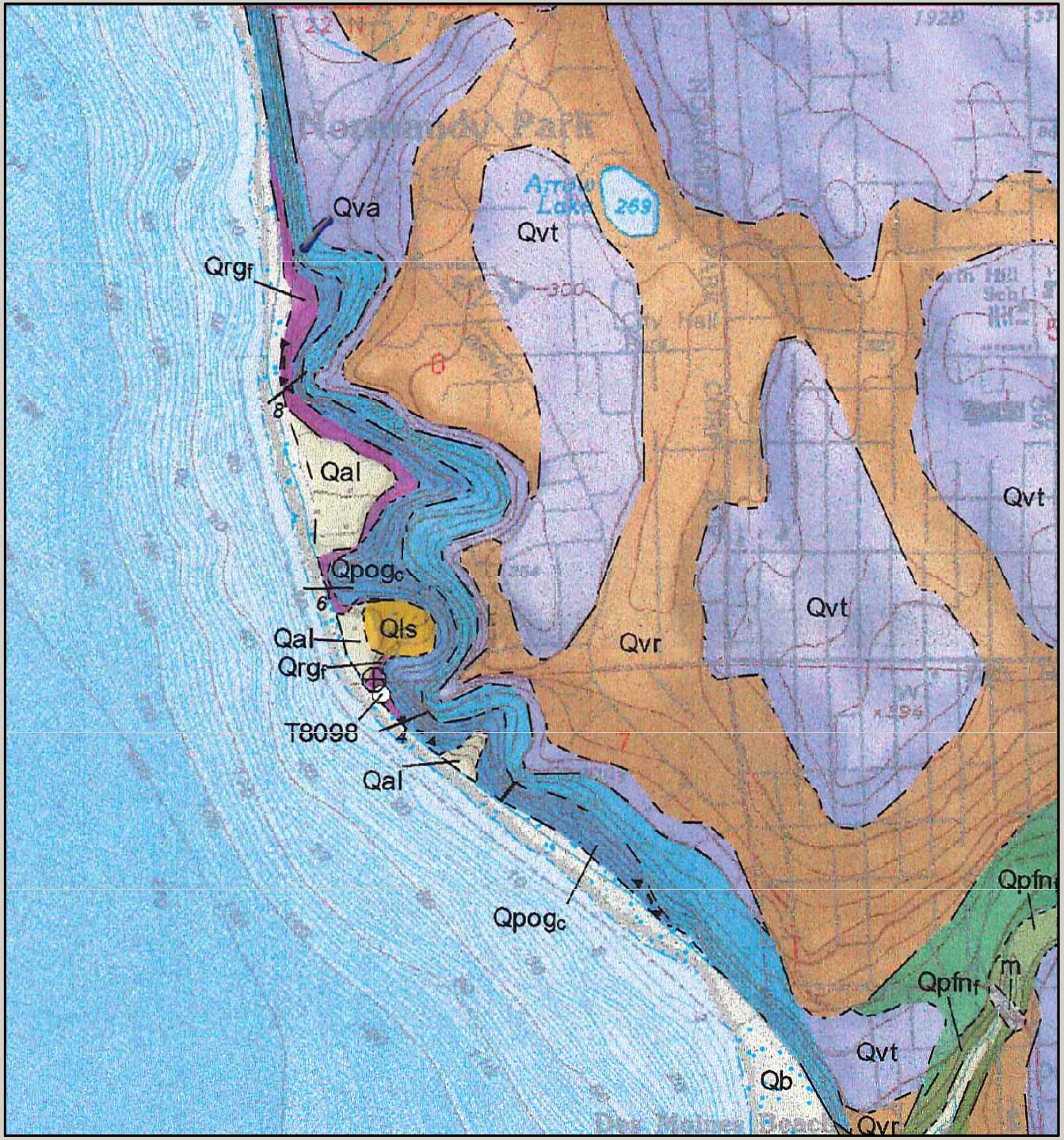
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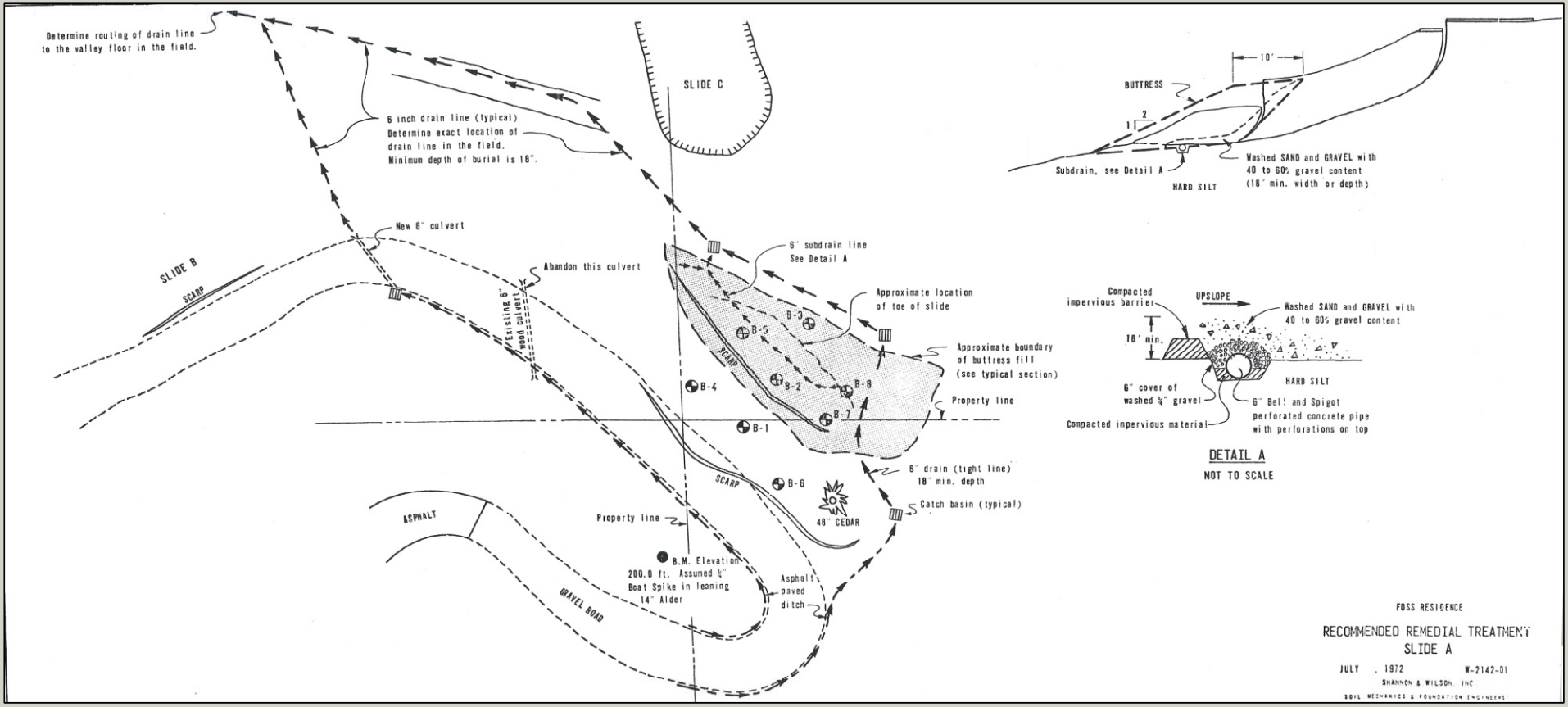
Qb
Qvr


Determine routing of drain line to the valley floor in the field.
6 inch drain line (typical)
Determine exact location of drain line in the field.
Minimum depth of burial is 18".
SLIDE C
New 6" culvert
Abandon this culvert
Existing 6" culvert
SLIDE B
SCARP
6" subdrain line
See Detail A
Approximate location of toe of slide
Approximate boundary of buttress fill (see typical section)
Property line
B-1
B-2
B-3
B-4
B-5
B-6
B-7
B-8
SCARP
SCARP
6" drain (tight line) 18" min. depth
Catch basin (typical)
48" CEDAR
ASPHALT
Property line
B.M. Elevation 200.0 ft. Assumed ¼" Boat Spike in leaning 14" Alder
Asphalt paved ditch
GRAVEL ROAD
10'
BUTTRESS
2
1
Subdrain, see Detail A
HARD SILT
Washed SAND and GRAVEL with 40 to 60% gravel content (18" min. width or depth)
Compacted impervious barrier
UPSLOPE
Washed SAND and GRAVEL with 40 to 60% gravel content
18" min.
HARD SILT
6" cover of washed ¾" gravel
6" Bell and Spigot perforated concrete pipe with perforations on top
Compacted impervious material
DETAIL A
NOT TO SCALE
FOSS RESIDENCE
RECOMMENDED REMEDIAL TREATMENT
SLIDE A
JULY , 1972
W-2142-01
SHANNON & WILSON, INC.
SOIL MECHANICS & FOUNDATION ENGINEERS

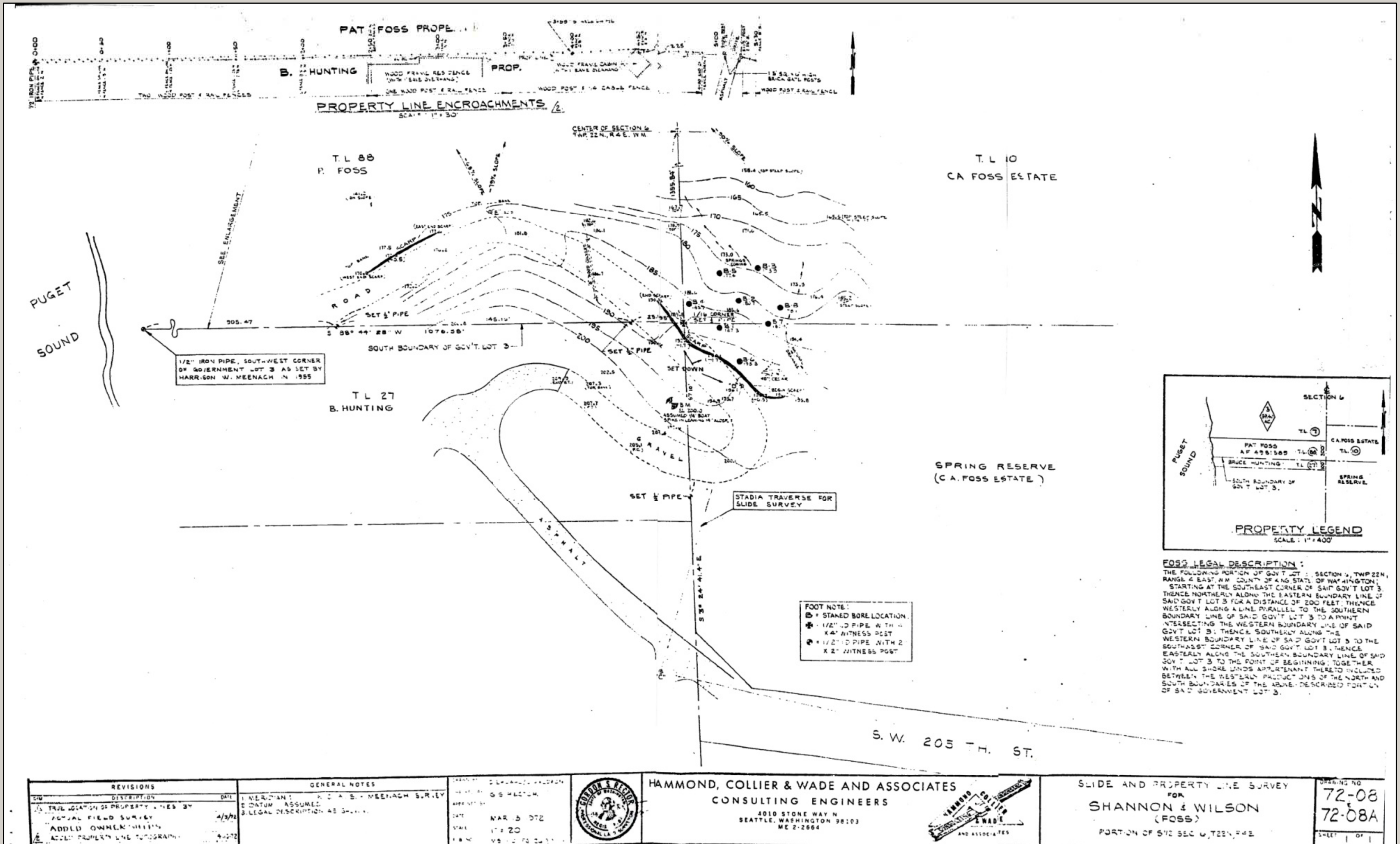
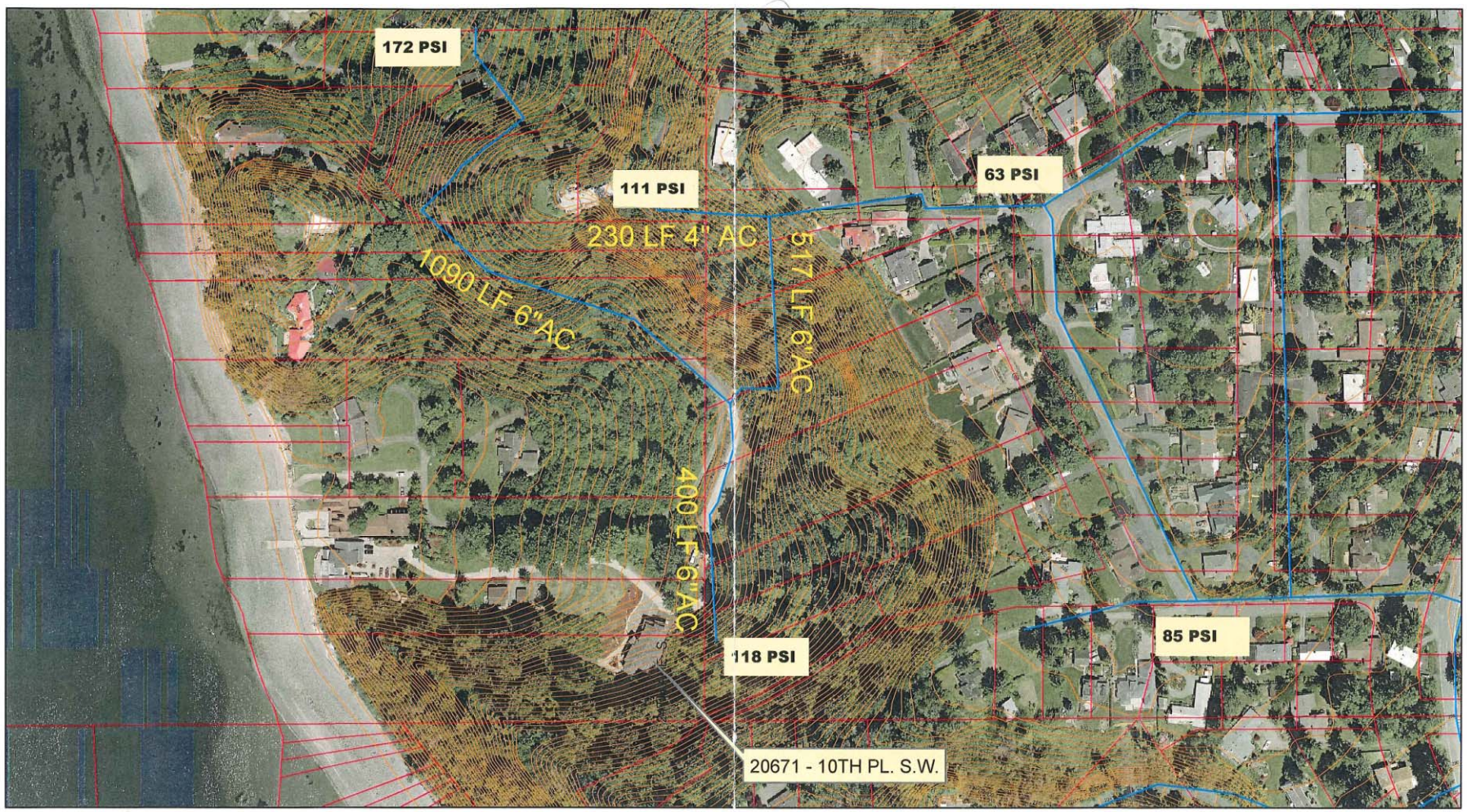

PAT FOSS PROPE
B. HUNTING
PROP.
PROPERTY LINE ENCROACHMENTS
CENTER OF SECTION 6 TWP. 22N., R4E. W.M.
T.L 88
P. FOSS
T.L 10
CA FOSS ESTATE
PUGET SOUND
ROAD
SET 1/2" PIPE
905.47
S 88° 44' 28" W 1076.35'
SOUTH BOUNDARY OF GOV'T. LOT 3
1/2" IRON PIPE, SOUTHWEST CORNER OF GOVERNMENT LOT 3 AS SET BY HARRISON W. MEENACH IN 1955
T L 27
B. HUNTING
SET DOWN
SPRING RESERVE
(C A. FOSS ESTATE)
SET 1/2" PIPE
STADIA TRAVERSE FOR SLIDE SURVEY
ASPHALT
GRAVEL
S 3° 24' 41" E
FOOT NOTE:
B = STAKED BORE LOCATION
S. W. 205 TH. ST.
SECTION 6
PUGET SOUND
PAT FOSS
C.A.FOSS ESTATE
BRUCE HUNTING
SPRING RESERVE
PROPERTY LEGEND
FOSS LEGAL DESCRIPTION :
REVISIONS
GENERAL NOTES
HAMMOND, COLLIER & WADE AND ASSOCIATES
CONSULTING ENGINEERS
4010 STONE WAY N
SEATTLE, WASHINGTON 98103
SLIDE AND PROPERTY LINE SURVEY
FOR
SHANNON & WILSON
(FOSS)
72-08
72-08A

