October 15—18, 2017
St. Simons, Georgia

2017 EXECUTIVE MANAGEMENT CONFERENCE

Continuous Assessments of Vulnerabilities to Improve Capital Investment Planning

Onondaga County Water Authority

October 2017

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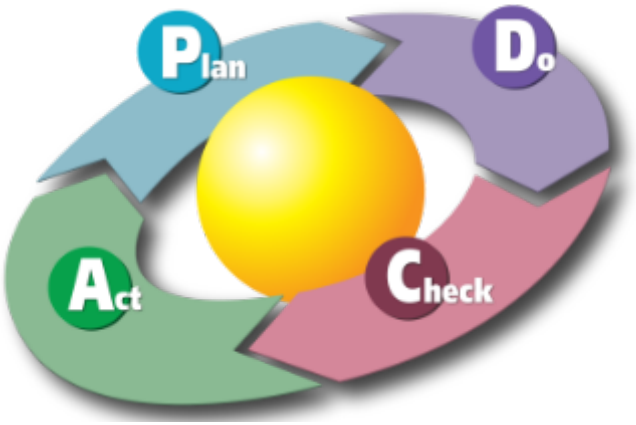
Barton & Loguidice

Agenda

1. What is OCWA
2. J100 Standard for Risk and Resilience Management
3. Risk Assessment and Managing Assets
    1. Counter Measure Valuations
    2. Risk Management
    3. Elements of Risk
4. Questions

Not A Project
But Continuous
Improvement Program

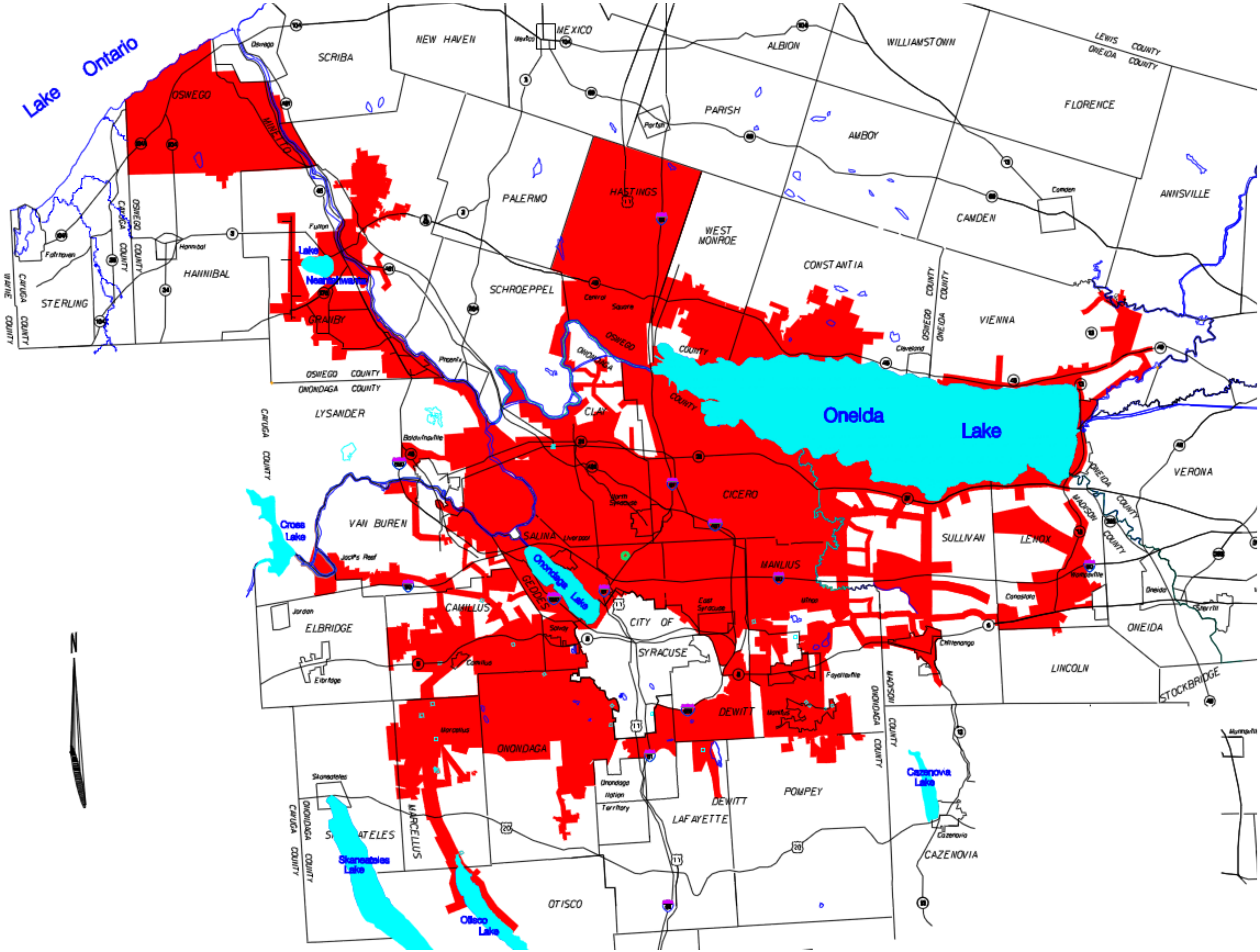


What is OCWA

- Onondaga County Water Authority
- Located in Central New York
- Formed in 1951 as a Public Benefit Corporation – NYS Authority Law
- Began operation in 1955 after purchase of New York Water Service's Assets
- Provided water to suburbs of Syracuse, NY

OCWA System Overview

- Total system delivery – 38 MGD
- From Otisco Lake WTP – 18 MGD
- From Lake Ontario – 19 MGD
- From Skaneateles Lake – 1 MGD
- Population served – 500,000
- Storage facilities – 54
- Pumping facilities – 47
- 2,040 miles of water main
- 13,000 fire hydrants
- 70 + Pressure Zones
- 175 Sites


Lake Ontario
OSWEGO
SCRIBA
NEW HAVEN
MEXICO
ALBION
WILLIAMSTOWN
LEWIS COUNTY
ONEIDA COUNTY
FLORENCE
PARISH
AMBOY
PALERMO
HASTINGS
WEST MONROE
CAMDEN
ANNSVILLE
CONSTANTIA
VIENNA
SCHROEPPEL
HANNIBAL
STERLING
GRANBY
OSWEGO COUNTY
ONONDAGA COUNTY
CAYUGA COUNTY
WAYNE COUNTY
Lake Neatahwanta
LYSANDER
CLAY
Oneida Lake
VERONA
CICERO
VAN BUREN
Cross Lake
SALINA
SULLIVAN
LENOX
MANLIUS
CAMILLUS
Onondaga Lake
GEDDES
CITY OF SYRACUSE
ELBRIDGE
ONEIDA
LINCOLN
DEWITT
STOCKBRIDGE
ONONDAGA
MADISON COUNTY
POMPEY
LAFAYETTE
SKANEATELES
MARCELLUS
Skaneateles Lake
Cazenovia Lake
CAZENOVIA
OTISCO
Otisco Lake
N

OCWA's Continuous Growth and Consolidation

- OCWA continues to expanded in Central New York
- Now serves a 5 County area including portions of Onondaga, Oswego, Madison, Cayuga, and Oneida Counties
- One of the largest Public Water Suppliers in the NY State

OCWA Statistics

- ~ 102,000 + Customer Accounts Served
- ~ 340,000 People Supplied Water
- 38 Million Gallons of Water Delivered Each Day
- 2,000 + Miles of Water Main Maintained
- 1 Treatment Plant
- 54 Tanks
- 41 Pump Stations
- 70 Pressure Zones Operated
- **175 Sites**

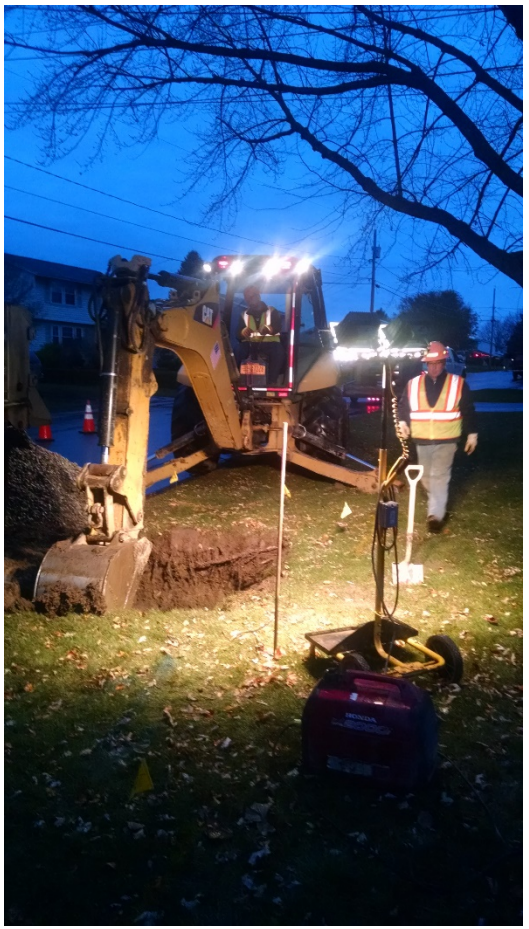
Risk Analysis and Management for Critical Asset Protection (RAMCAP®)

In May 4, 2010 the RAMCAP Standard for Risk and Resilience Management of Water and Wastewater Systems Using the ASME-ITI RAMCAP Plus Methodology was published

Tools to help develop a risk assessment become available including:

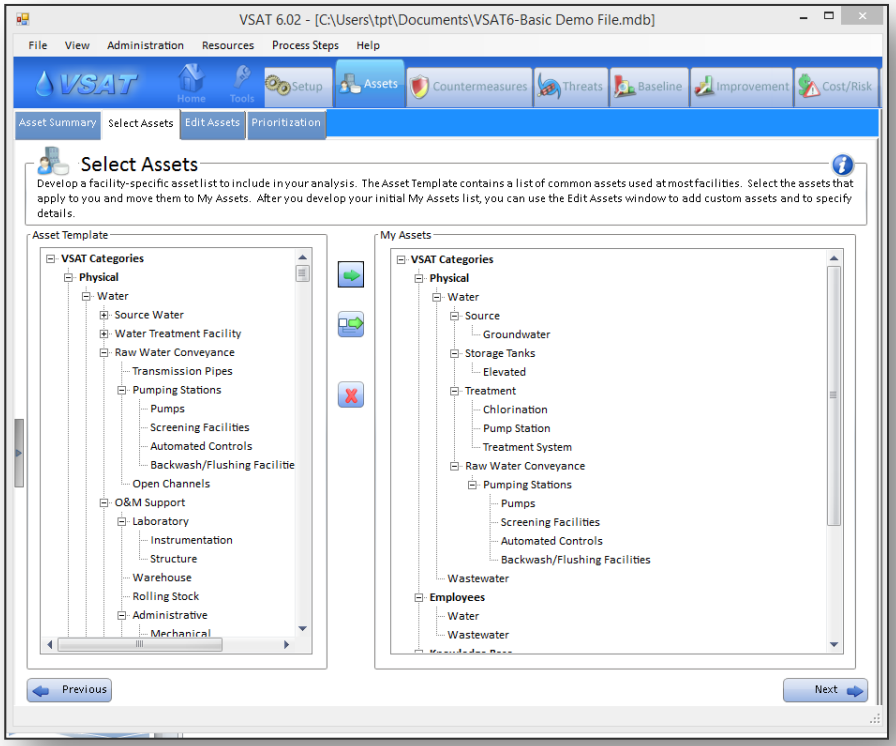
1. Risk Assessment Methodology—Water (RAM-W™)

2. Vulnerability Self-Assessment Tool™ (VSAT™)



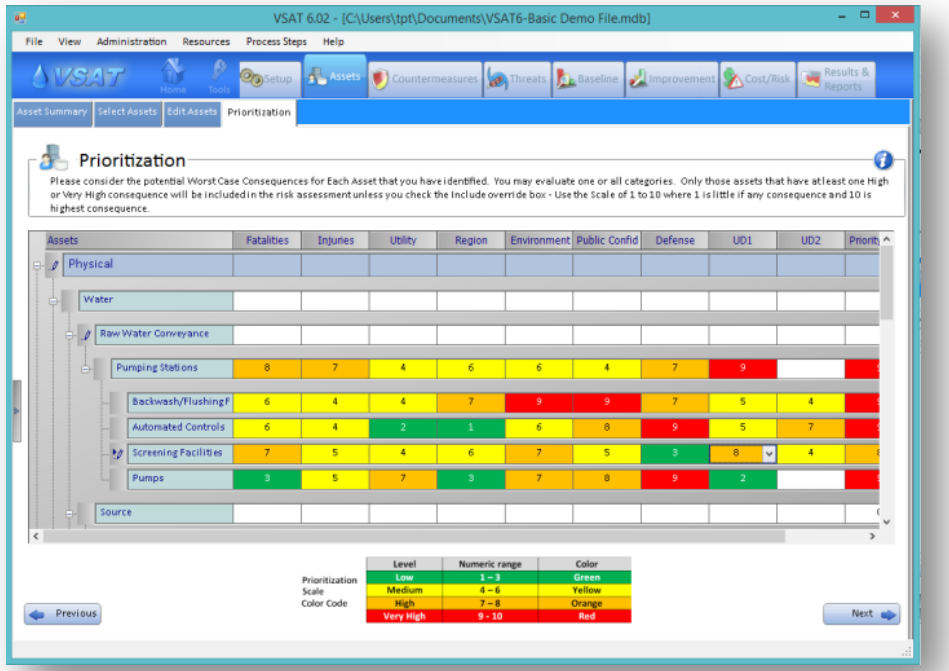
Vulnerability Self-Assessment Tool (VSAT) 6.0

EPA developed the Vulnerability Self-Assessment Tool (VSAT) to assist water and wastewater utilities of all sizes with determining vulnerabilities to both man-made and natural hazards and with evaluating potential improvements to enhance their security and resiliency.



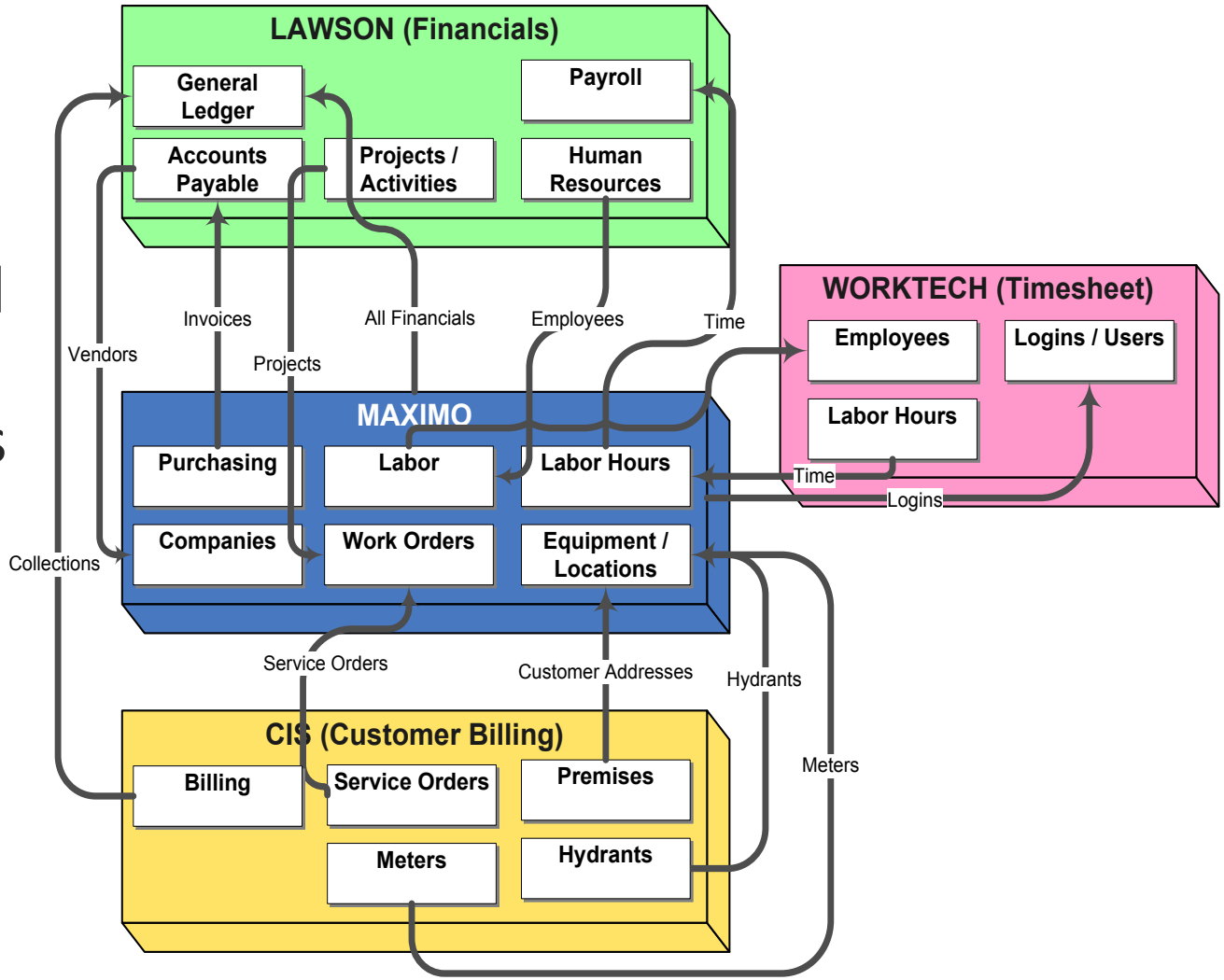
Risk Assessment Criteria is not a Good Match for OCWA

- Stand-alone database, not integrated with other systems
- Difficult to manage a large number of assets / sites
- No tracking of status of recommendations
- Limiting in how risk was captured



OCWA's Maximo Asset Management System

Implemented in 2003 – a central component for their operations



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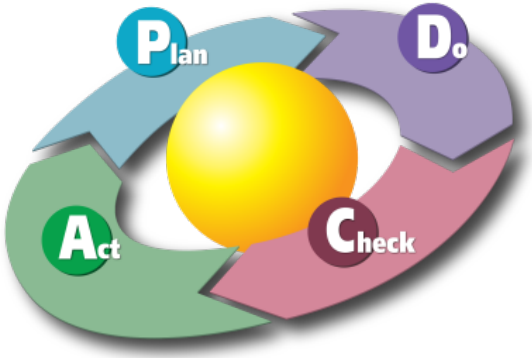
1 Risk Assessment

Assess the Consequence of a Successful Threat and Likelihood it is Going to Occur



Risk Characterization

R = C x V x T, where

Consequence (C) is the result of an event occurrence, including immediate, short- and long-term, direct and indirect losses and effects.

Vulnerability (V) in VSAT is viewed as a function of countermeasure capabilities to withstand a threat.

- Assessment of Counter Measures

Threat Likelihood (T), also referred to as the probability of occurrence, is the probability of the event occurring.