FIG. 9

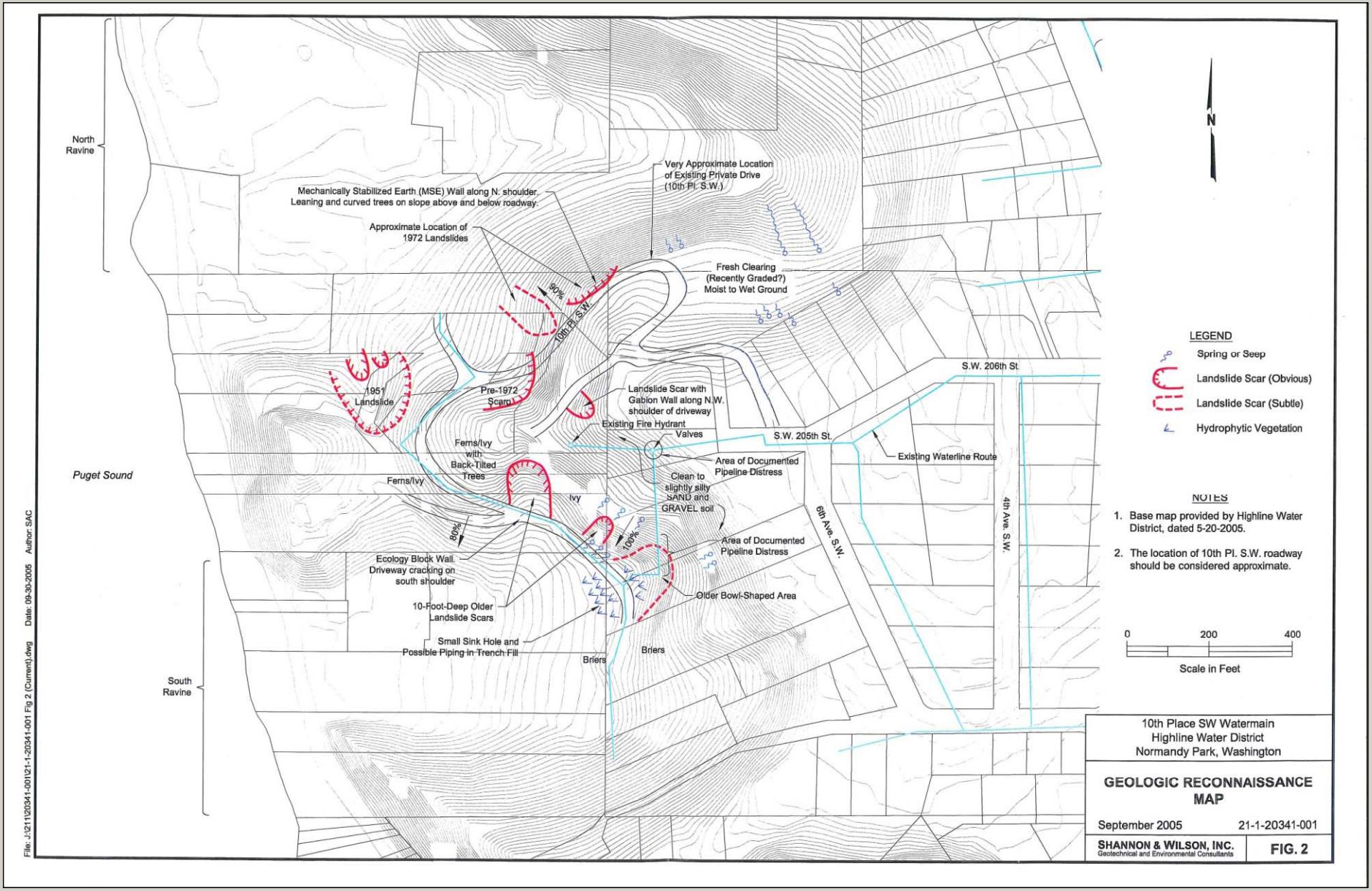


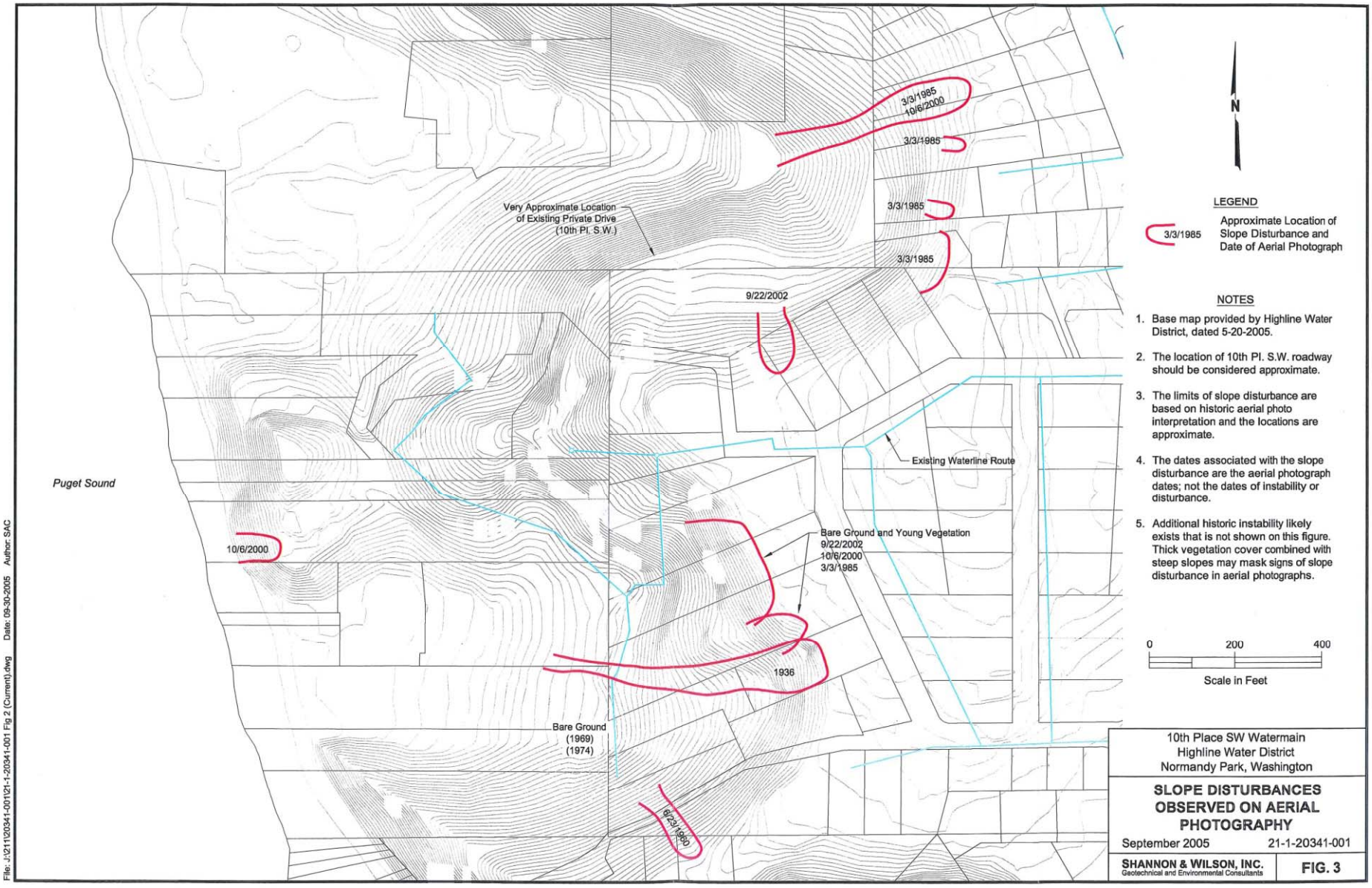
20671 - 10TH PL. S.W.

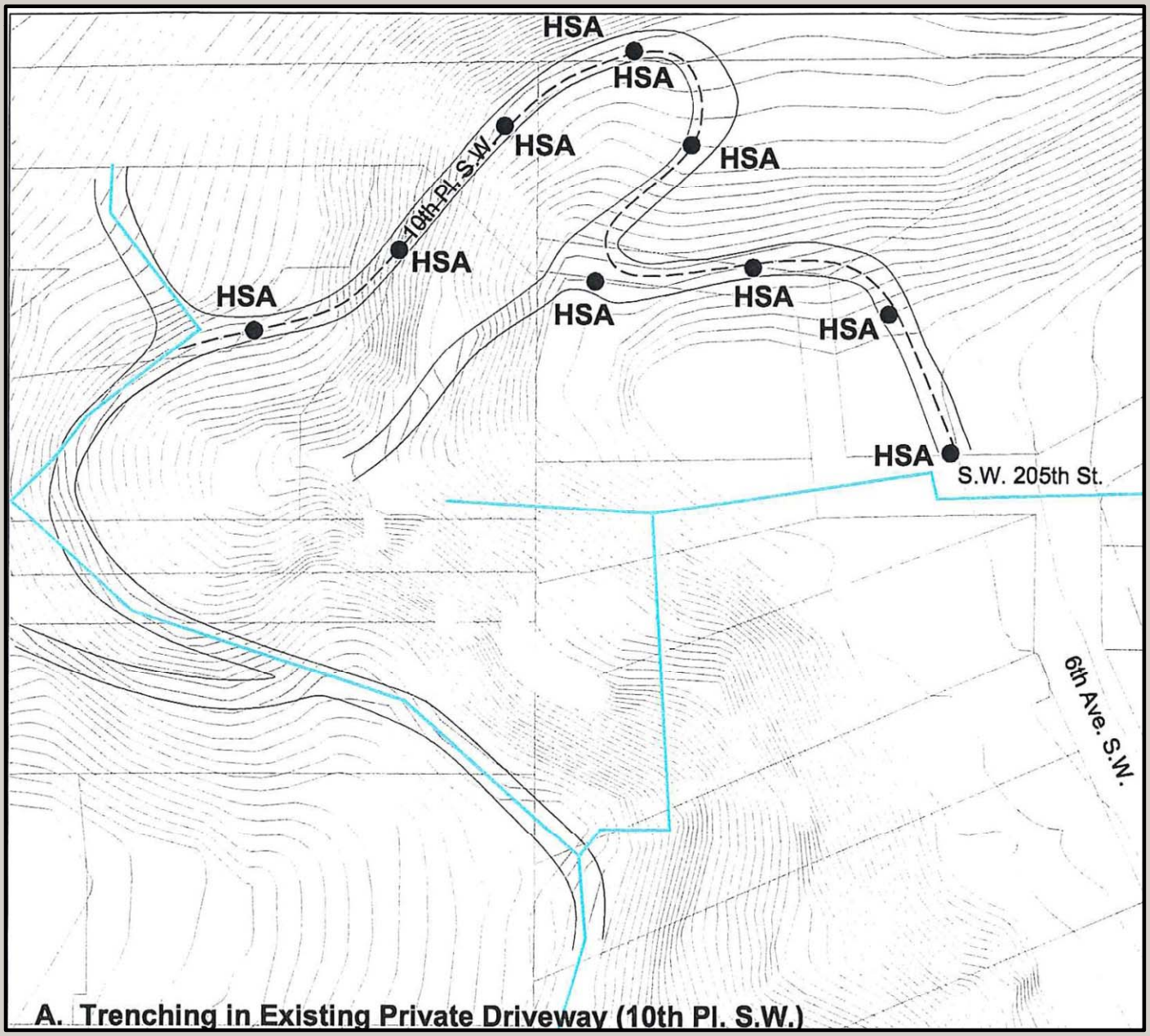
SURROUNDING AREA MAP

MARCH 16, 2005

N


North Ravine
Mechanically Stabilized Earth (MSE) Wall along N. shoulder. Leaning and curved trees on slope above and below roadway.
Very Approximate Location of Existing Private Drive (10th Pl. S.W.)
Approximate Location of 1972 Landslides
Fresh Clearing (Recently Graded?) Moist to Wet Ground
90%
10th Pl. S.W.
1951 Landslide
Pre-1972 Scarp
Landslide Scar with Gabion Wall along N.W. shoulder of driveway
Existing Fire Hydrant
Valves
S.W. 206th St.
S.W. 205th St.
Existing Waterline Route
Ferns/Ivy with Back-Tilted Trees
Ferns/Ivy
Puget Sound
Ivy
Clean to slightly silty SAND and GRAVEL soil
Area of Documented Pipeline Distress
80%
100%
Area of Documented Pipeline Distress
6th Ave. S.W.
4th Ave. S.W.
Ecology Block Wall. Driveway cracking on south shoulder
Older Bowl-Shaped Area
10-Foot-Deep Older Landslide Scars
Small Sink Hole and Possible Piping in Trench Fill
Briers
Briers
South Ravine
N
LEGEND
Spring or Seep
Landslide Scar (Obvious)
Landslide Scar (Subtle)
Hydrophytic Vegetation
NOTES
1. Base map provided by Highline Water District, dated 5-20-2005.
2. The location of 10th Pl. S.W. roadway should be considered approximate.
0
200
400
Scale in Feet
10th Place SW Watermain
Highline Water District
Normandy Park, Washington
GEOLOGIC RECONNAISSANCE MAP
September 2005
21-1-20341-001
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants
FIG. 2
File: J:\21\20341-001\21-1-20341-001 Fig 2 (Current).dwg Date: 09-30-2005 Author: SAC


3/3/1985
10/6/2000
3/3/1985
3/3/1985
3/3/1985
Very Approximate Location
of Existing Private Drive
(10th Pl. S.W.)
9/22/2002
Existing Waterline Route
Puget Sound
10/6/2000
Bare Ground and Young Vegetation
9/22/2002
10/6/2000
3/3/1985
1936
Bare Ground
(1969)
(1974)
9/23/1960
N
LEGEND
3/3/1985
Approximate Location of
Slope Disturbance and
Date of Aerial Photograph
NOTES
1. Base map provided by Highline Water District, dated 5-20-2005.
2. The location of 10th Pl. S.W. roadway should be considered approximate.
3. The limits of slope disturbance are based on historic aerial photo interpretation and the locations are approximate.
4. The dates associated with the slope disturbance are the aerial photograph dates; not the dates of instability or disturbance.
5. Additional historic instability likely exists that is not shown on this figure. Thick vegetation cover combined with steep slopes may mask signs of slope disturbance in aerial photographs.
0
200
400
Scale in Feet
10th Place SW Watermain
Highline Water District
Normandy Park, Washington
SLOPE DISTURBANCES OBSERVED ON AERIAL PHOTOGRAPHY
September 2005
21-1-20341-001
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants
FIG. 3
File: J:\21\20341-001\21-1-20341-001 Fig 2 (Current).dwg Date: 09-30-2005 Author: SAC