Five Classifications of Countermeasures

1. Consequence Reduction
2. Delay
3. Detection
4. Response
5. Other

Countermeasures

Facility Type												Class	Type	Counter Measure
Elevated Tank	Ground Tank - Steel	Large Pump Station	Meter or Control Valve Pit	OCWA - Organization	Ground Tank - Concrete	Small Pump Station	Facility / Building	Tank - Standpipe	Intake / Dam	Treatment Plant	Undergound Reservoir			
Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Delay	Barriers	Bollards
		Y				Y	Y			Y		Delay	Barriers	Bullet Resistant Windows
		Y				Y	Y			Y		Delay	Barriers	Films for glass shatter protection
												Delay	Barriers	Jersey barriers
												Delay	Barriers	King-tut blocks
												Delay	Barriers	Outfall entry barrier
												Delay	Barriers	Perimeter concrete wall
Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Delay	Barriers	Perimeter fencing
Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Delay	Locks	Hardened doors, welded hinges
Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Delay	Locks	Hardened gates
Y	Y				Y			Y				Delay	Locks	Hardened ladder access

Elevated Tank

Ground Tank - Steel

Large Pump Station

Meter or Control Valve Pit

OCWA - Organization

Ground Tank - Concrete

Small Pump Station

Facility / Building

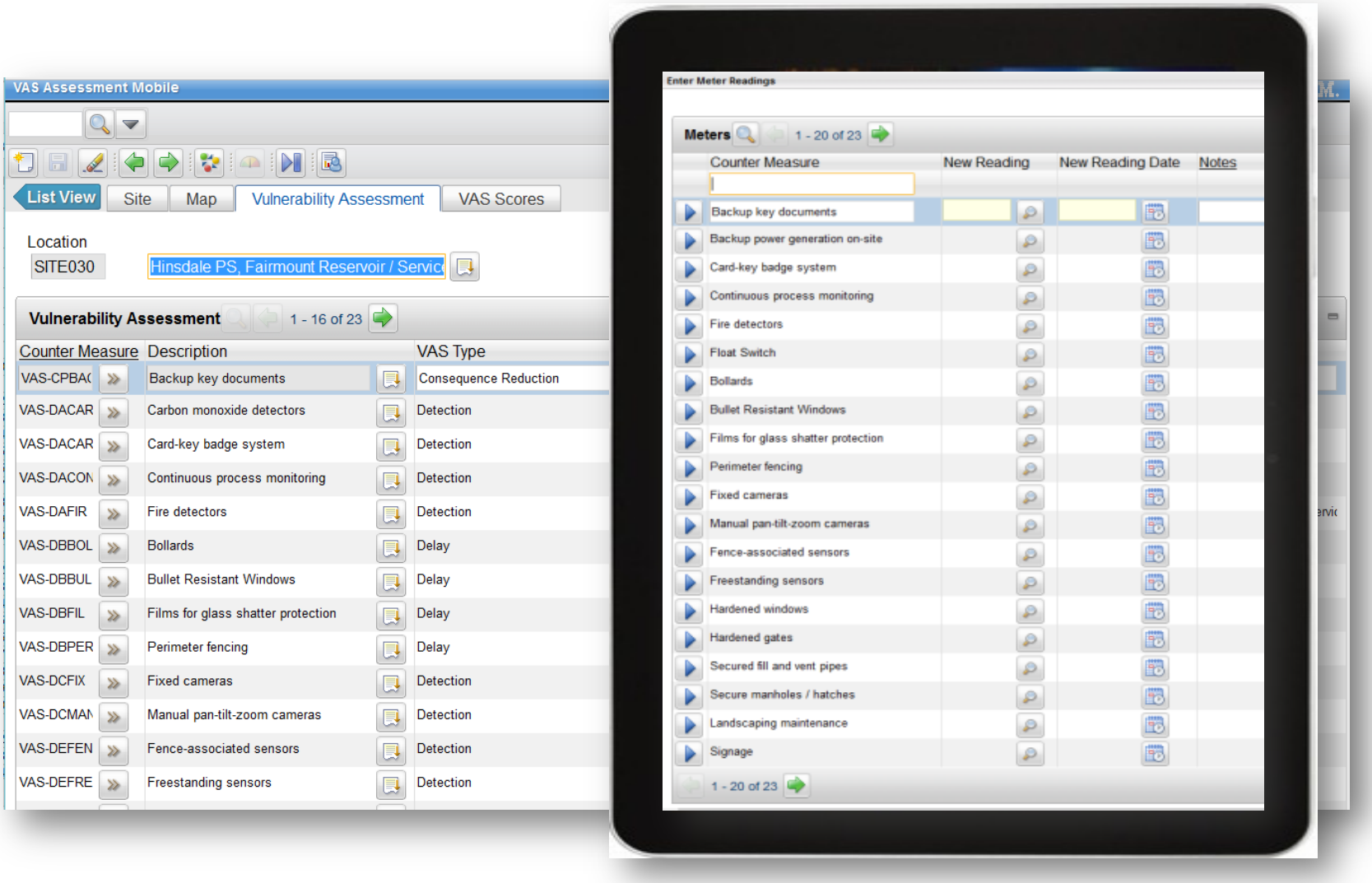
Tank - Standpipe

Intake / Dam

Treatment Plant

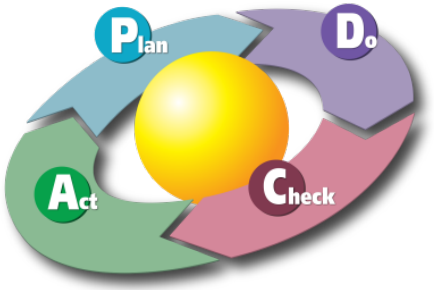
Undergound Reservoir

Countermeasure Assessment

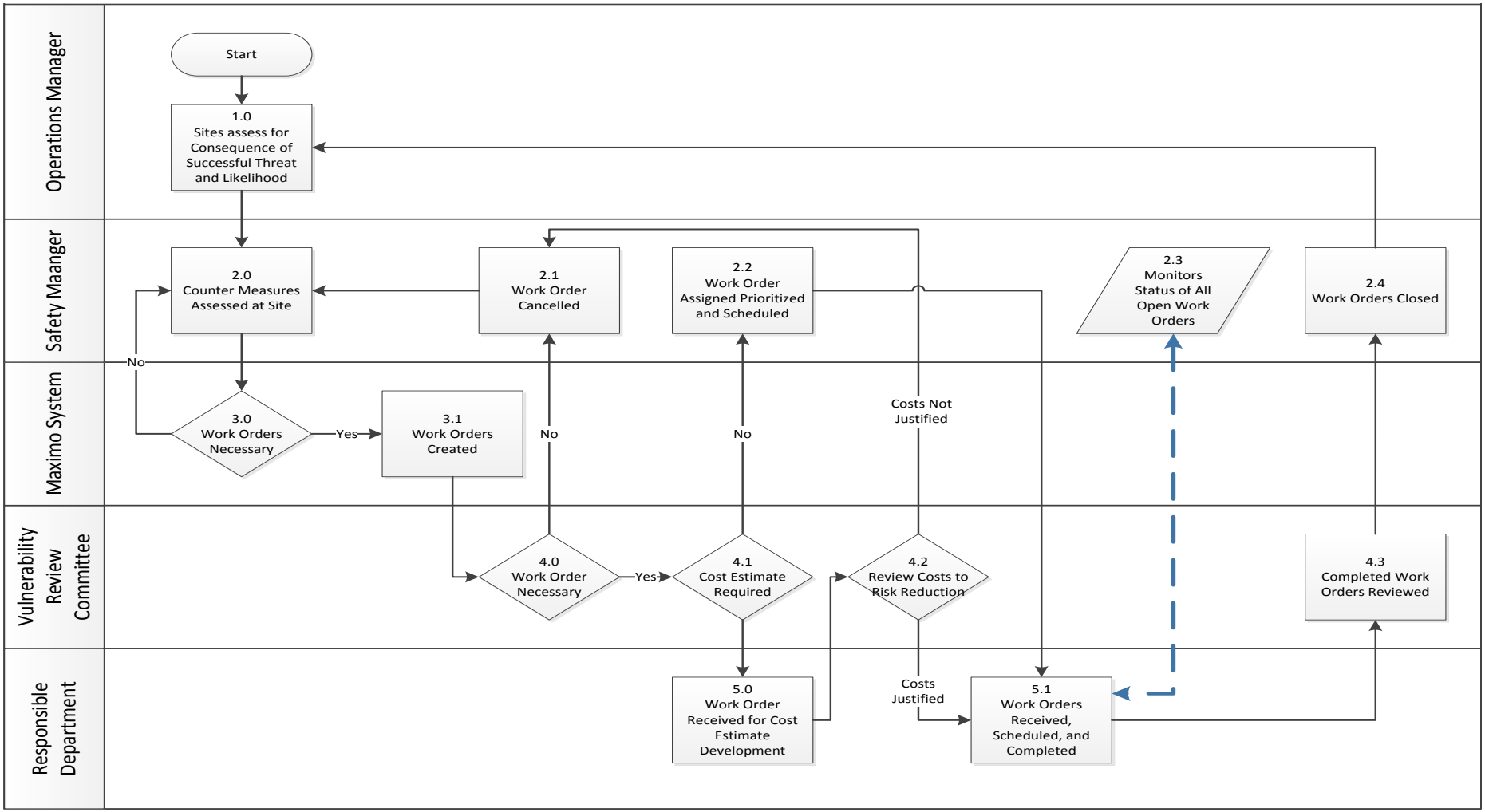


2 Countermeasure Assessment

A measure or action taken to counter or offset a threat



OCWA VAS Business Process



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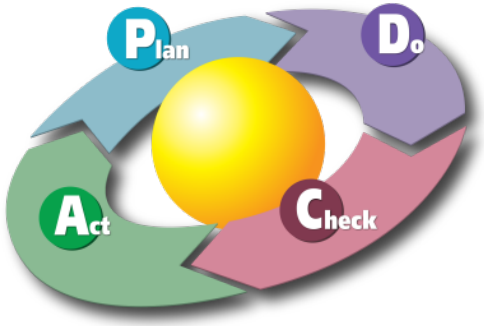
3 Improve and Implement Counter Measures (Work Orders) and Capital Planning Prioritization