A. Trenching in Existing Private Driveway (10th Pl. S.W.)

Trenching in Existing Road

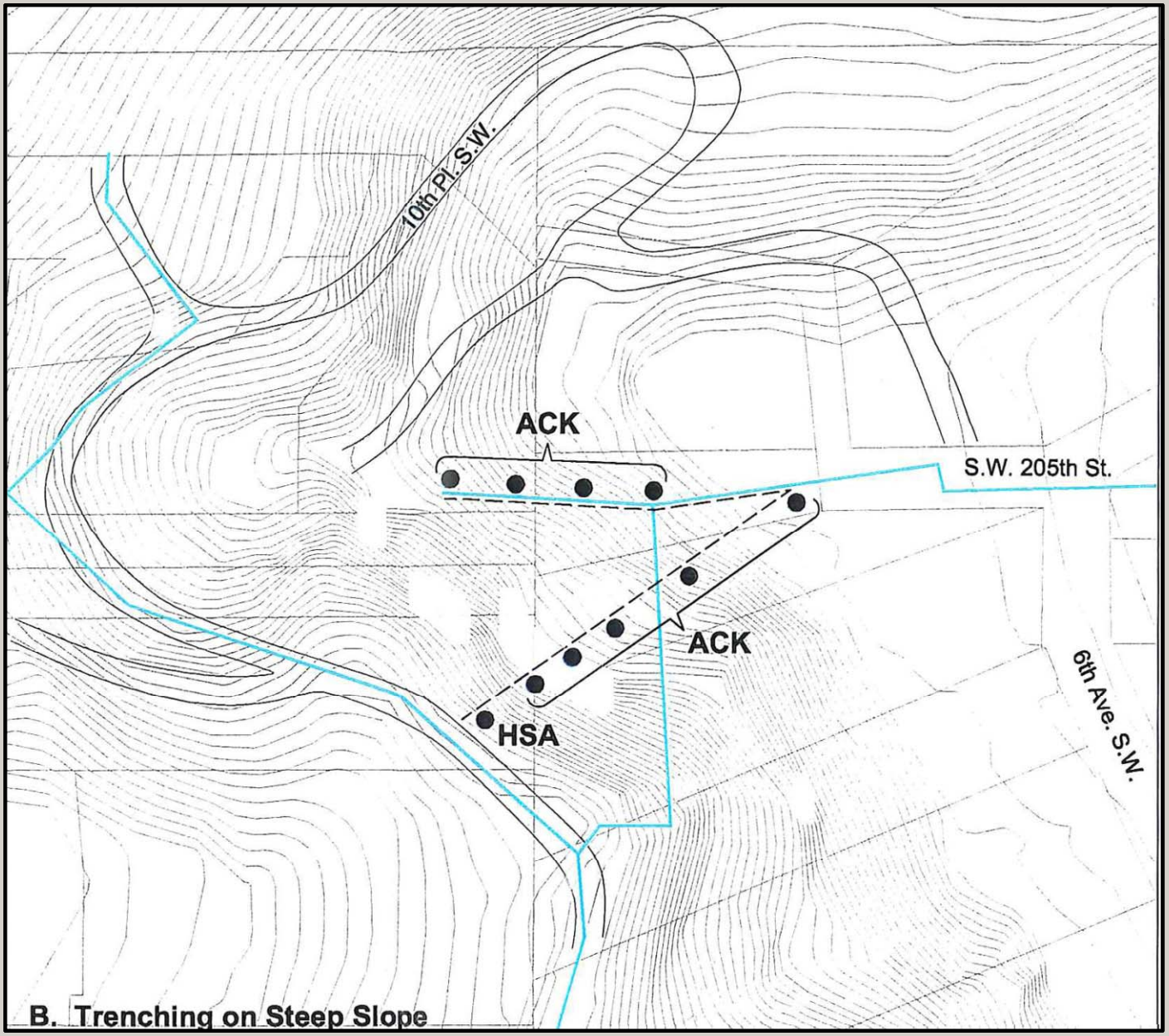
Pros

- Cut and Cover
- Easy accessibility
- Stable on inboard side
- Least expensive

Trenching in Existing Raod

Cons

- Existing utilities
- Documented instability
- Residential traffic
- Pavement replacement
- Residential access



B. Trenching on Steep Slope

Trenching on Steep Slope

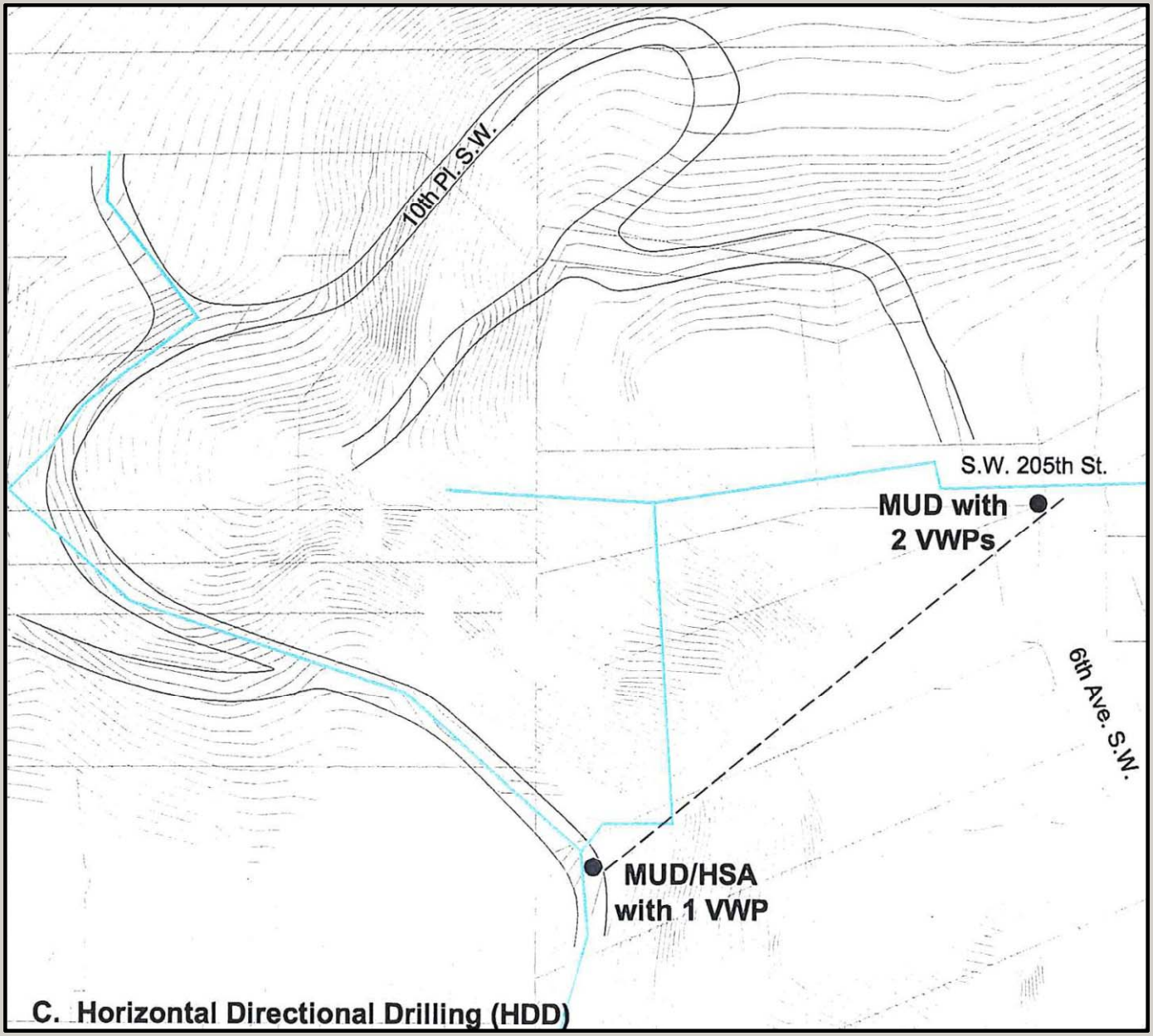
Pros

- Minimal traffic disruption
- Short distance
- Valve accessible

Trenching on Steep Slope

Cons

- Difficult access for explorations
- Significant steep slope disturbance
- Uncertain constructability
- Continued risk of washout on unstable slope


10th Pl. S.W.
S.W. 205th St.
MUD with
2 VWPs
6th Ave. S.W.
MUD/HSA
with 1 VWP
C. Horizontal Directional Drilling (HDD)

Horizontal Directional Drilling (HDD)

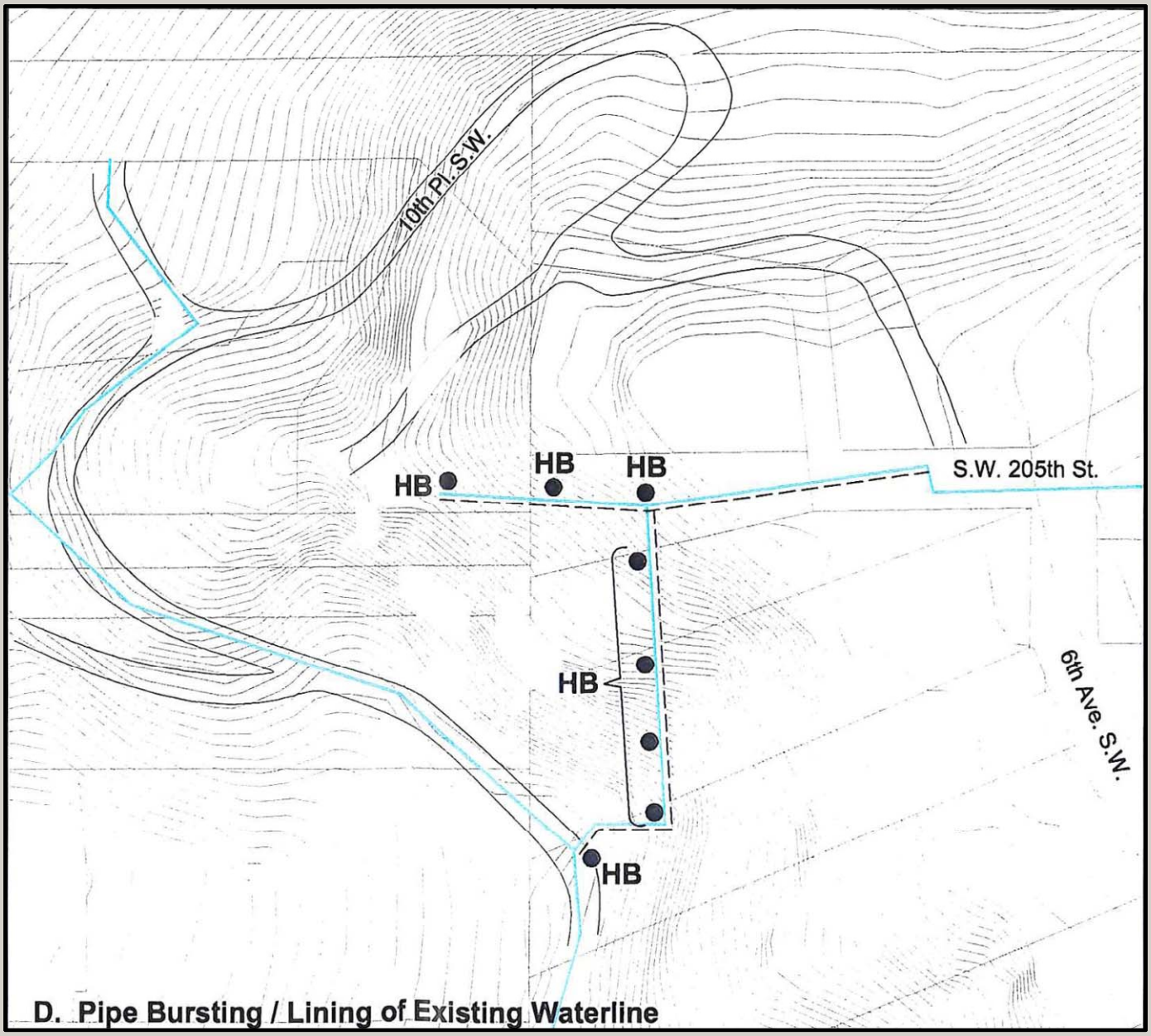
Pros

- Reduced maintenance
- Elimination of midslope tee
- Most pipe buried below landslide mass
- Much reduced traffic disruption

Horizontal Directional Drilling (HDD)

Cons

- Relatively high construction costs
- Higher exploratory costs
- Higher engineering costs
- Higher uncertainty
- Fewer qualified contractors
- Potential instability on low end



D. Pipe Bursting / Lining of Existing Waterline

Pipe Bursting

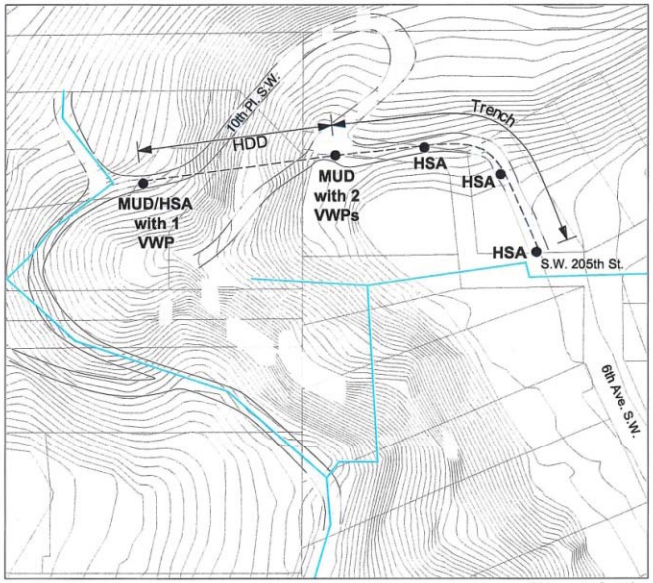
Pros

- Minimal slope disturbance
- Low exploratory cost
- Low engineering cost
- Maintenance of existing easement

Pipe Bursting

Cons

- Difficult access for explorations
- Maintenance access difficult
- Risk of landslide vulnerability
- Side slope alignment subject to creep
- Shafts in slope/landslide area



E. Combination of HDD and Trenching in Existing Private Driveway (10th Pl. S.W.)

0 200 400

Scale in Feet

LEGEND

HSA ●	Proposed Exploration, Type, and Approximate Location
- - - -	Proposed Alternative Waterline Alignment
———	Existing Waterline Location (Approximate)

EXPLORATION TYPE

HSA	Hollow Stem Auger - Truck-Mounted
MUD	Mud Rotary - Truck-Mounted
ACK	Portable Auger Rig - Hollow Stem Auger
HB	Hand Boring
VWP	Vibrating Wire Piezometer

NOTES

1. Base map provided by Highline Water District, dated 5-20-2005.
2. The location of 10th Pl. S.W. roadway should be considered approximate.
3. Exploration and proposed alignment locations are shown for planning purposes only. Variations between this plan and the actual exploration plan should be expected.

10th Place SW Watermain
Highline Water District
Normandy Park, Washington

POTENTIAL WATERLINE ALTERNATIVES WITH PROPOSED EXPLORATION LOCATIONS

September 2005 21-1-20341-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 4
Sheet 2 of 2

File: J:\21\20341-001\21-1-20341-001 Fig 4 (9-29-05).dwg Date: 09-30-2005 Author: SAC

Trenching/HDD Combination

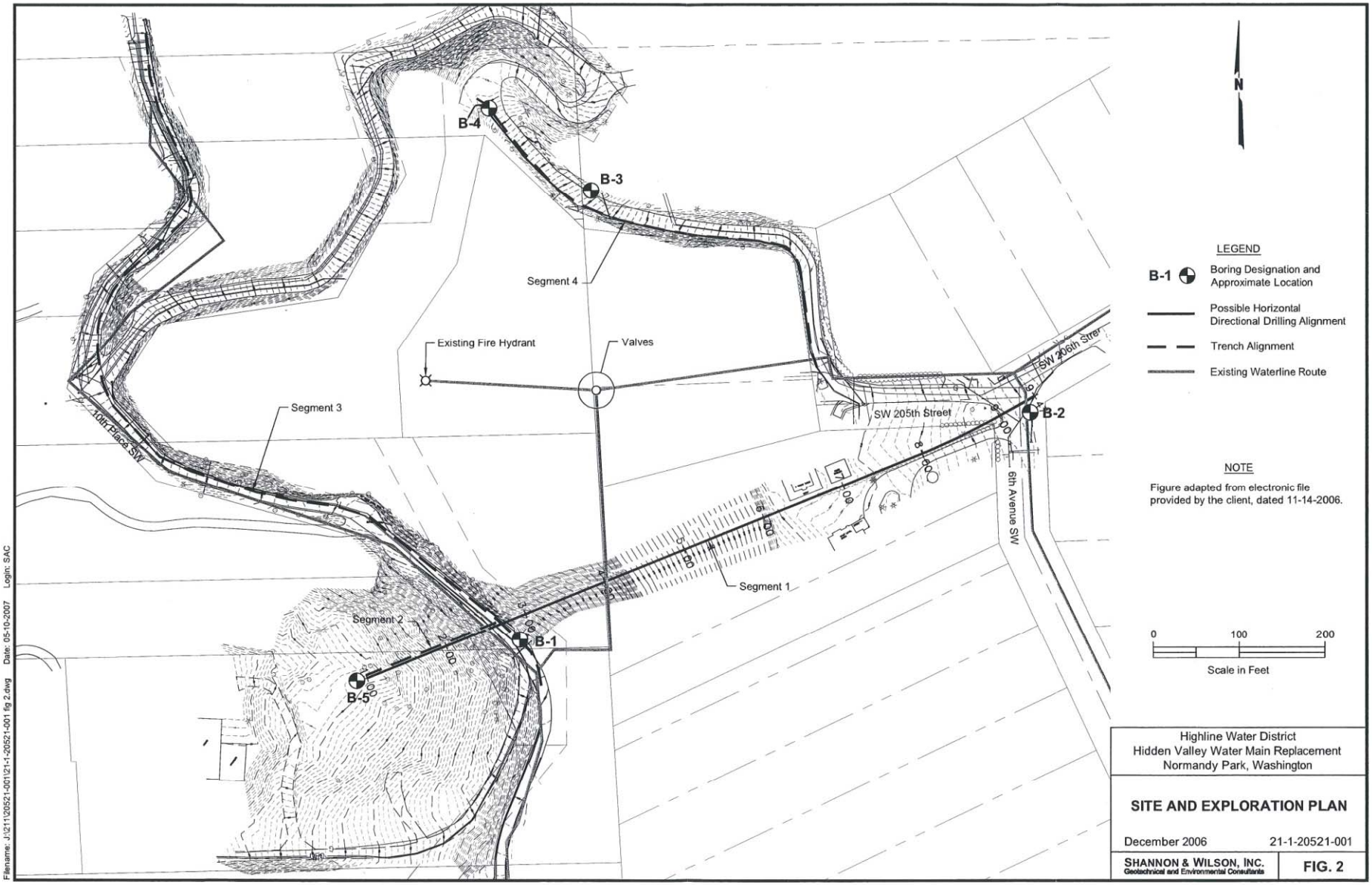
Pros

- Upper trench easy construction and easy maintenance
- Minimal slope disturbance
- Lowest construction cost