Plan, Do, Check, Act



Prioritization of Resources

Perform Vulnerability Assessment

- Analyze All Hazard Risk for Each Site
- Inspect and Score Countermeasures for Site

Identify Follow-up Actions

- Small Tasks – O&M Work Orders
- Large Tasks – Capital Projects

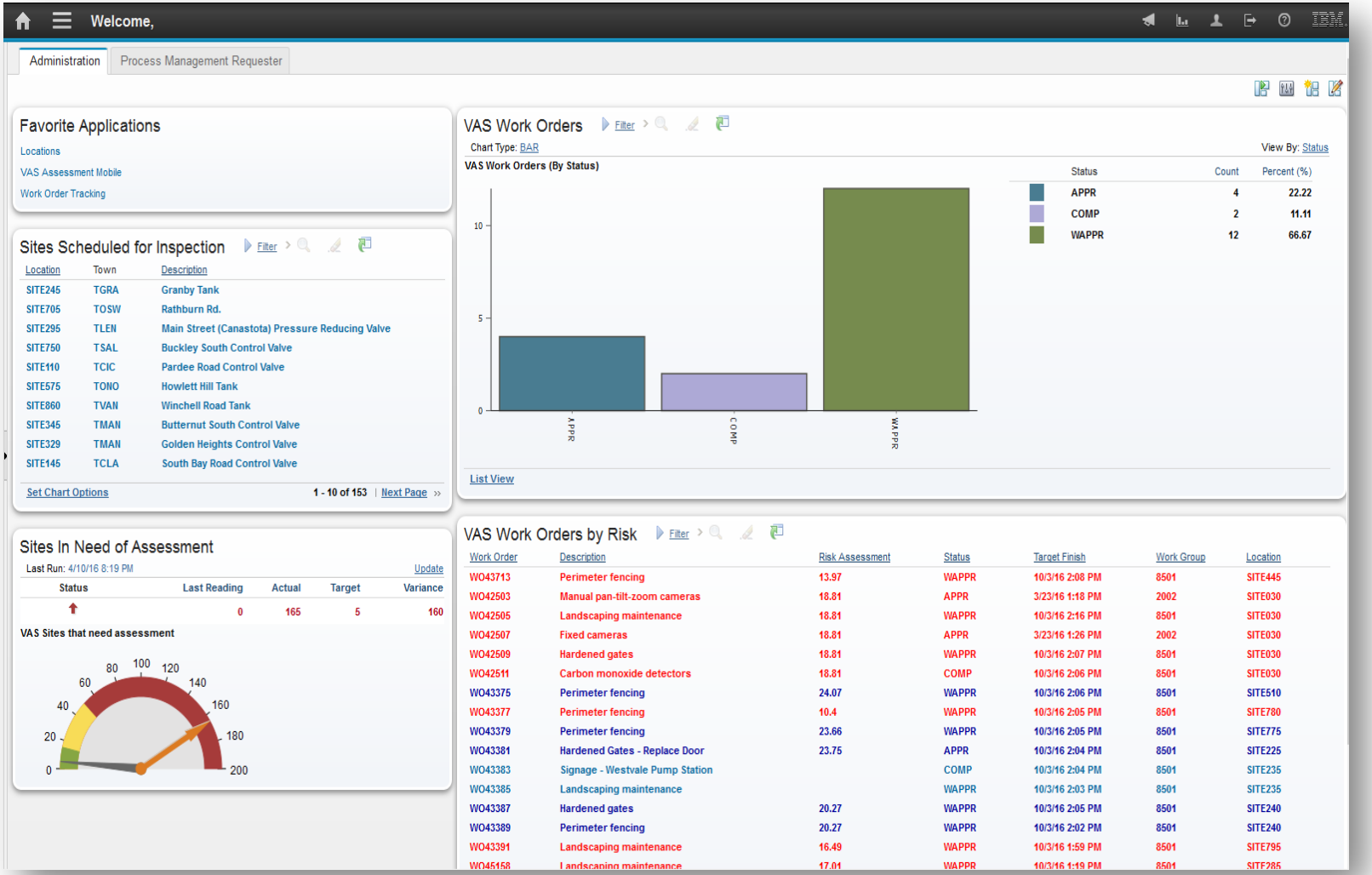
Prioritize Actions

- Execute Work Orders Focusing on High Risk
- Rank Projects by Risk Reduction

Repeat Every 3 years

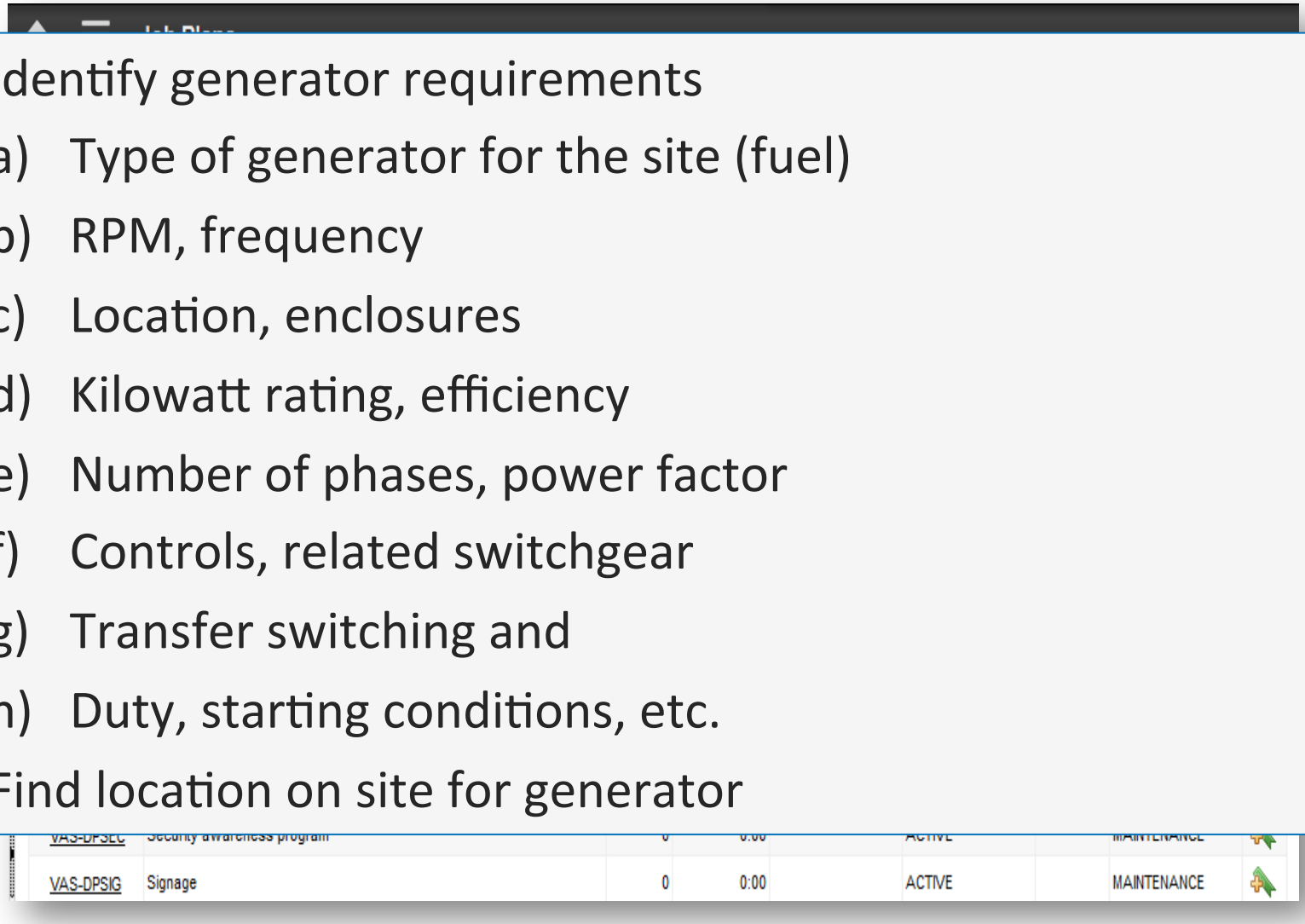
(~215 Sites)

Track Progress of Site Assessments



Templates of Counter Measure Work

1. Identify generator requirements
   a) Type of generator for the site (fuel)
   b) RPM, frequency
   c) Location, enclosures
   d) Kilowatt rating, efficiency
   e) Number of phases, power factor
   f) Controls, related switchgear
   g) Transfer switching and
   h) Duty, starting conditions, etc.
2. Find location on site for generator

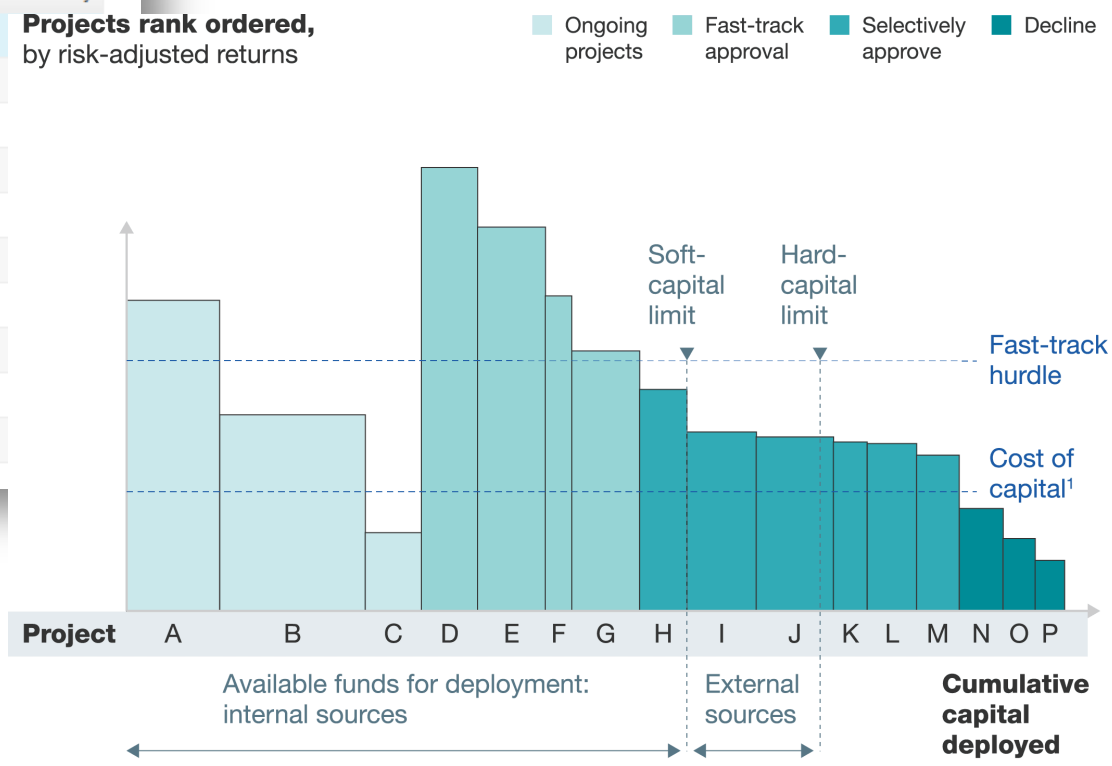


Detailed Tracking of Risk Reduction Costs Work Orders and Capital Projects

WO Costs

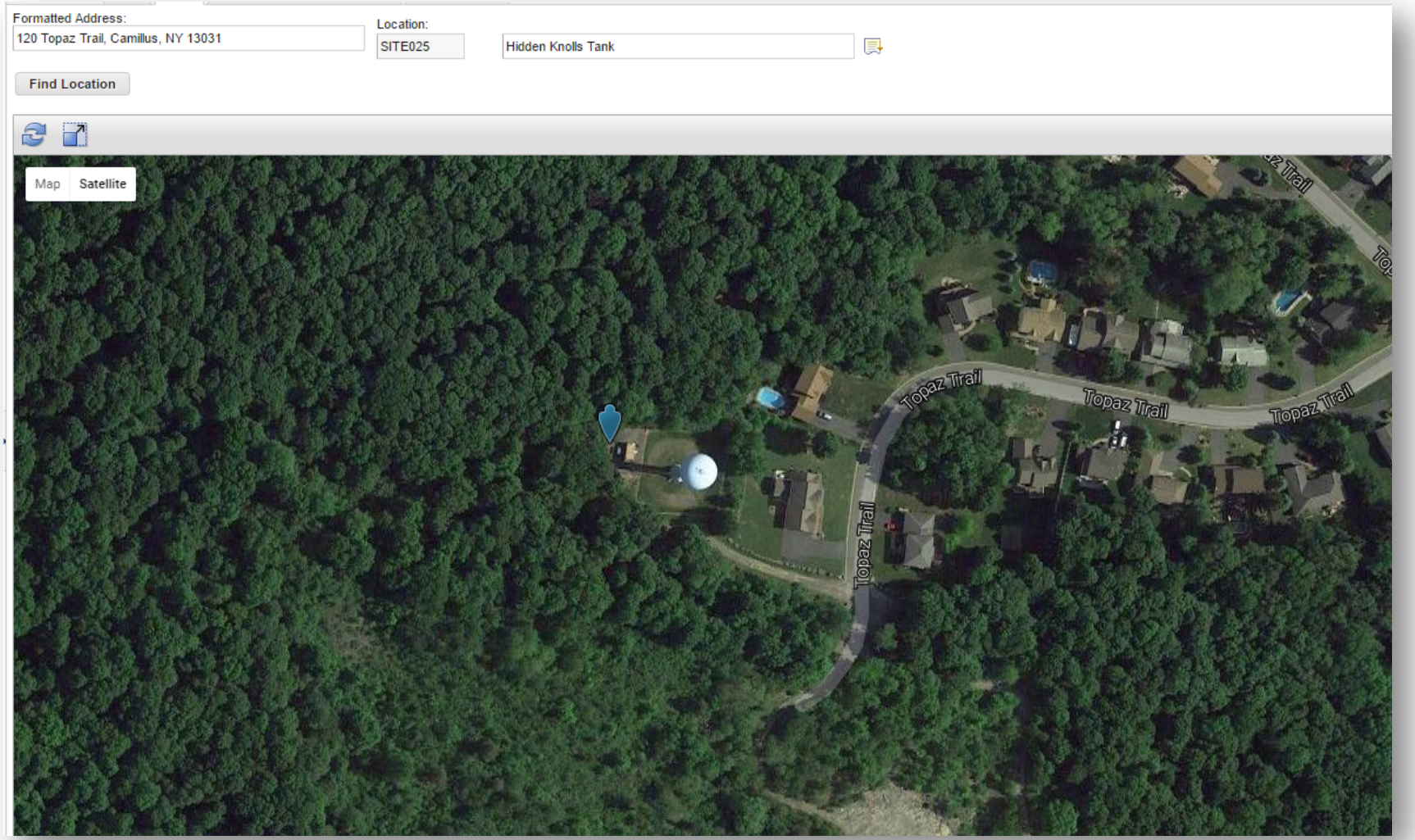
Filter > 1 - 10 of 10

Resource	Current Estimate	Approved Estimate	Actual	Exceeds Estimate by
Internal Labor Hours	0.0000	0.0000	1.0000	
External Labor Hours	0.0000	0.0000	0.0000	
Labor Hours	0.0000	0.0000	1.0000	
Internal Labor Cost	0.0000	0.0000	51.1900	
External Labor Cost	0.0000	0.0000	0.0000	
Labor Costs	0.0000	0.0000	51.1900	
Material Cost	0.0000	0.0000	0.0000	
Tool Costs	0.0000	0.0000	0.0000	
Service Cost	0.0000	0.0000	0.0000	
Total Cost	0.0000	0.0000	51.1900	



[1]Weighted average cost of capital typically adjusted to eliminate double counting.