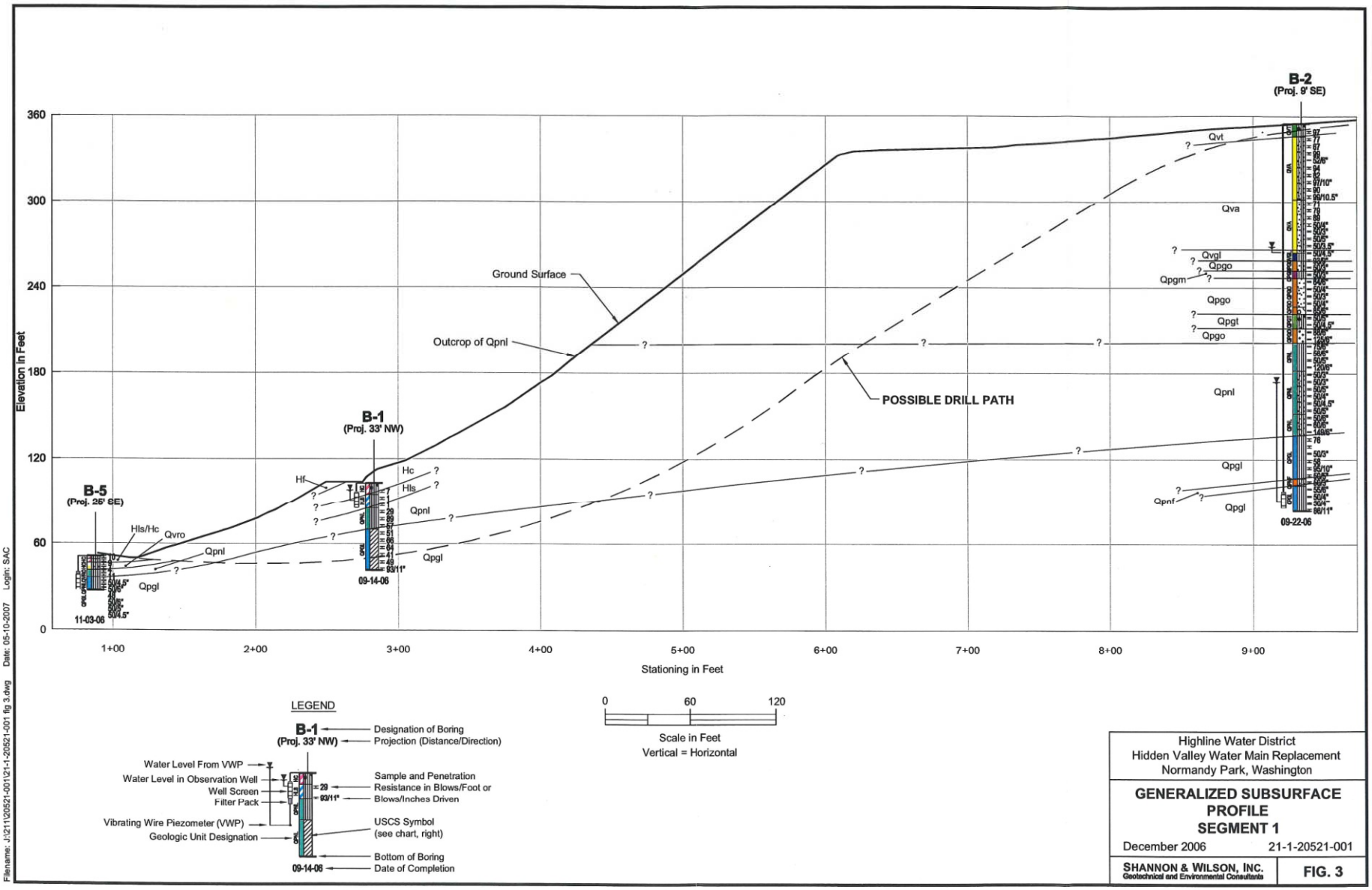
Trenching/HDD Combination

Cons

- Existing utilities
- Residential traffic disruption
- Residential access
- Pavement replacement
- Risks of HDD portion



Filename: J:\21\20521-001\21-1-20521-001 fig 2.dwg Date: 05-10-2007 Login: SAC



Highline Water District
Hidden Valley Water Main Replacement
Normandy Park, Washington

GENERALIZED SUBSURFACE PROFILE
SEGMENT 1

December 2006 21-1-20521-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 3

Filename: J:\21\20521-001\21-1-20521-001 fig 3.dwg Date: 05-10-2007 Login: SAC


Vermeer
6


PROFESSIONAL
UNDERGROUND
SERVICES, INC.
(541) 367-5859


Vermeer


KOBELCO


KOBELCO
KAR-VEL
SK 210 LC


KOBELCO
SK 210

Thanks to Highline Water District

Matt Everett – District Manager

Tom Keown – former District Engineer

Dave Stanley – District Operations Supervisor

Thanks for your Attention

Questions??

HDPE PIPELINE CONSTRUCTION –

KEYS FOR SUCCESSFUL DESIGN, CONSTRUCTION, AND MAINTENANCE

Series 2 – Construction
The Real World – Top Ten List

RH2 ENGINEERS PLANNERS SCIENTISTS

Donald Popoff P.E.

Presenter History

Donald G. Popoff P.E.

Project Manager for RH2 Engineering – Wenatchee Office

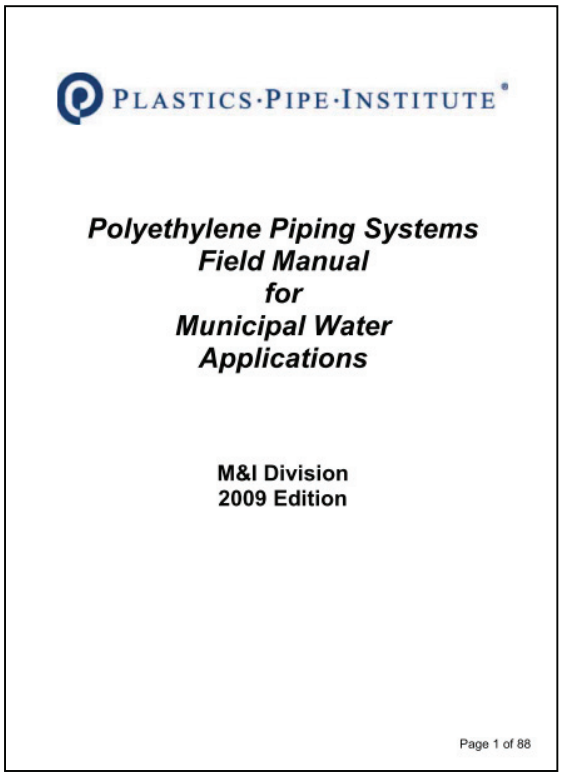
- Spent the last 10 years designing and providing construction inspection of HDPE pipelines.
  - HDPE Pipe for Water Systems
  - HDPE Pipe for Sewer Force mains
  - HDPE Pipe for Storm water
  - HDPE Pipe for irrigation mains
  - Sizes of 63” to 2”

Why and where I use HDPE in a water system..

- As a Water System Design Engineer I don't use HDPE every time…
  - Wide open stretches / minimal crossing utilities.
  - When we are dealing with very acidic soils.
  - When restraint is an issue.
  - Diving under a major crossing.
  - Directional drilling.
  - Wet/Water areas / hard to work in.
- I don't use it –
  - Lots of crossing utilities / Downtown areas are tough.
  - Where you can't weld in field long stretches

Manuals / Standards / References

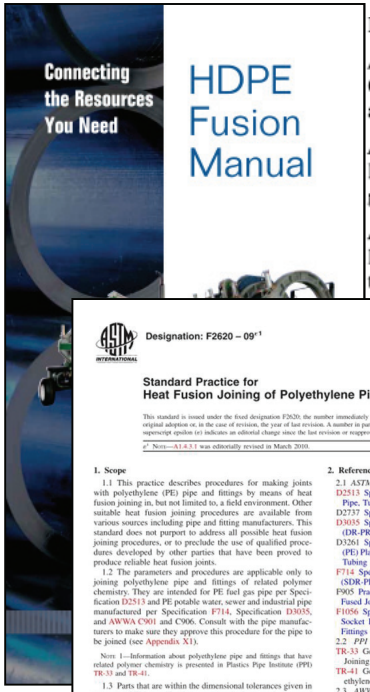
- Manuals
  - AWWA
  - ASTM
  - ASME
  - PPI
  - Pipe Manufacturers

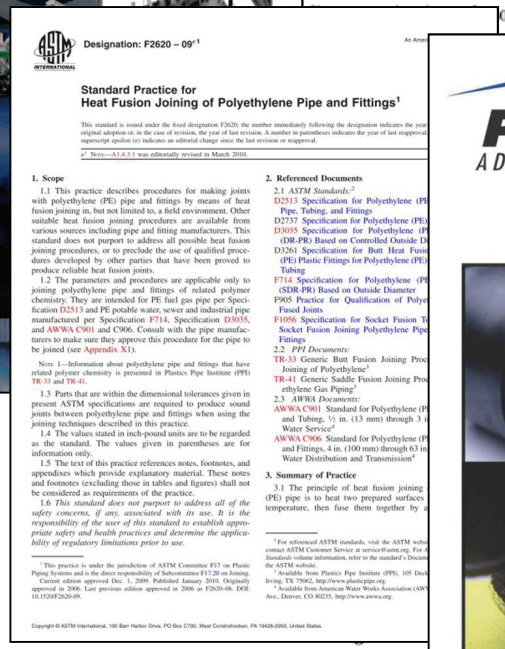

PLASTICS·PIPE·INSTITUTE

Polyethylene Piping Systems Field Manual for Municipal Water Applications

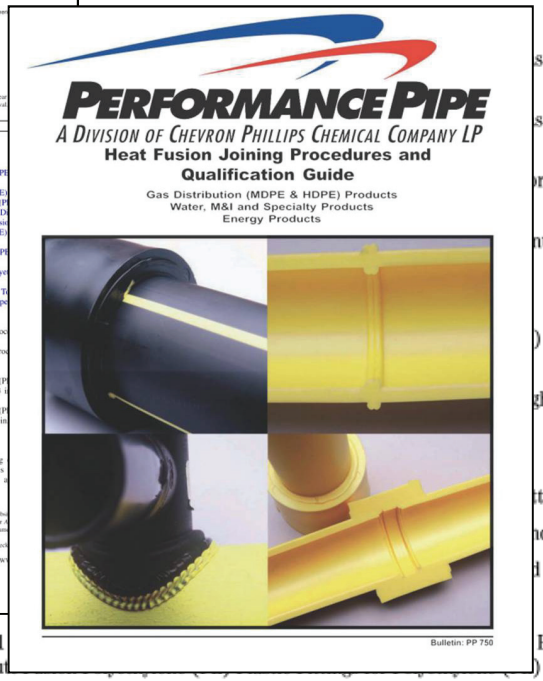
M&I Division
2009 Edition

Page 1 of 88




Designation: F2620 – 09ε1

Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings[1]



Pipe dimensions and manufacturing requirements:

ASTM F 714-05 Standard Specification for Polyethylene (PE) Pipe (SDR-PR) Based on Outside Diameter. This standard is used for most large diameter HDPE pipe (4" to 63") applications other than gas pipe.

ASTM D 2513-05 Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing and Fittings. Polyethylene pipe and other plastic for natural gas distribution are described in great detail in this standard.

ASTM D 3035-03a Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter. Most HDPE water tubing (1/2 inch to 3") is made to the dimensions in this standard. While pipe sizes up to 24" are provided, very little large

o this standard.

stic Pipe for

stic Pressure

r Placement

nto Existing

) Through 3

gh 63 In

ttings

nd Fittings

l Fittings

ASTM D 3261
Fittings for But
and Tubing

Plastic
) Plastic Pipe

ASTM F 1055 Standard Specification for Electrofusion Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing

Reference table provided from ISCO Industries Product Catalog, 2011.

Construction of HDPE Mains

What to look for – common field issues with HDPE Construction….

Top Ten List

1. Gouges
2. Alignment Issues when welding
3. Temperature, Pressure, and Time
4. Pressure Rating of Fittings
5. Connection to Different sizes of HDPE pipe and fittings.
6. Operators on the Machine
7. Connecting to a different pipe
8. Installation of Tee's and Fittings
9. Electrofusion
10. Use of Data Logging Equipment

Welding Demonstration – Ferguson Industrial Plastics

Construction of HDPE Mains What to look for -

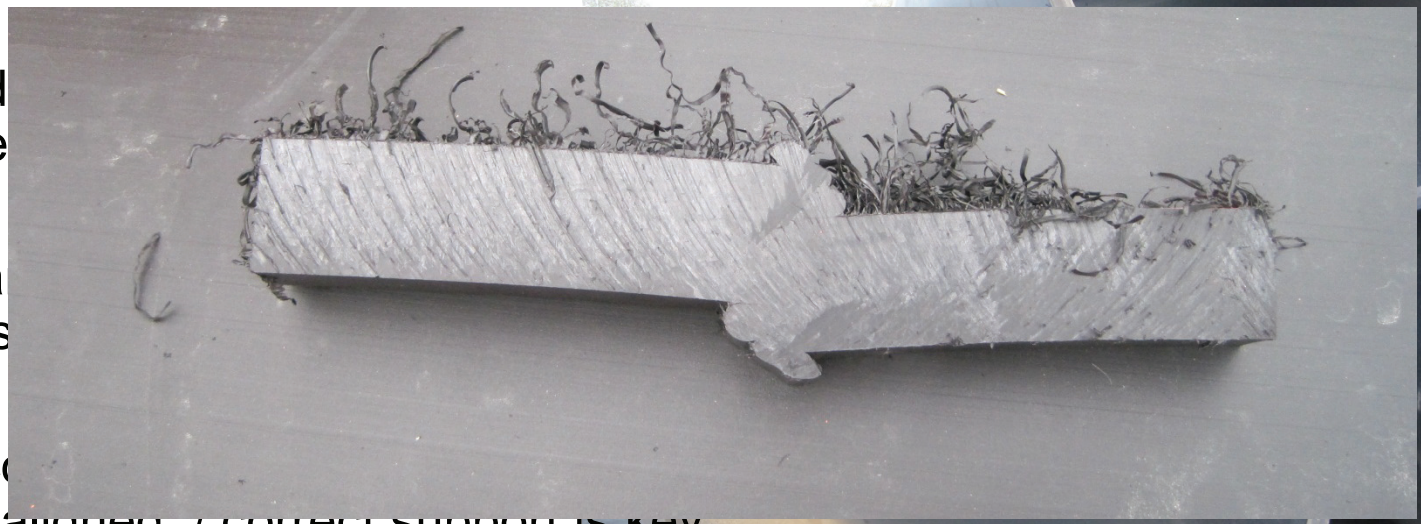
1. Gouges – 10% of wall thickness.

- Every pipeline project has gouges that are questionable.
- Contractors drag pipe – it happens.
- Contractors never like to cut them out.
- How to make your case.

Construction of HDPE Mains What to look for -

2. Alignment issues when welding

- The weld
  processe
- Offset ca
  thickness
- Having c
  properly aligned / correct support is key.
  - Clamping
  - Rotating
  - Facing …more facing
- Seen this happen when “toe-in” welded to a freshly cut pipe.



Construction of HDPE Mains What to look for -

3. Temperature, Pressure and Time

During the butt fusion weld -

- Temperature of plates should be 425 °F
- Interfacial pressure should be 75 psi
- Soak Time – Dependent on size and thickness
- Cooling Time – Dependent on size and thickness

Construction of HDPE Mains
What to look for -

4. Pressure Rating of Fittings

- Do you have the correct pressure rated fitting.
  - Fittings are de-rated if they are mitered – due to increased stress at the same wall thickness.
  - Molded fittings are typically not de-rated – increased wall thickness.
  - ASME B31.3.304.2

Construction of HDPE Mains
What to look for -

5. Connection to different size HDPE materials

- Rule of Thumb – 1 to 2 SDR different max.
- 26% different wall thickness.
- OD's must match.

Construction of HDPE Mains What to look for -

6. Operators on the Machine

- Are the operators on your machine qualified?
- PPI has testing standards
- Operators need to be certified to weld.
- Bend back testing to qualify a machine.

Construction of HDPE Mains What to look for -

7. Connection to Different Materials

- Bolting
  - Tighten and re-tighten
  - Use of flange gaskets
- Flanges / Sizing - double check in submittal phase
- Connections to PVC

Construction of HDPE Mains What to look for -

8. Installation of Tee's / Fittings / Services

- Electro-fusion
- Sidewall Fusion
- Weld tees in-line

Place tee's / services after main is placed.