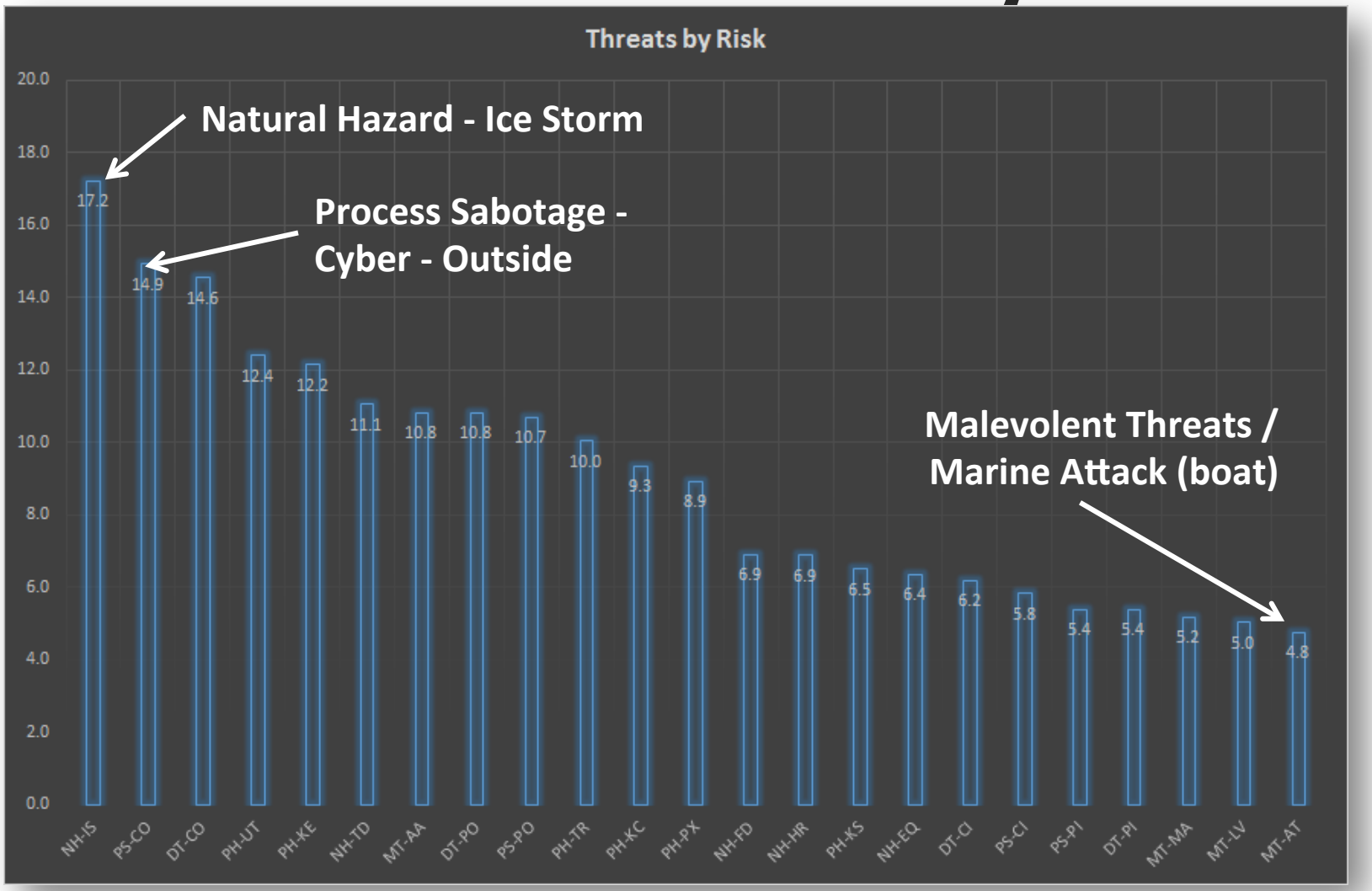
GIS Mapping Integration to Maximo



“Real–Time” Reports of Risks and Vulnerabilities

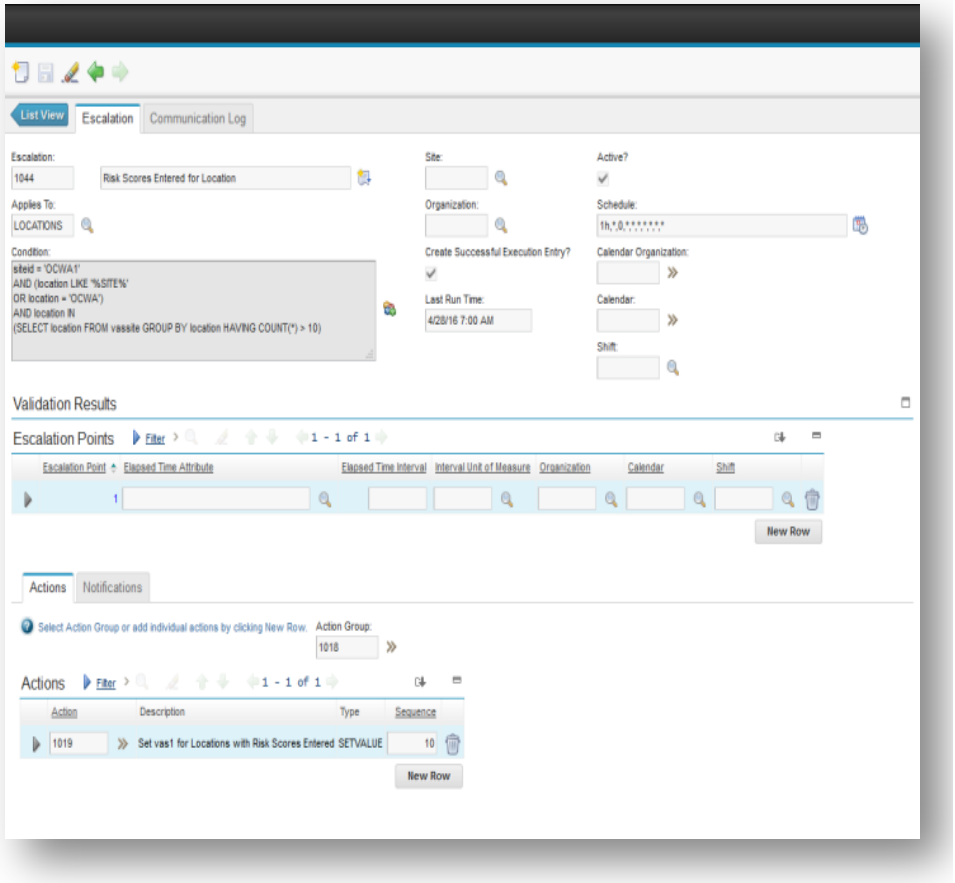
Site ID	Site Description	Threat	Threat Description	Risk
SITE510	North Syracuse Tank	MT-AA	Malevolent Threats / Air Attack (plane / drone)	24.07
SITE510	North Syracuse Tank	NH-IS	Natural Hazard Reference Threat Scenarios - Ice Storm (no power for 2 weeks)	23.75
SITE225	Solvay Pump Station	NH-IS	Natural Hazard Reference Threat Scenarios - Ice Storm (no power for 2 weeks)	23.75
SITE775	Park Street Pump Station and Control Valve	NH-IS	Natural Hazard Reference Threat Scenarios - Ice Storm (no power for 2 weeks)	23.66
SITE240	Westvale and Solvay Tanks	NH-IS	Natural Hazard Reference Threat Scenarios - Ice Storm (no power for 2 weeks)	20.27
SITE775	Park Street Pump Station and Control Valve	NH-FD	Natural Hazard Reference Threat Scenarios - Floods (1 week without facility)	18.97
SITE030	Hinsdale PS, Fairmount Reservoir / Service Center	NH-IS	Natural Hazard Reference Threat Scenarios - Ice Storm (no power for 2 weeks)	18.81
SITE775	Park Street Pump Station and Control Valve	PS-CO	Malevolent Threats / Process Sabotage - Cyber - Outside	18.56
SITE510	North Syracuse Tank	PS-CO	Malevolent Threats / Process Sabotage - Cyber - Outside	18.56
SITE510	North Syracuse Tank	DT-CO	Malevolent Threats / Diversion or Theft - Cyber - Outside	18.56
SITE775	Park Street Pump Station and Control Valve	DT-CO	Malevolent Threats / Diversion or Theft - Cyber - Outside	18.56
SITE225	Solvay Pump Station	DT-CO	Malevolent Threats / Diversion or Theft - Cyber - Outside	18.56
SITE225	Solvay Pump Station	PS-CO	Malevolent Threats / Process Sabotage - Cyber - Outside	18.56

Detail Risk and Threat Analysis



Risk Calculations Updated Every Day

- Identification of new vulnerabilities
- Each site assessed every 3-years
- Allows for ongoing evaluation of related capital needs
- Implementation of new countermeasures
- Flexibility to adopt and address critical needs in a more timely manner
- Re-assessment of the Likelihood – based on experience and changing situations



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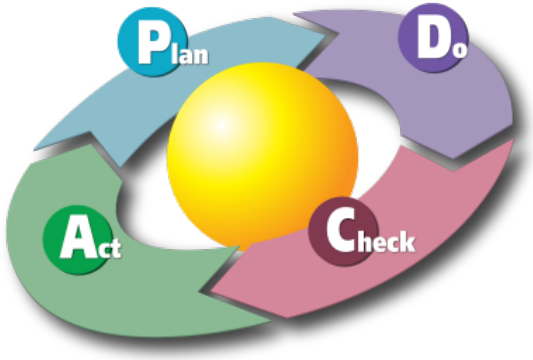
4 Quantifying Risk



J100 Vulnerability Assessment Approach

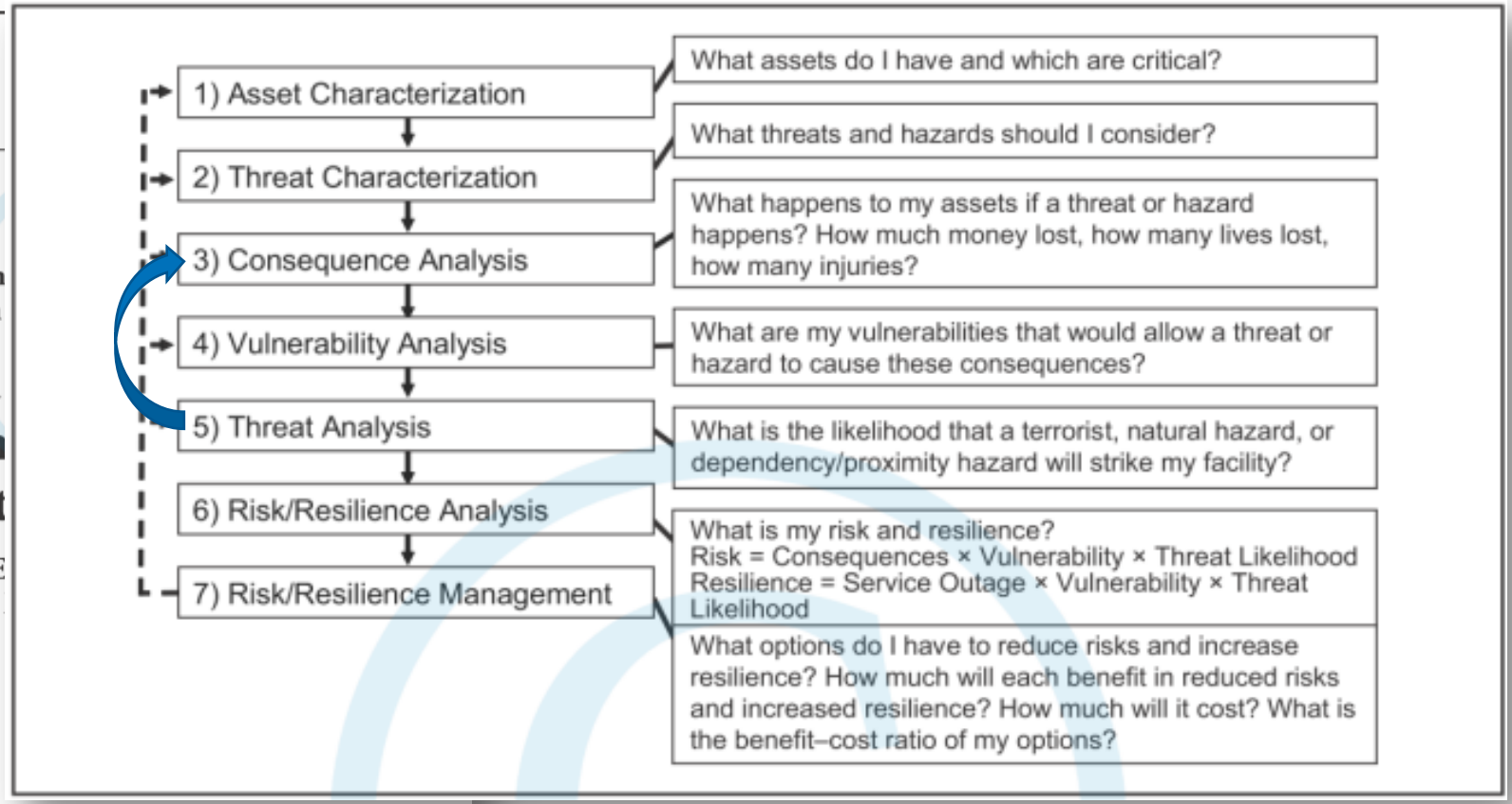
American Water Works Association

Risk Analysis an
Asset Protection

Risk and
Managen
and Wast

Using the ASME
RAMCAP Plus®

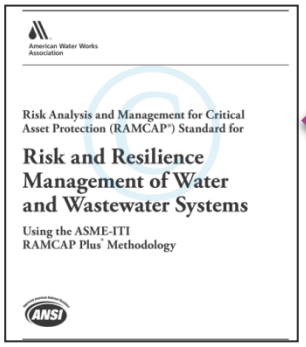
ANSI



Risk Assessments Now Part of Design Reviews

$$R = C \times V \times T$$

- Consequence (C) is the result of an event occurrence, including immediate, short- and long-term, direct and indirect losses and effects.
- Vulnerability (V) in a function of countermeasure capabilities to withstand a threat.
- Threat Likelihood (T), also referred to as the probability of occurrence, is the probability of the event occurring.