Construction of HDPE Mains
What to look for -

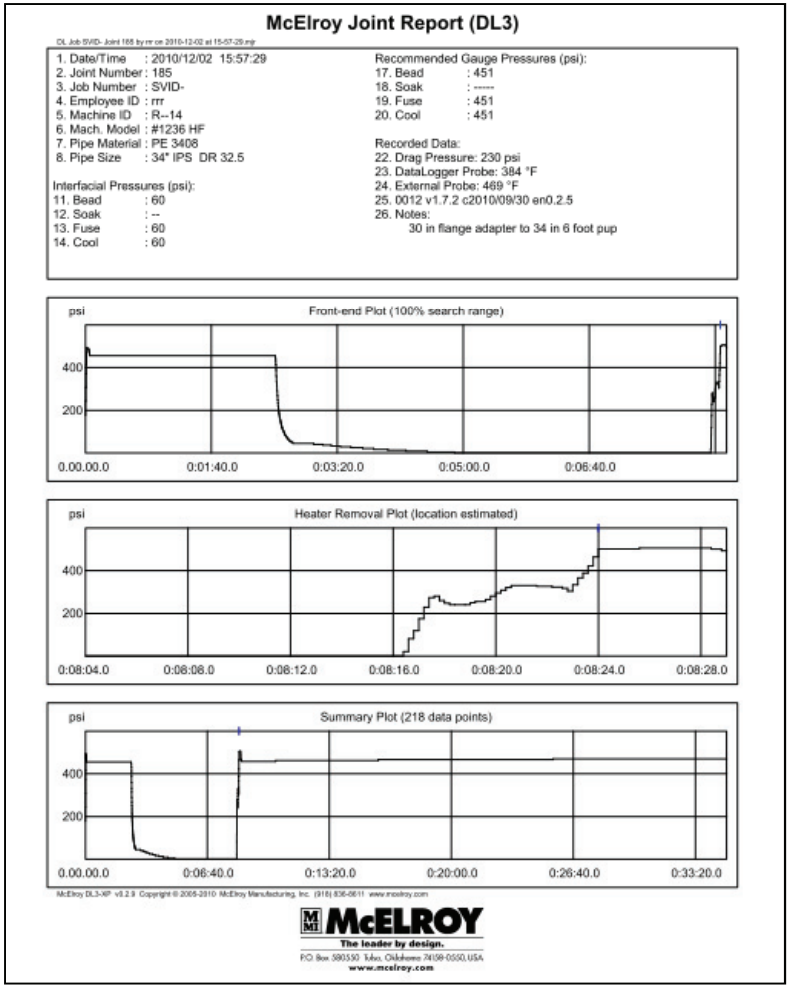
9. Electrofusion

- Scrape your pipe
- Make sure pipe is round and true.
- Make sure coupling is pushed home / no gaps.
- Make sure there is diesel in the generator…

Construction of HDPE Mains What to look for -

10. Use of data logging equipment.

- Record every joint – required.
- Number every joint to correspond to report.
- Station recording on every number of every joint



McElroy Joint Report (DL3)

DL Job SVID- Joint 185 by rrr on 2010-12-02 at 15:57:29.mjr

1. Date/Time	: 2010/12/02 15:57:29	Recommended Gauge Pressures (psi):	
2. Joint Number	: 185	17. Bead	: 451
3. Job Number	: SVID-	18. Soak	: -----
4. Employee ID	: rrr	19. Fuse	: 451
5. Machine ID	: R--14	20. Cool	: 451
6. Mach. Model	: #1236 HF		
7. Pipe Material	: PE 3408	Recorded Data:	
8. Pipe Size	: 34" IPS DR 32.5	22. Drag Pressure: 230 psi	
		23. DataLogger Probe: 384 °F	
Interfacial Pressures (psi):		24. External Probe: 469 °F	
11. Bead	: 60	25. 0012 v1.7.2 c2010/09/30 en0.2.5	
12. Soak	: --	26. Notes:	
13. Fuse	: 60	30 in flange adapter to 34 in 6 foot pup	
14. Cool	: 60		

McElroy DL3-XP v0.2.9 Copyright © 2005-2010 McElroy Manufacturing, Inc. (918) 836-0611 www.mcelroy.com

McELROY
The leader by design.
P.O. Box 580550 Tulsa, Oklahoma 74158-0550, USA
www.mcelroy.com

Construction - The Real World

Top Ten List

1. Gouges
2. Alignment Issues when welding
3. Temperature, Pressure, and Time
4. Pressure Rating of Fittings
5. Connection to Different sizes of HDPE pipe and fittings.
6. Operators on the Machine
7. Connecting to a different pipe
8. Installation of Tee's and Fittings
9. Electrofusion
10. Use of Data Logging Equipment

BONUS – What do I need if I have break?

What do I need on hand if I have a line break?

- Consistently hear from field personnel –
  - I don't use HDPE because our crews don't have the equipment to fix it.
  - If we use HDPE, we limit the number of contractors that are experienced to fix the pipe.
  - Most suppliers don't have the parts on hand / they are not readily available.

Electrofusion Machine - couplers

With an electro fusion machine, two couplers and a piece of pipe you can service almost 70% of all line breaks.

Hand welding machine.

Service up to six-inch pipe.

Let’s Weld Some Pipe…

4” Butt Fusion

8” x 2” Electrofusion saddle.

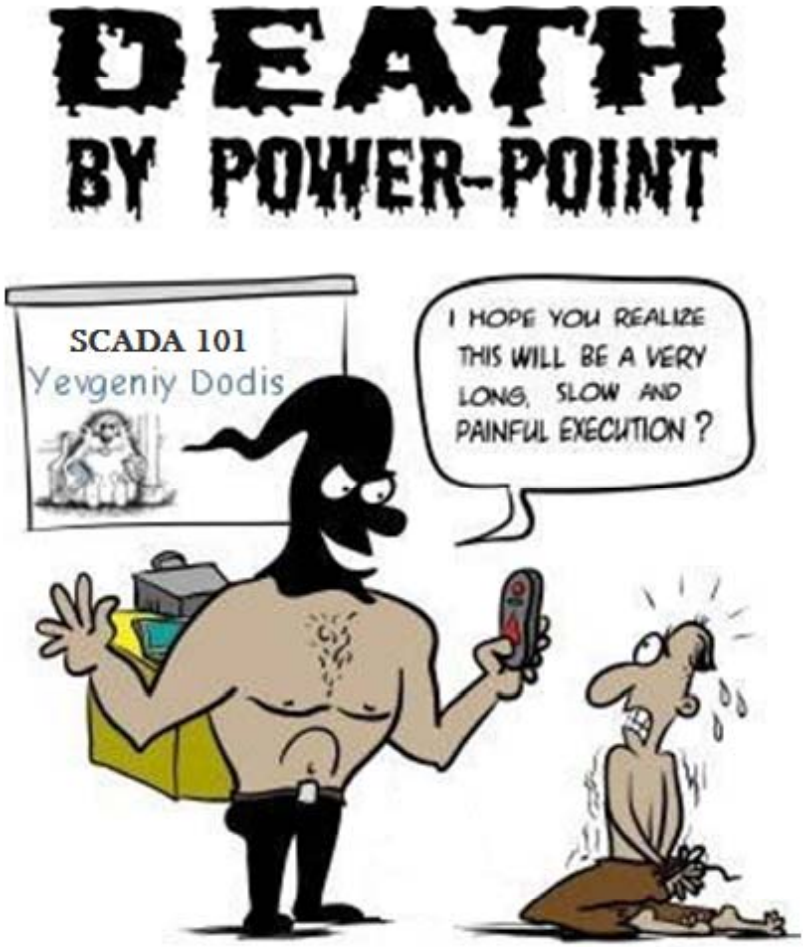
CH2MHILL

Upgrading Your SCADA System While Managing Cash Flow

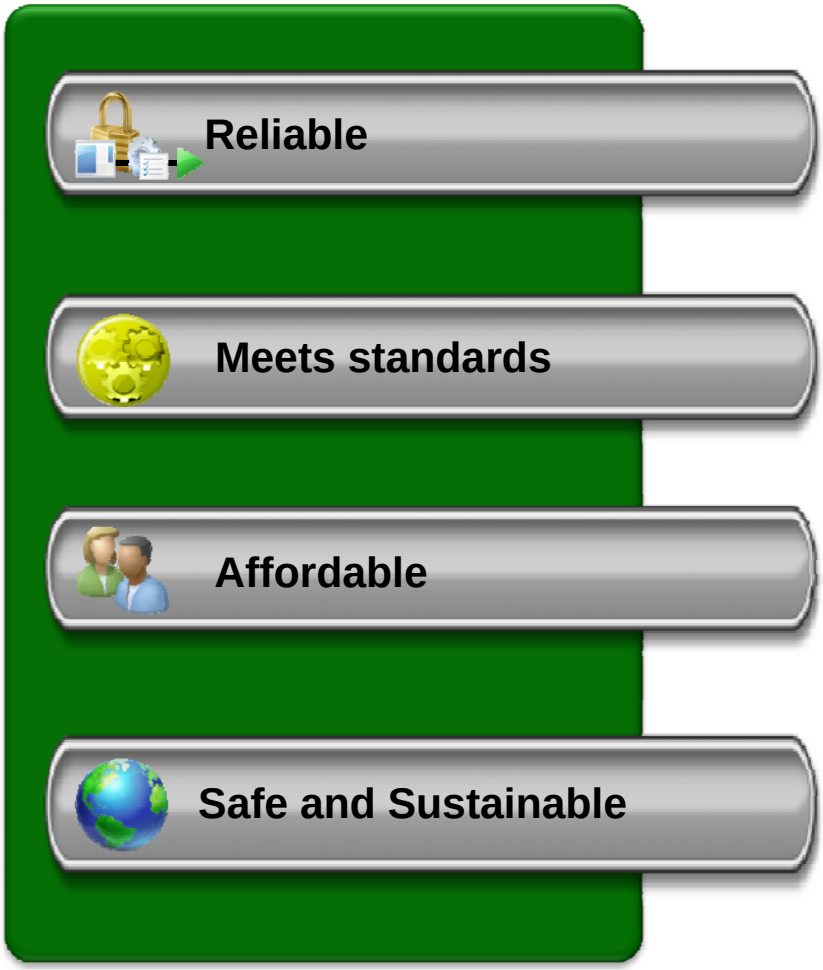
Michael Karl
CH2M HILL
mkarl@ch2m.com - May 2012

AGENDA

- SCADA's mission
- When, Why and How to upgrade
- SCADA in the distribution system
- What's new in SCADA



SCADA supports your mission



The mission: To provide the safest and most reliable services to our customers, while maintaining policies and practices that protect the environment, and promote the health and welfare of the community at a fair and equitable cost.

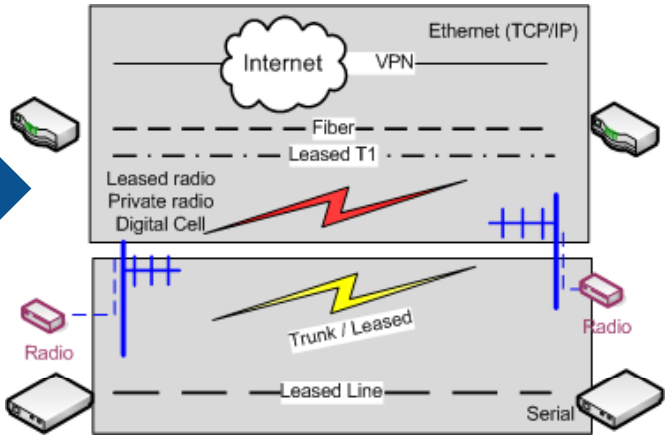
SCADA automates the monitoring and control of water systems

Human Machine Interface

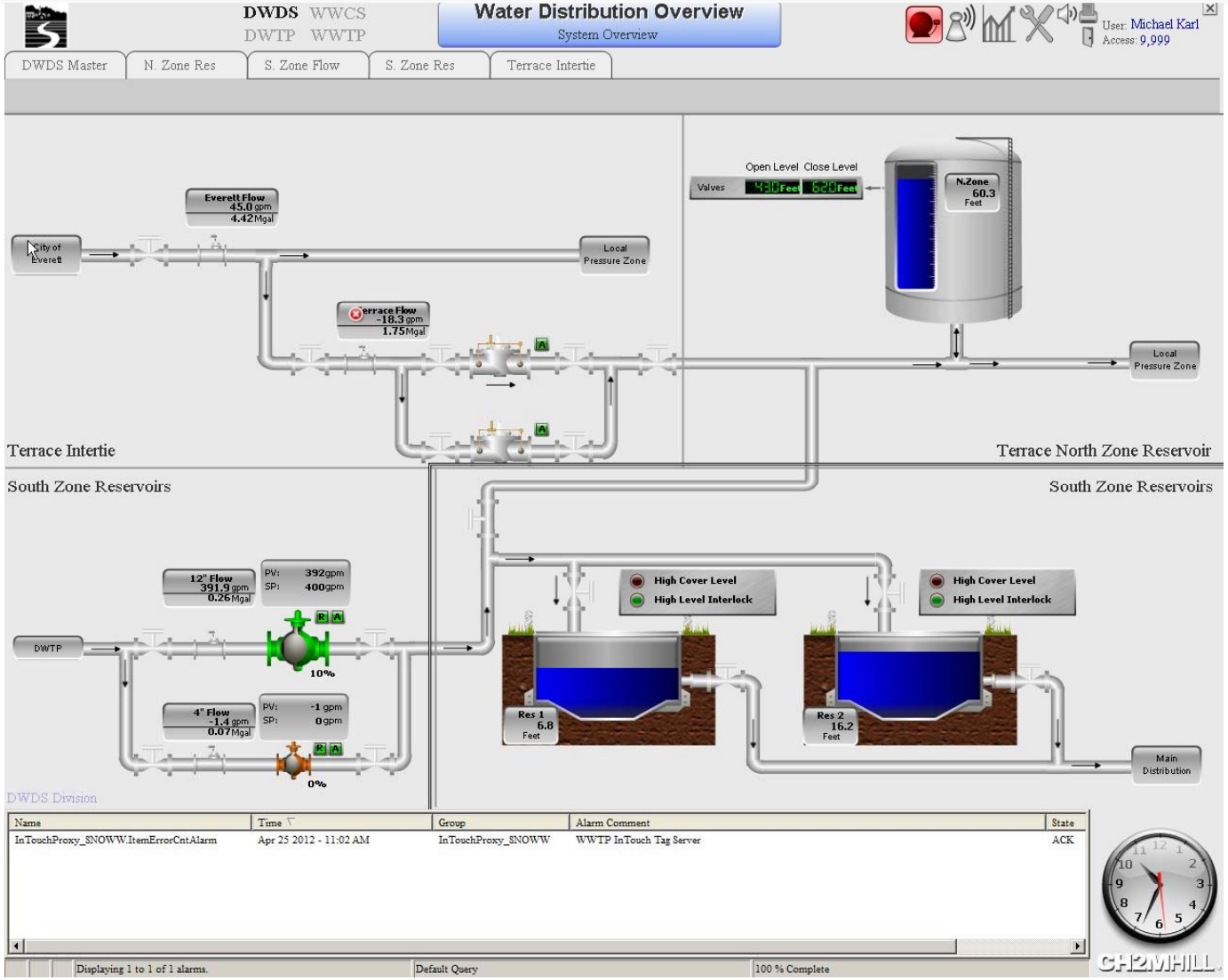
Communications

Controllers

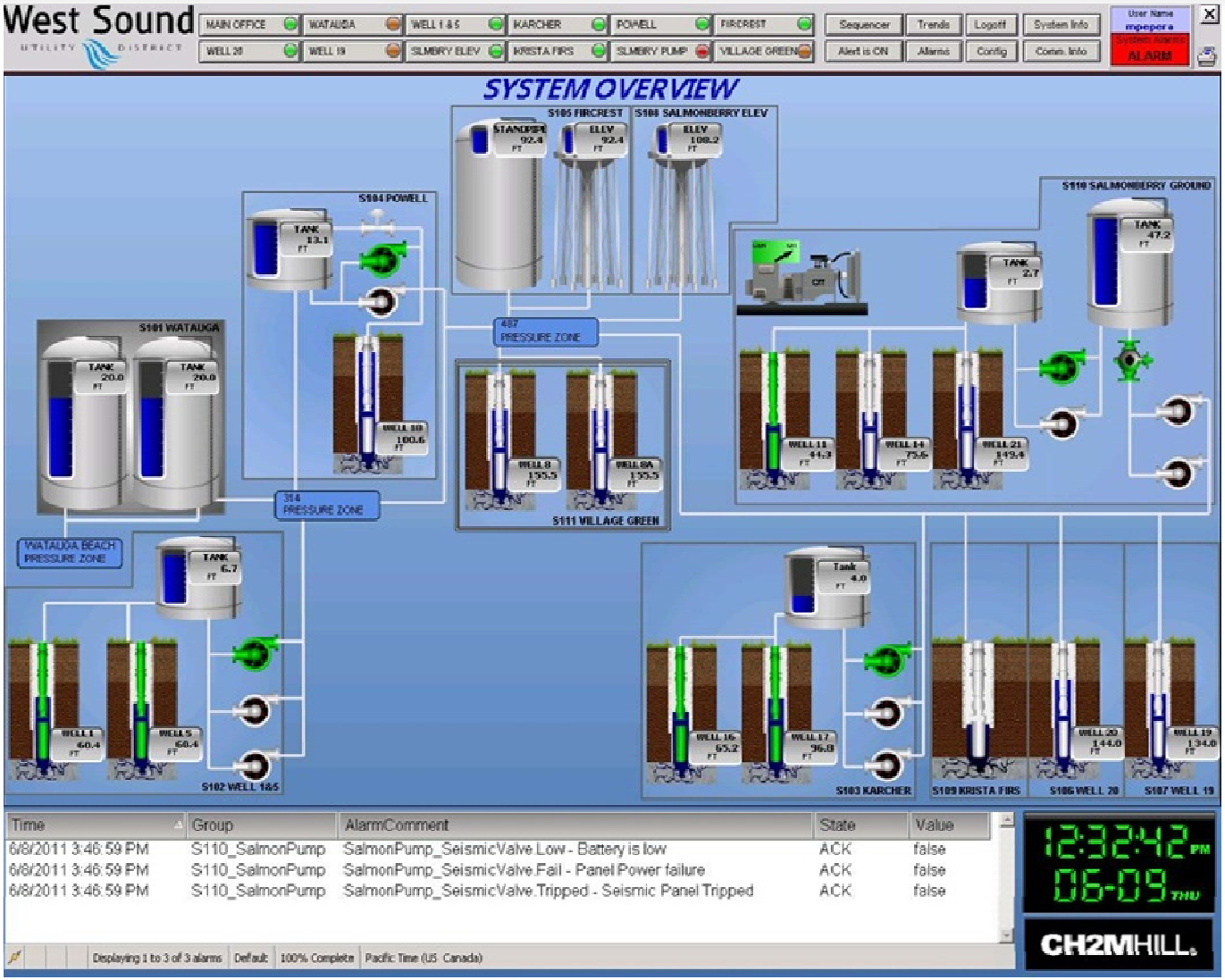
Field Equipment Sensor / Control Elements



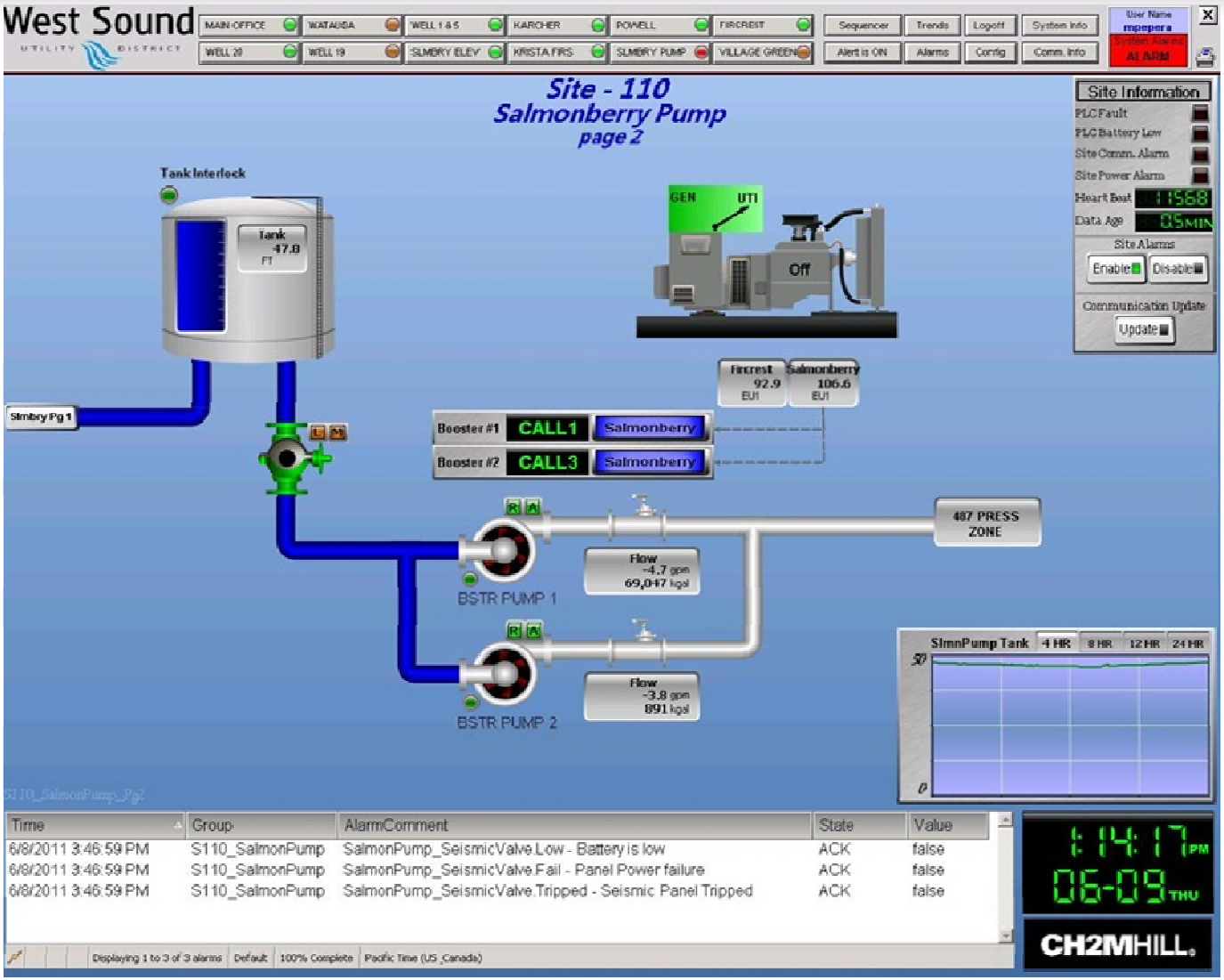
Sample HMI graphics



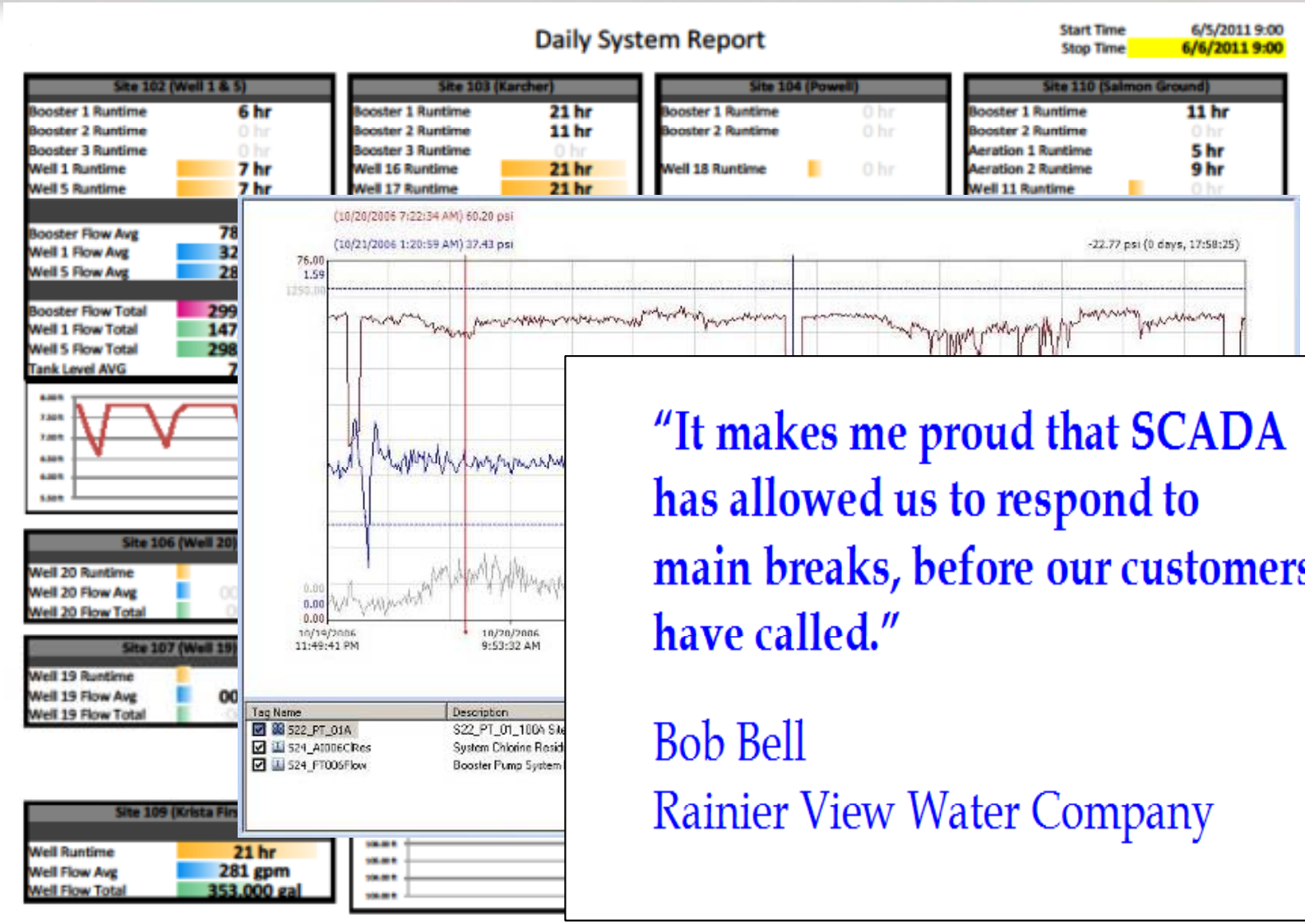
Sample HMI graphics



Sample HMI graphics



SCADA converts “geek-speak” to “operator-speak”



“It makes me proud that SCADA has allowed us to respond to main breaks, before our customers have called.”

Bob Bell

Rainier View Water Company

What does SCADA do for You?

- Monitor and control treatment process
- Remote monitoring
- Increased safety
- Lower costs
- Automated reporting
- Lower cost training and spare parts
- Fewer callouts
- Frees staff for more productive activities

"After upgrading our SCADA system, not only did our costs decrease but *our operators say their quality of life has improved*"

Michael Whitehead
West Sound Utility District

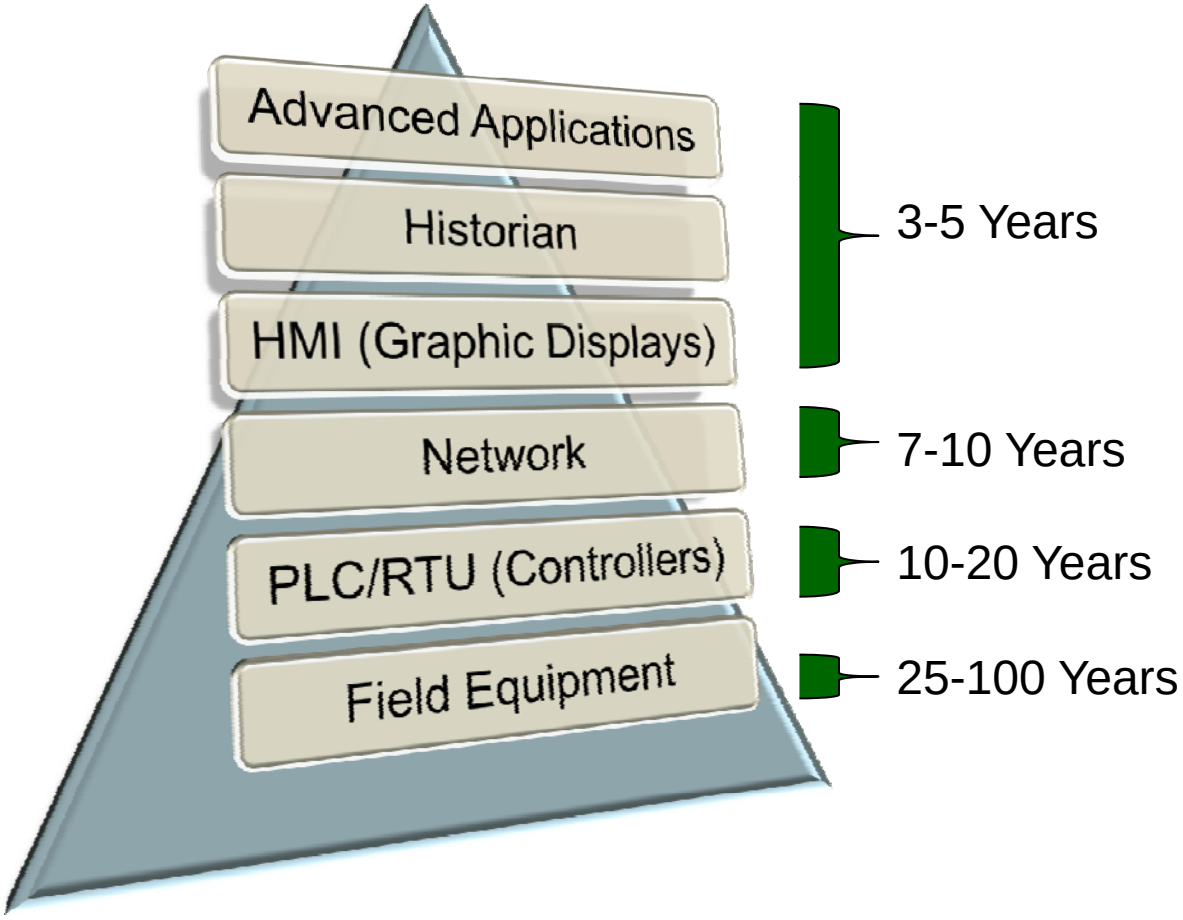
WHEN, ***WHY*** AND ***HOW*** TO UPGRADE YOUR SCADA SYSTEM

Why upgrade?

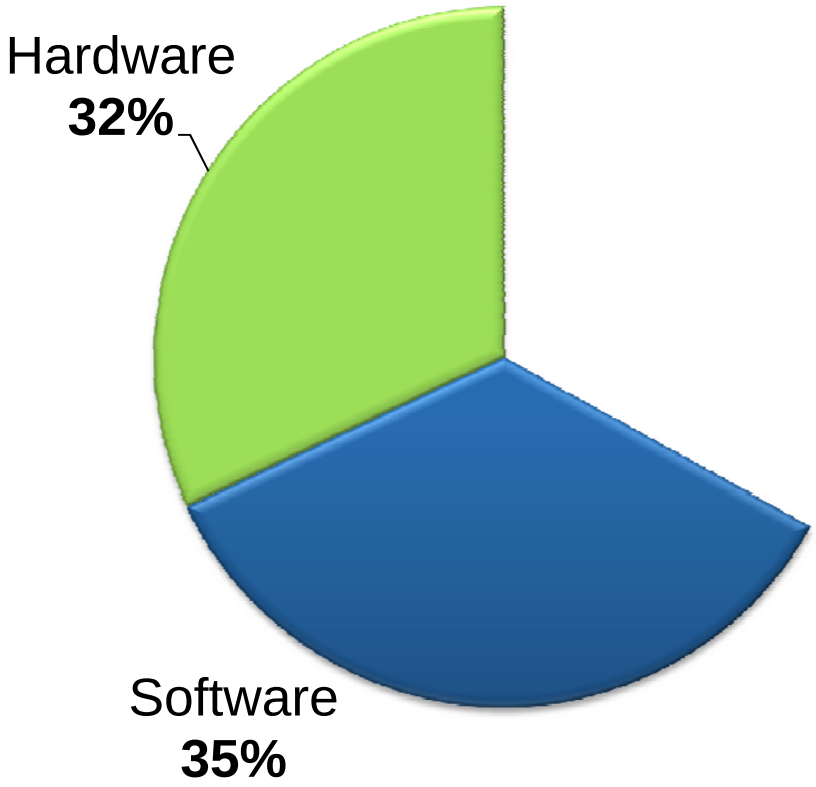
How many people have main replacement programs?

- Equipment obsolescence
  - Lack of support in failure
  - No redundancy
- Lack of documentation
- Reduce risk of permit violations, system excursions
  - As equipment ages, failure rate is not linear
  - First 10 years = 1 fail per year, then an increase
  - Failures can be expensive!
- Improve operational efficiency and quality
  - Water quality
  - Water loss
  - Energy management

Average lifespan of automation equipment



70% of system failures are hardware/software related



Lawrence Berkeley National Laboratories study

Tank overflows are a common system failure

Overflowing Tank Floods PSU Bookstore

Damage Estimated At $1 Million

POSTED: 3:46 pm PST February 8, 2010
UPDATED: 6:24 pm PST February 8, 2010

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PORTLAND, Ore. -- An overflowing tank dumped thousands of gallons of water into the Portland State Bookstore basement Sunday night, causing $1 million in damage.

On Monday, bookstore workers cleaned up the soggy mess that was caused by a sensor malfunction in the storage tank that holds water for fire suppression.

Ken Brown, who runs the Portland State Bookstore, said the sensors indicated there was little water in the tank when, in fact, it was filled with 40,000 gallons.

$1,000,000 in damage due to a $1,000 level sensor failure

Blue Screen of Death

Problem – Lack of Attention

- 3:20 PM on December 23rd
- Loss of Automation
  - Alarm monitoring
  - Alarm Notification
  - Historical Information

- Lessons Learned
  - Make Virtual Image Backups
  - Test your Backups
  - Ensure you have working manual backup

I know I need to Upgrade…

- Get in-house or outside integrator support
  - Do a system walk-through
  - Identify what needs to be upgraded
- Develop your system vision – *What do you want?*
- Know how much you can spend, over what time period
  - Dictates phasing approach
- Develop plan for cut-over to new system
- Plan for long-term support

Example vision for an upgraded SCADA system

1. **Reliable -** 24x7, with minimal interruption
2. **Responsive -** Efficient, with minimal delay
3. **Stable -** Automatically detect and compensate for failures/faults rapidly
4. **Scalable -** Accommodate future growth and expansion including addition of new sites and demands for additional capacity
5. **Flexible -** Maximize interoperability with multiple products to accommodate changes in technology
6. **Secure -** Protected from unauthorized loss, interception, and/or modification

Operators must be a part of the Vision Setting!
They are the end users.