Outside Consultants

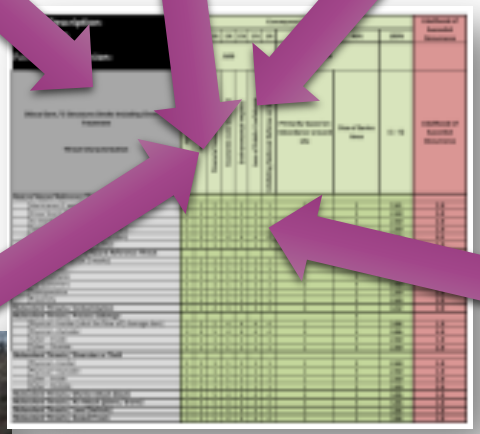
Health & Safety

Engineering

Team Collaboration

Multi Discipline Assessment of the Risks

Operations



Information Services

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Questions

Continuous Improvements, Not Just a Snapshot Program

Risk – Organization of Threats

Facility Description: / MAXIMO ID: / Facility Main Mission:	Consequence Analysis										Likeli Succ Occu
	1%	1%	1%	1%	1%	1%	1%	53%	40%	100%	
	J100							CoF			
Otisco Dam / 5 Structures Onsite Including Chemical Treatment Threat Characterization	Fatalities	Serious Injury	Financial Losses to the OCWA	Economic Loss to Region	Environmental Impacts	Loss of Public Confidence	Inhibiting National Defense or Government	Primarily based on redundance around site	Size of Serice Area	(1 - 5)	Likeli Succ Occu
Natural Hazard Reference Threat Scenarios											
Hurricanes (2 weeks without power)	1	1	2	1	1	1	1	1	5	2.61	2
Snow Storm (Blizzard)	1	1	1	1	1	1	1	1	5	2.60	3
Ice Storm (no power for 2 weeks)	1	1	1	1	1	1	1	1	5	2.60	2
Tornadoes (1 weeks without power)	1	1	1	1	1	1	1	1	5	2.60	2
Earthquakes (major damage to dam)	3	3	5	4	4	4	4	3	5	3.86	0
Floods (1 week without facility)	1	1	1	1	1	1	1	1	5	2.60	1
Dependency and Proximity Hazard Reference Threat									5		
Utilities (no pwer for 2 weeks)	1	1	1	1	1	1	1	1	5	2.60	4
Key Suppliers	1	1	1	1	1	1	1	1	5	2.60	3
Key employees	1	1	1	1	1	1	1	1	5	2.60	1
Key Customers	1	1	1	1	1	1	1	1	5	2.60	3
Transporation	1	1	1	1	1	1	1	1	5	2.60	2
Proximity	1	1	1	1	1	1	1	1	5	2.60	2
Malevolent Threats / Contamination	2	2	4	3	3	3	3	4	5	4.32	2
Malevolent Threats / Process Sabotage									5		
Physical—Insider (shut the flow off, damage dam)	3	3	5	4	4	4	4	3	5	3.86	1
Physical—Outsider	3	3	5	4	4	4	4	3	5	3.86	2
Cyber - Inside	1	1	1	1	1	1	1	1	5	2.60	1
Cyber - Outside	1	1	1	1	1	1	1	1	5	2.60	2
Malevolent Threats / Diversion or Theft											
Physical—Insider	1	1	1	1	1	1	1	1	5	2.60	1
Physical—Outsider	1	1	1	1	1	1	1	1	5	2.60	1
Cyber - Inside	1	1	1	1	1	1	1	1	5	2.60	2
Cyber - Outside	1	1	1	1	1	1	1	1	5	2.60	2
Malevolent Threats / Marine Attack (boat)	3	3	5	4	4	4	4	3	5	3.86	1
Malevolent Threats / Air Attack (plane / drone)	3	3	5	4	4	4	4	3	5	3.86	1
Malevolent Threats / Land (Vehicle)	3	3	5	4	4	4	4	3	5	3.86	1
Malevolent Threats / Assault Team	3	3	5	4	4	4	4	3	5	3.86	1

Natural Hazard Reference Threat Scenarios
Hurricanes (2 weeks without power)
Snow Storm (Blizzard)
Ice Storm (no power for 2 weeks)
Tornadoes (1 weeks without power)
Earthquakes (major damage to dam)
Floods (1 week without facility)
Dependency and Proximity Hazard Reference Threat
Utilities (no pwer for 2 weeks)
Key Suppliers
Key employees
Key Customers
Transporation
Proximity
Malevolent Threats / Contamination
Malevolent Threats / Process Sabotage
Physical—Insider (shut the flow off, damage dam)
Physical—Outsider
Cyber - Inside
Cyber - Outside
Malevolent Threats / Diversion or Theft
Physical—Insider
Physical—Outsider
Cyber - Inside
Cyber - Outside
Malevolent Threats / Marine Attack (boat)
Malevolent Threats / Air Attack (plane / drone)
Malevolent Threats / Land (Vehicle)
Malevolent Threats / Assault Team

Risk – Consequences of Occurrence

OCWA Consequences of Failure		Weighting
J100	Fatalities	1%
J100	Serious Injury	1%
J100	Financial Losses to the OCWA	1%
J100	Economic Loss to Region	1%
J100	Environmental Impacts	1%
J100	Loss of Public Confidence	1%
J100	Inhibiting National Defense or Government	1%
OCWA	**Overall Impact to Service** 1-Adequate supply of safe water 2-Adequate supply of safe water to meet emergency needs 3-Parts of system w/o water 4-Contaminated water available for fire fighting, sanitary purposes 5-No water available	53%
OCWA	**Size of Service Area** 1 - < 2,500 customers 2 - 2,500 - 5,000 3 - 5,000 - 10,000 4 - 10,000 - 25,000 5 - > 25.000	40%

Risk –Likelihood of Occurrence

Scale (0 - 5)