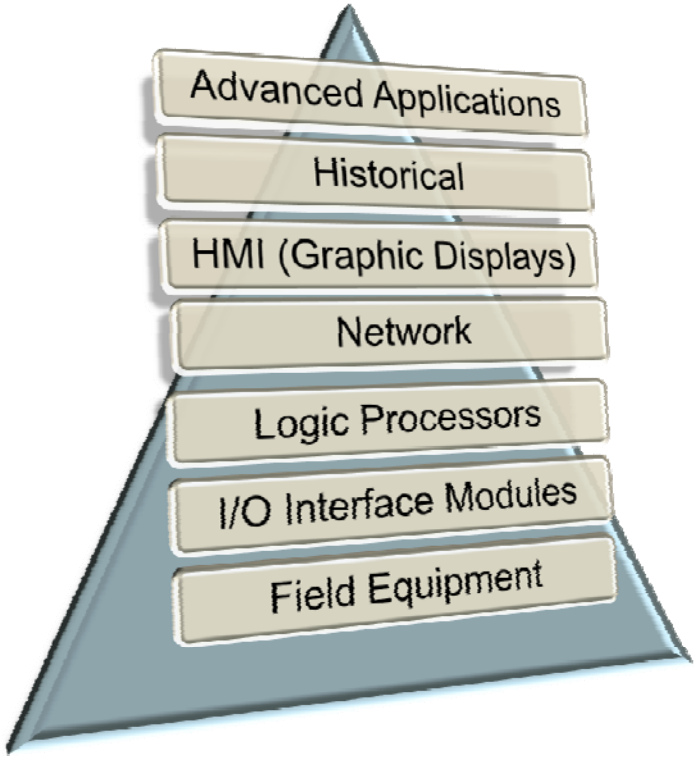
Replacement options

HORIZONTAL

- Upgrade each technology layer, one at a time

VERTICAL

- Upgrade each station or process train, one at a time

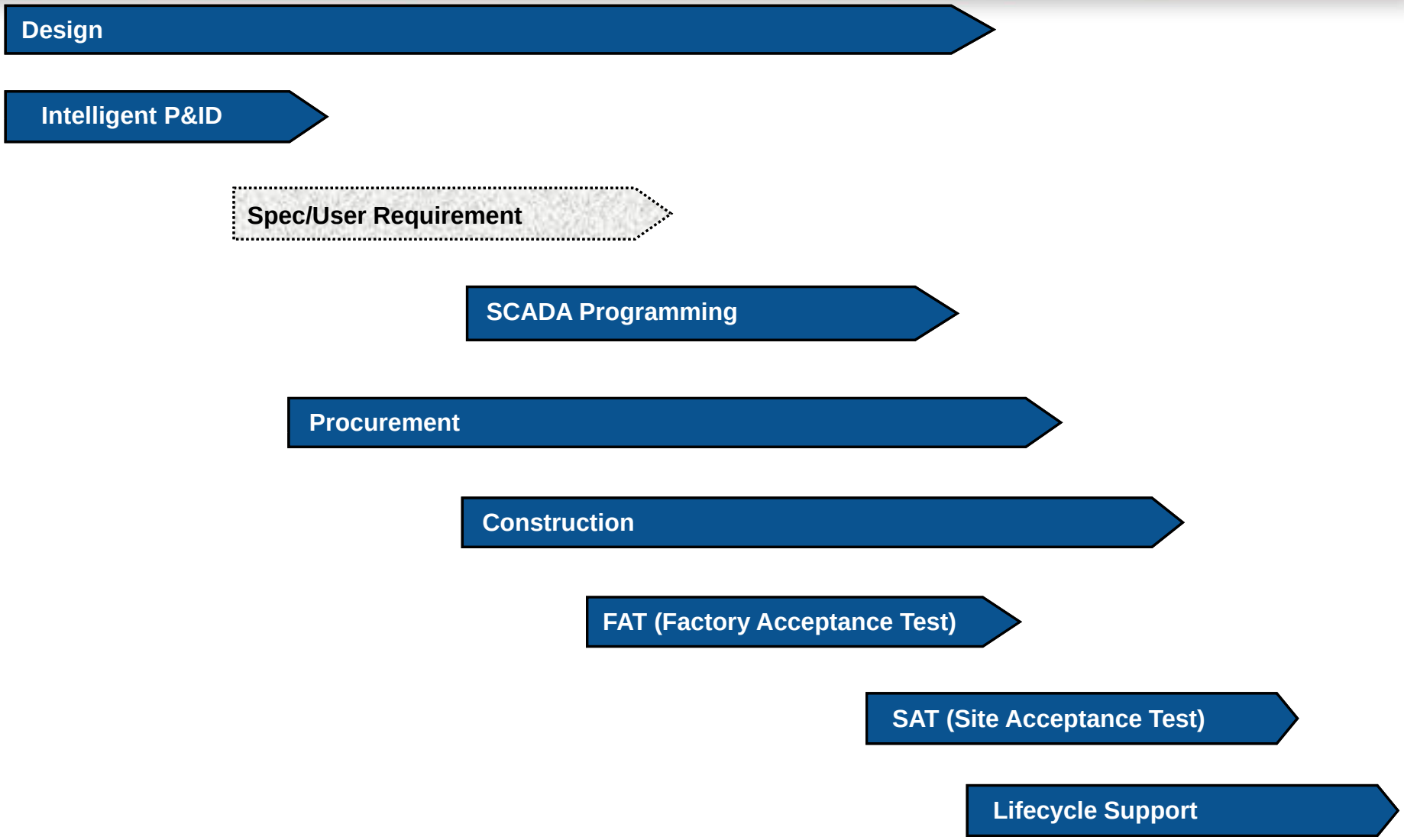


Phased approach extends the overall life of your control system

- Upgrade computer layer to current
- Upgrade network communications
- Replace remote facilities over time

Don't wait until failure to begin a phased upgrade!

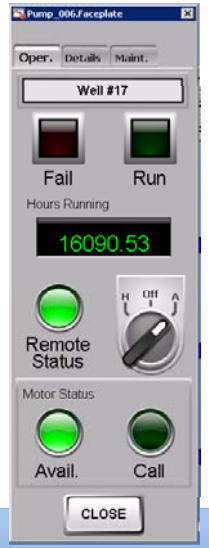
Reduce Cost and Schedule!

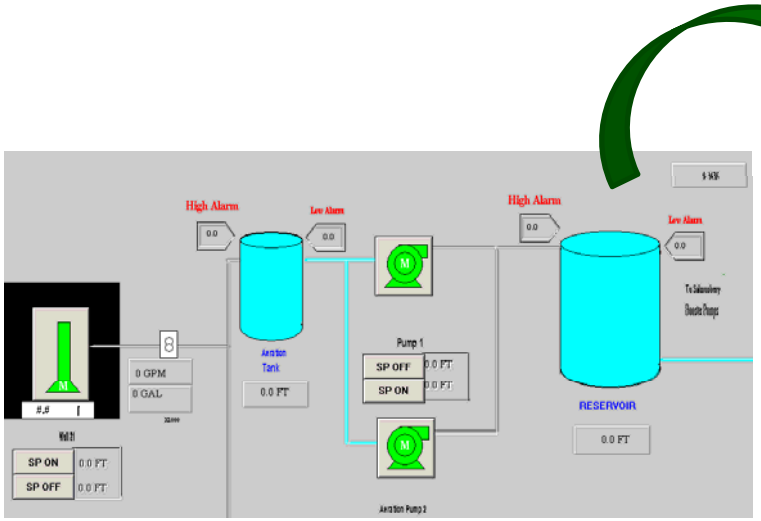


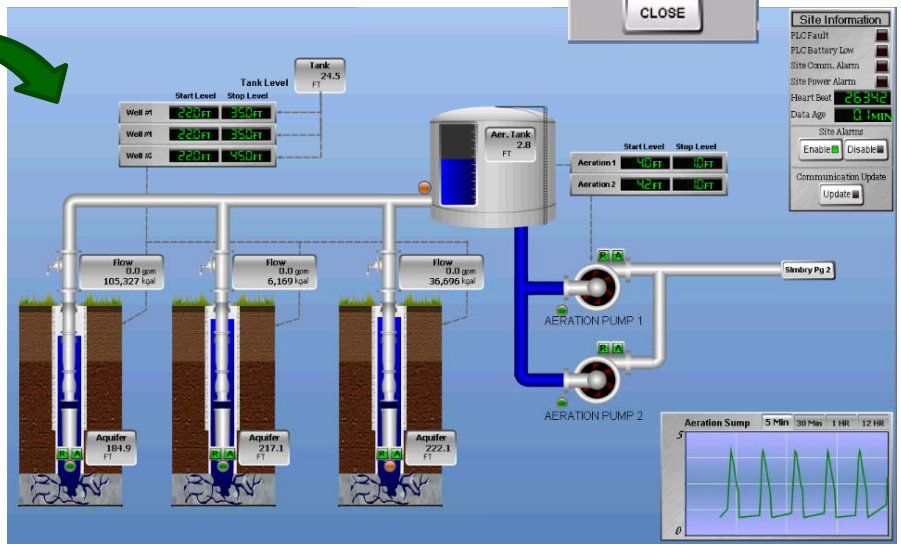
Costs are controlled by use of libraries and templates

Value of Templates and Standards

- Ease of support
- Ease of maintenance
- Uniform way of programming
- Either create your own standards or use a firm with mature delivery standards

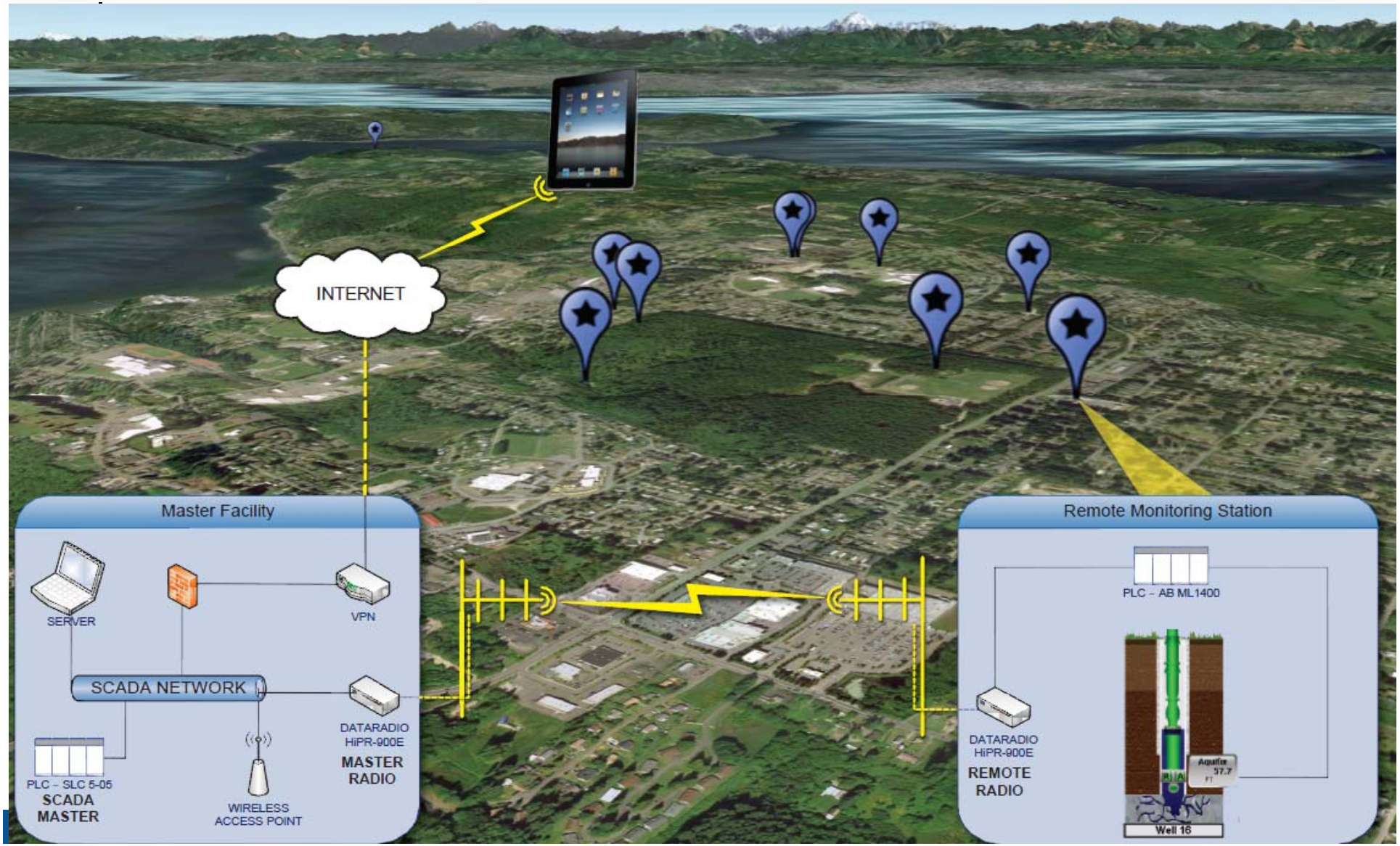




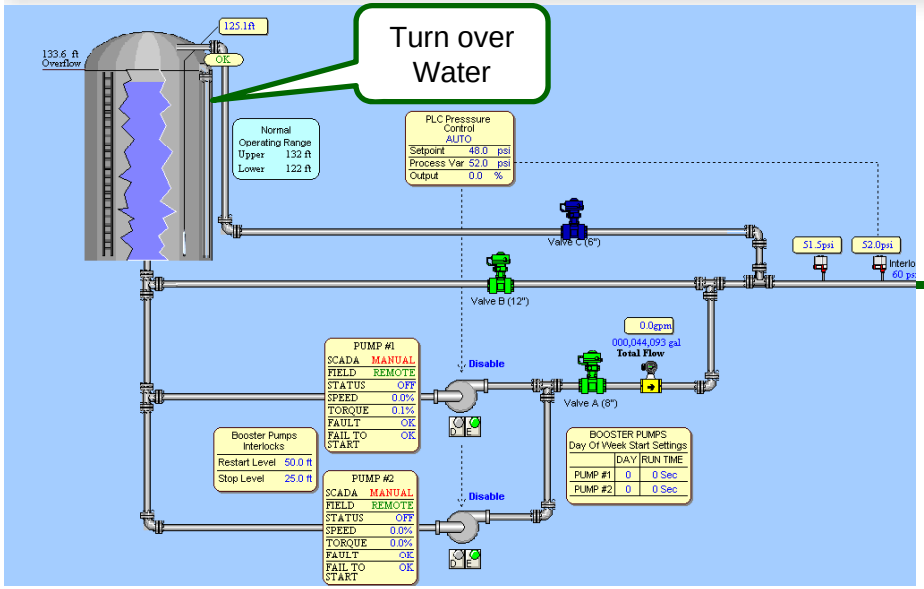


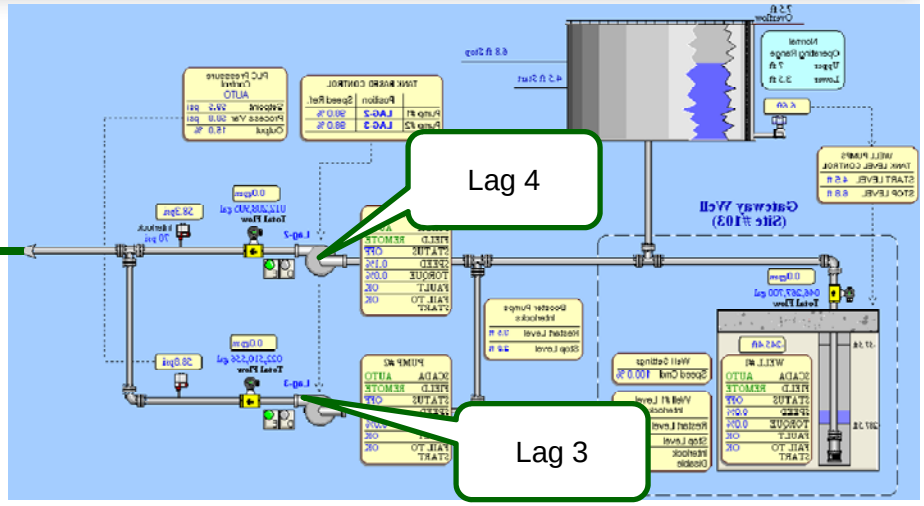
SCADA IN THE DISTRIBUTION SYSTEM

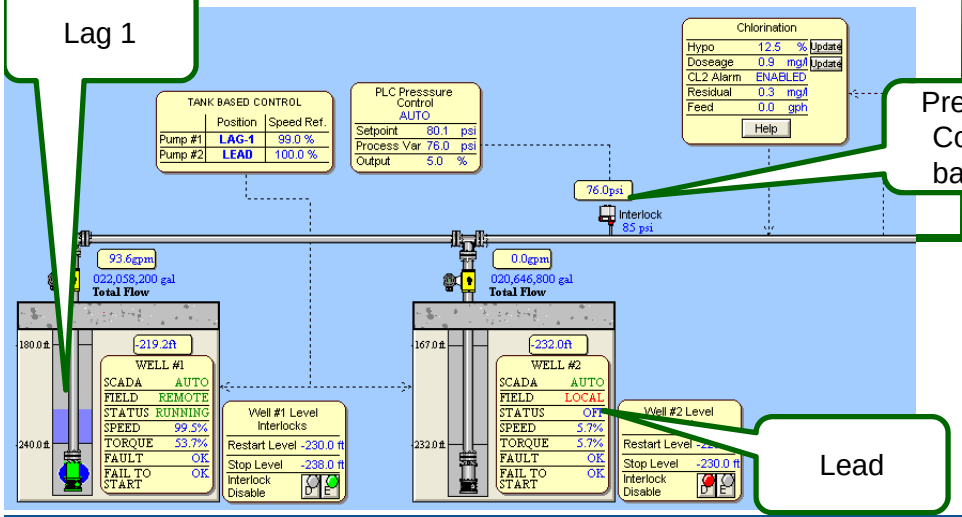
Remote facilities communicate through telemetry



Distribution system control example







Level Control

	Lead	Lag-1	Lag-2	Lag-3
Start Level	126.0 ft	125.5 ft	125.0 ft	124.5 ft
Stop Level	131.0 ft	131.0 ft	131.0 ft	131.0 ft
Start Delay	10 sec	4.0 hr	8.0 hr	4.0 hr
Stop Delay	10 sec	30 sec	30 sec	30 sec
	Called	Called		

Tank Based Sequence Control

Source	Control	Avail	Status	Speed	Selection
Olympic Mall Docster #1	TANK BASED	YES	OFF	90.0 %	LEAD LAG-1 **LAG-2** LAG-3 DIS
Olympic Mall Docster #2	LOCAL PRESS.	YES	OFF	90.0 %	LEAD LAG-1 LAG-2 **LAG-3** DIS
Reid Road Well #1	TANK BASED	YES	RUNNING	99.0 %	LEAD **LAG-1** LAG-2 LAG-3 DIS
Reid Road Well #2	LOCAL PRESS.	NO	OFF	100.0 %	LEAD LAG-1 LAG-2 LAG-3 DIS

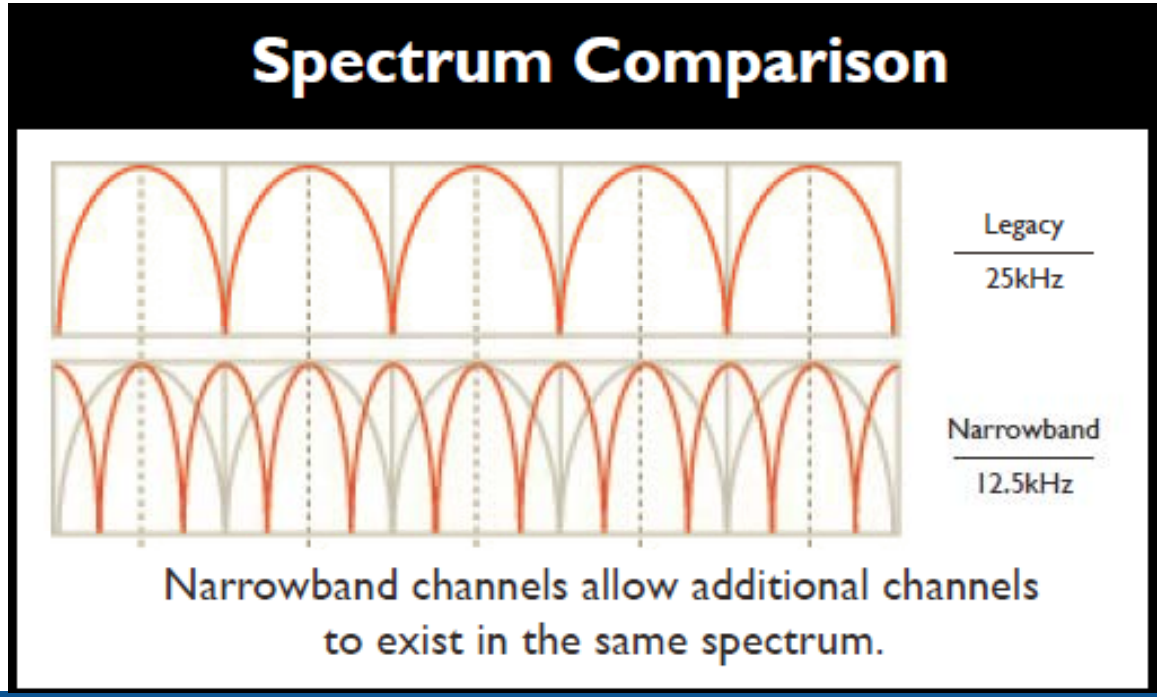
Available Pumps: 3 Running Pumps: 1
Pumps Required: CAL_LAG 1

Lead/Lag Shuffle: **ENABLE** DISABLE

CH2MHILL

All 2-way radios must be narrowband by January 1, 2013

- FCC requirement
- Replace old radios – 25 kHz
- Renew license for compliant radios – 12.5 kHz
- Fines of up to $10,000 per day



Mobile applications make operator's job easier

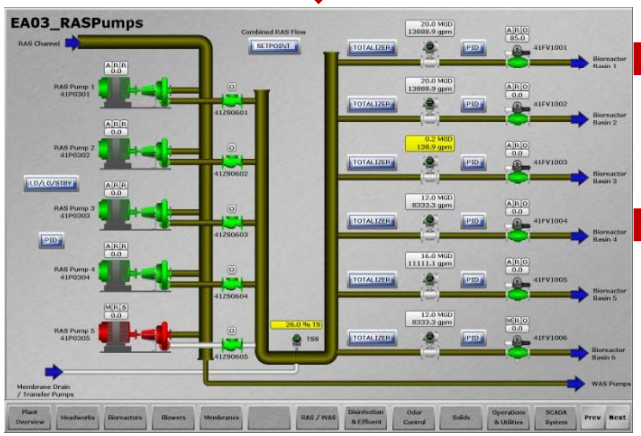
Plant site generates data

Secured Hosted Database.
SQL server based Web Service

Administrative Control
Web Login

Third Party PUSH Service

Mobile apps to view and
analyze data



Secured Transmission via
SSL under HTTPS Formats:
SOAP, POX and JSON

Remote View Application

Send data from HMI, Excel, Historian(s), Information Server

- On-demand (manually, using Excel Template)
- Real-Time (automatically, using connectors)

iPad is a great tool for operators

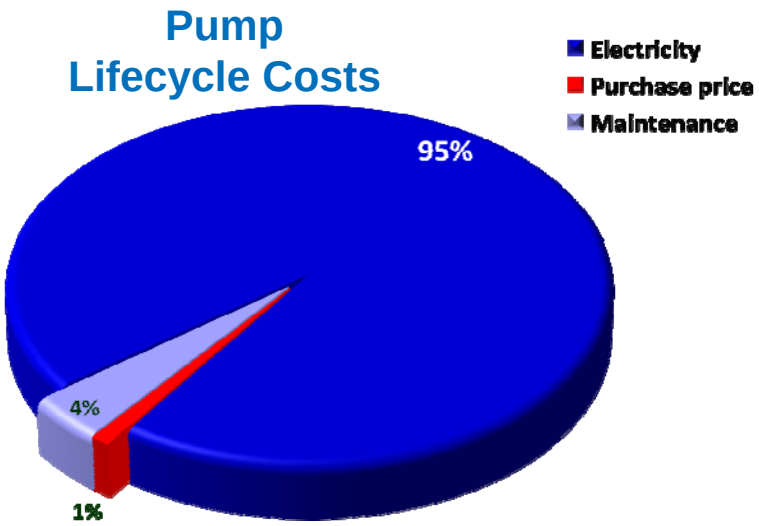
WHAT'S NEW IN SCADA

Hot trends

- Energy management
- Use of mobile devices and “Cloud”
- Virtualization
- Cyber Security

Newer software tracks energy use…

- Identify malfunctioning pumps
- Proactive preventative maintenance
- Extend equipment life
- Minimize power use



…and reduces operator time

- Control screens show equipment
- Reduce need for operators to drive out to pumps and stations
- Saves time and fuel
- Reduces maintenance and wear on vehicles

Who's heard of the "Cloud"?

Virtualization

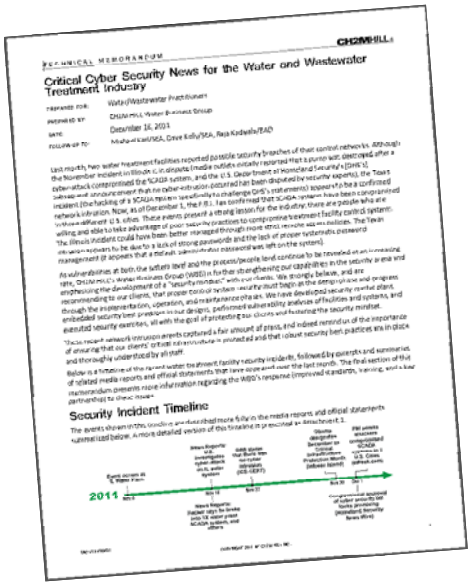
Virtualization	• What is Virtualization? • What benefits does it have?
Microsoft's Solution	• Core focus Server 2008 Hyper V
Hyper V	• Structure of Hyper V • Implementation
Fail Over Clusters	• High availability • Disaster Recovery

Stepping into the future: immersive virtual reality plant – EYESim for plant crew training

EYESim- 3D modelling

Critical cyber security news for the water and wastewater treatment industry

- U.S. investigates cyber-attack on Springfield, Illinois water system
- Two water treatment facilities reported possible security breaches of their control networks


TECHNICAL MEMORANDUM

CH2MHILL

Critical Cyber Security News for the Water and Wastewater Treatment Industry

Prepared for: Water/Wastewater Practitioners

Prepared by: CH2M HILL Water Business Group

Date: December 16, 2011

Follow-up to: Michael Lee/USEA, Dave Kelly/SEA, Rea Kadwell/EAD

Last month, two water treatment facilities reported possible security breaches of their control networks. Although the November incident in Illinois (i.e. disgruntled insider outside entity) reported that a pump was destroyed after a cyber-attack compromised the SCADA system, and the U.S. Department of Homeland Security (DHS's) subsequent and concurrent report that no cyber-intrusion occurred has been disputed by security experts), the Texas incident (the hacking of a SCADA system specifically to challenge DHS's statements) appears to be a confirmed network intrusion. Now, as of December 1, the F.B.I. has confirmed that SCADA systems have been compromised without-different U.S. cities. These events present a strong lesson for the industry: there are people who are willing and able to take advantage of poor security practices to compromise treatment facility control systems. The Illinois incident could have been better managed through more strict remote access policies. The Texas incident appears to be due to a lack of strong passwords and the lack of proper systematic password management (it appears that a default administrator password was left on the system).

As vulnerabilities at both the system level and the process/people level continue to be revealed on an increasing rate, CH2M HILL's Water Business Group (WBG) is further strengthening our capabilities in the security arena and emphasizing the development of a "security mindset" with our clients. We strongly believe, and are recommending to our clients, that proper control system security must begin at the design phase and progress through the implementation, operation, and maintenance phases. We have developed security-minded plans, embedded security-level protection in our designs, performed vulnerability analyses of facilities and systems, and executed security exercises, all with the goal of protecting our clients and fostering the security mindset.

"These recent network intrusion events captured a fair amount of press, and indeed remind us of the importance of ensuring that our clients' critical infrastructure is protected and that robust security best practices are in place and thoroughly understood by all staff.

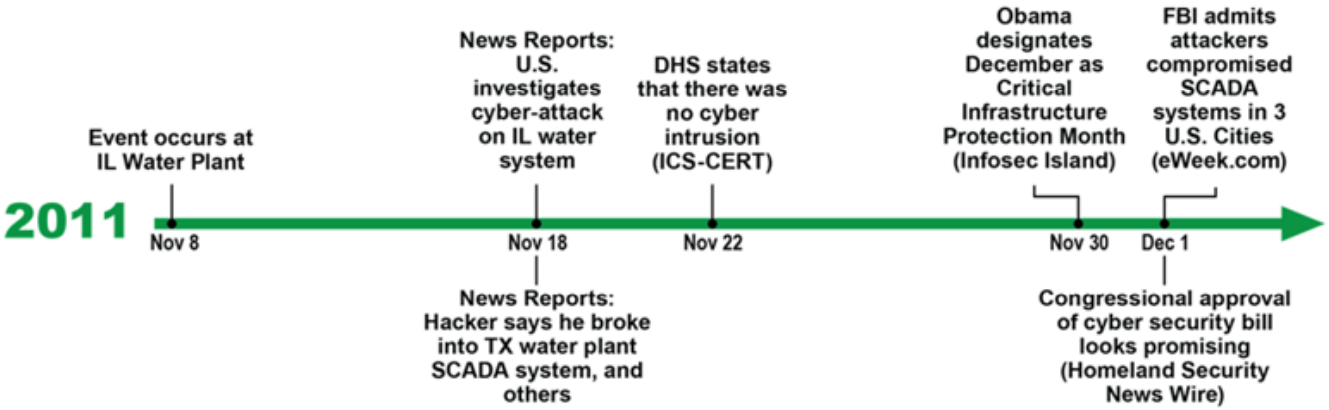
Below is a timeline of the recent water treatment facility security incidents, followed by excerpts and summaries of related media reports and official statements that have appeared over the last month. The final section of this memorandum presents more information regarding the WBG's response (improved standards, training, and a few partnerships to stress issues).

Security Incident Timeline

The events shown in this timeline are described more fully in the media reports and official statements summarized below. A more detailed version of this timeline is provided as Attachment 1.

2011

Security Incident Timeline



What is needed to perform a hack?

Attacker (threat agent)

- Hacker
- Virus
- Malware
- Insider
- Vendor
- Activist group
- Organized crime

Communications channel

- Dial-up telephone
- Cellular communications
- Leased communication
- Satellite
- Internet
- LAN/WAN
- Wireless/WiFi
- **Removable media**
- **Laptops**

Weakness (vulnerability)

- Poor policy
- Insufficient firewall
- **Windows updates**
- **Application patches**
- Poor configuration network
- Un-necessary applications
- **Poorly configured application**
- Default passwords

Targeted device

- HMI work station
- Application server
- Historian server
- PCs
- Radio equipment
- PLC
- RTU

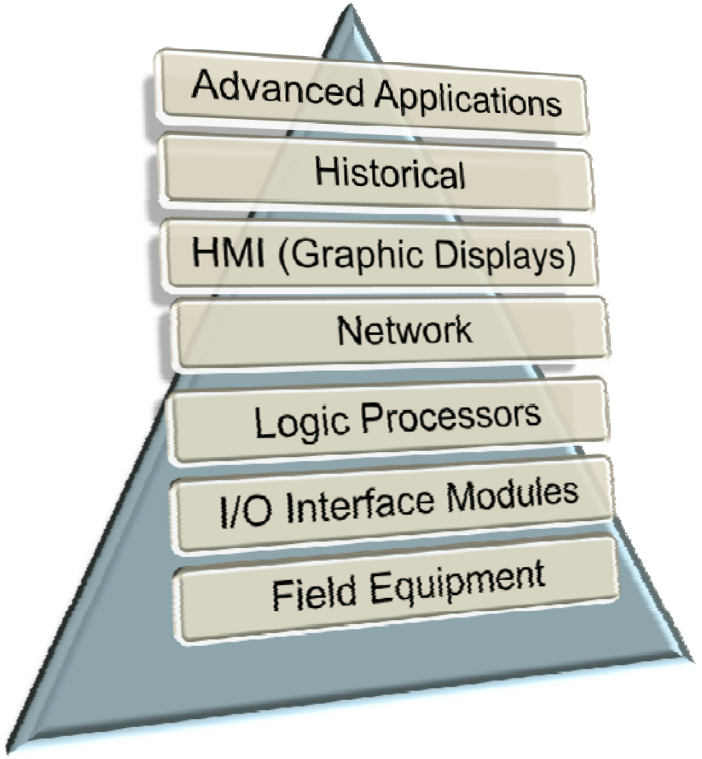
How to protect against most risks

- Regularly evaluate your assets
- Implement Policies
  - Written procedures, lead by example
  - Training, background checks
  - Access restrictions, ID badges
- Physical Securities
  - Gates, walls, fences
  - Access controls, surveillance
- Regularly Review Cyber Security
  - Business Network and SCADA networks
  - Patch Management
  - Firewall, passwords
  - Separation of networks, data encryption

Note: Image courtesy of Google Images

Summary - SCADA supports Your mission

- Provides powerful benefits
  - *System monitoring & control*
  - *Efficiency and cost savings*
- Upgrades can be easily phased
- New technology make operator's life easier
- Industry trends to watch:
  - Energy management
  - Mobile applications
  - Virtualization
  - Cybersecurity



CH2MHILL

Thank you-
Discussion and Feedback

Michael Karl | CH2M HILL
mkarl@ch2m.com

May 2012