0 - Will Never Occur

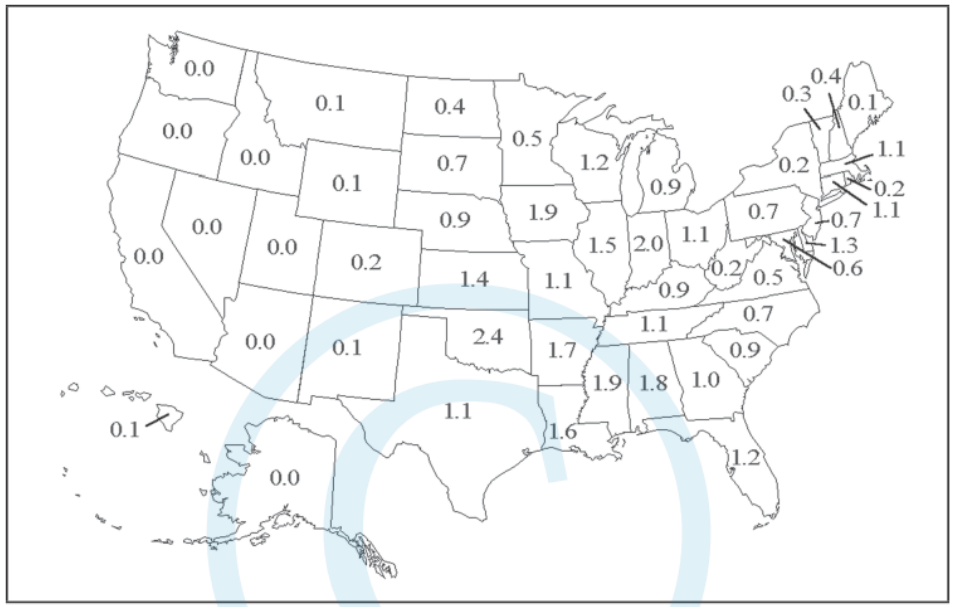
1 - every 100 years

2 - Every 25 Years

3 - Every 5 Years

4 - Every Year

5 - Multiple Occurrences Per Year

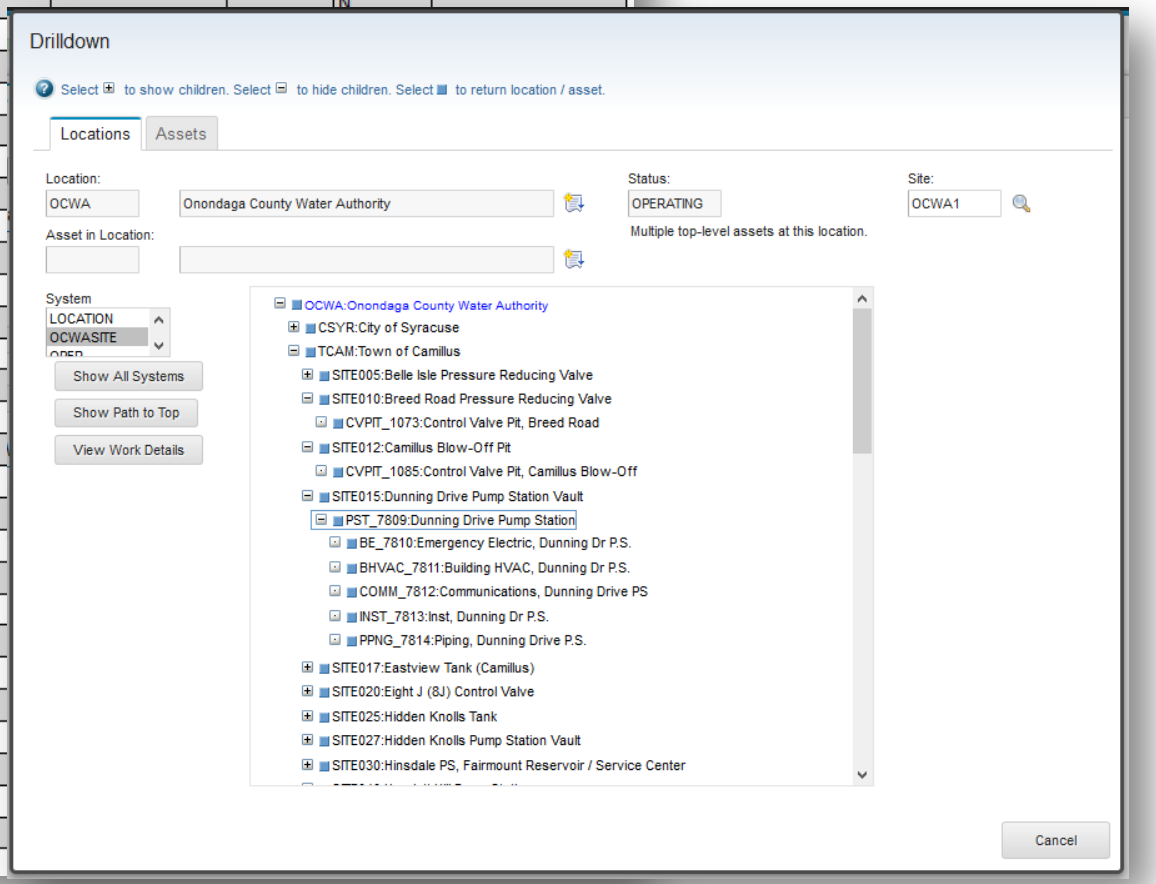


Source: http://www.ncdc.noaa.gov/oa/climate/severeweather/tornadoes.html#maps

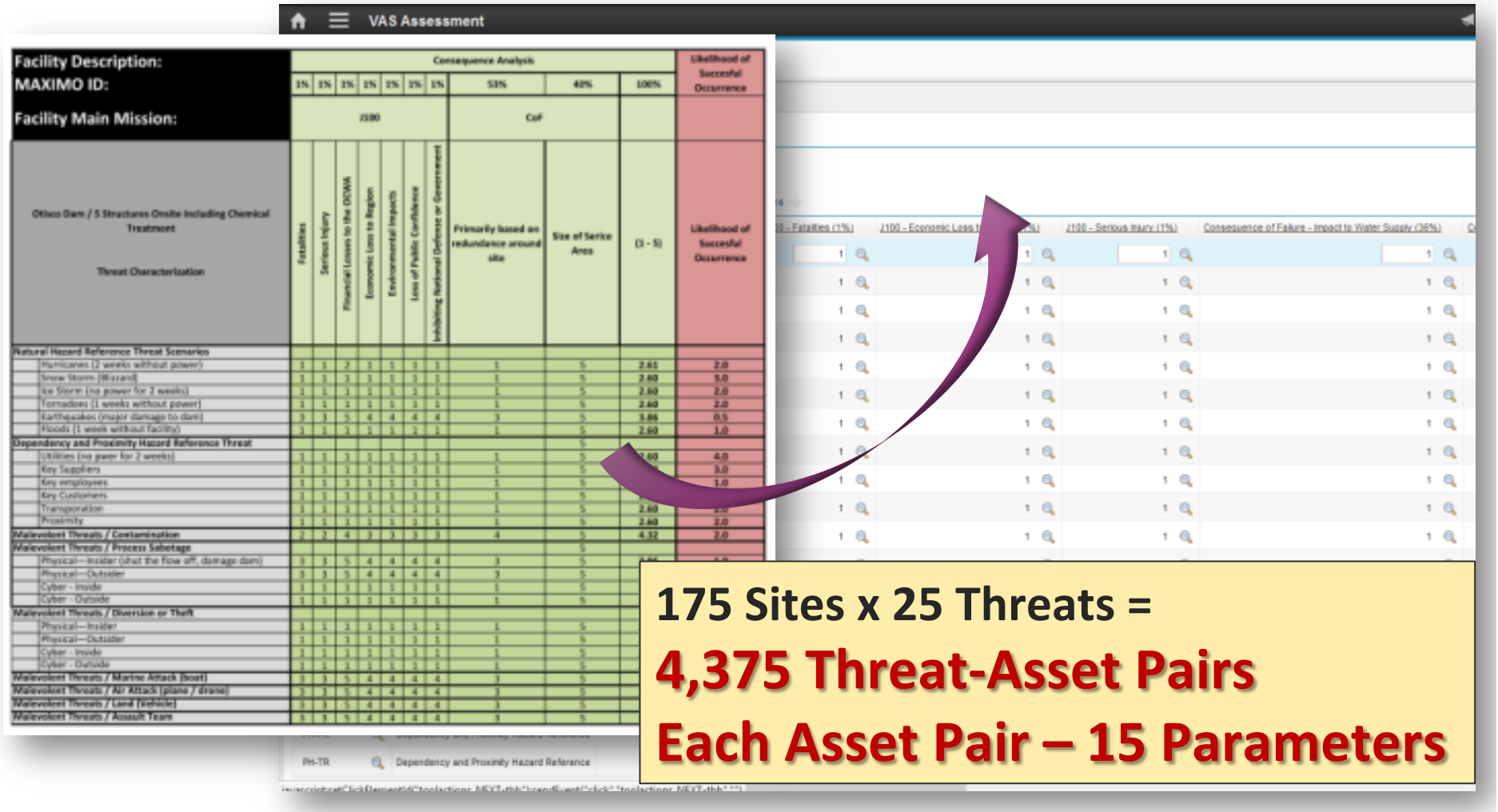
Figure G-9 Average Annual Number of Strong-Violent Tornadoes (F2-F5) per 10,000 Square Miles by State, 1953-2004.

Organize and Confirm all Sites

Location	Description	Last Countermeasure Assessment	Parent Location	Risk Scores Loaded	Last VAS Date
OCWA	Onondaga County Water Authority			N	
SITE005	Belle Isle Pressure Reducing Valve				
SITE010	Breed Road Pressure Reducing Valve				
SITE015	Dunning Drive Pump Station Vault				
SITE020	Eight J (8J) Control Valve				
SITE025	Hidden Knolls Tank				
SITE030	Hinsdale PS, Fairmount Reservoir / Service Center				
SITE040	Howlett Hill Pump Station				
SITE045	Kasson Road Pump Station Vault				
SITE050	Kasson Road Control Valve				
SITE055	Maple Dr Pressure Reducing Valve				
SITE060	Munro Road Pressure Reducing Valve				
SITE065	Rolling Hills Pump Station				
SITE070	Scenic Meadows Pump Station				
SITE075	Sherwood Pump Station				
SITE080	Warners Tank				
SITE085	Warners Pump Station				
SITE090	West Hill Tank				
SITE095	Brewerton Tank				
SITE100	Cicero Airport Control Valve				
SITE105	McKinley Road Control Valve				
SITE110	Pardee Road Control Valve				
SITE115	Route 11 (Mud Mill Cv)				
SITE120	Bear Road Control Valve				
SITE125	Buckley North Control Valve				
SITE130	Caughdenoy Road Control Valve				
SITE135	Clay Tank				
SITE140	Route 57 Control Valve				



Risk Data Loaded into Maximo



Effectiveness of Countermeasures to Safeguard from Threats

$$\text{Effectiveness} = \frac{\text{Achieved}}{\text{Desired}}$$

Countermeasures Effectiveness Against Threats	Consequence Reduction				Delay													
	Policies and Procedures	Redundancy			Barriers				Locks							Policies and Procedures		
1 = Very Effective 2 = Effective 3 = Somewhat Effective 4 = Not Effective 5 = No Impact	Backup key documents	Redundant clearwell(s)	Redundant raw water intake structure(s)	Redundant water source(s) [surface, ground,	Bollards	Bullet Resistant Windows	Films for glass shatter protection	Perimeter fencing	Hardened doors, welded hinges	Hardened gates	Hardened ladder access	Tamper alarm on ladder	Hardened windows	Secured fill and vent pipes	Secure manholes / hatches	Doors & windows locking procedures	Maintain vehicular setback from buildings	Require secondary user I.D. and password
Threat Characterization																		
Natural Hazard Reference Threat Scenarios																		
		3	3	3	5	2	2	5	3	3	3	3	3	3	3	3	3	3
		3	3	3	5	3	3	4	4	4	4	4	4	4	4	4	4	4
		3	3	3	5	3	3	5	4	4	4	4	4	4	4	4	4	4
		3	3	3	5	2	2	5	3	3	3	3	3	3	3	3	3	3
		3	3	3	5	3	3	5	4	4	4	4	4	4	4	4	4	4
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		3	3	3	5	5	5	5	5	5	5	5	5	5	5	5	5	5
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		3	3	3	5	5	5	5	5	5	5	5	5	5	5	5	5	5
		4	4	4	3	3	3	4	3	3	3	3	3	3	3	3	3	2
		3	3	3	4	3	3	4	3	3	3	3	3	3	3	3	3	3
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		3	3	3	4	3	3	2	2	2	2	2	2	2	2	2	2	2
		3	3	3	4	3	3	4	2	2	2	2	2	2	2	2	2	2
		3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2
		3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2
		3.04	3.04	3.04	4.32	3.60	3.60	4.20	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.72	3.68