Risk & Resiliency Assessment
City of Albany Water System

October 2020

Certified Document

Emmons, Rob

From: scs@epacdx.net
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EPA acknowledges on 10/5/2020 receipt of ALBANY, CITY OF risk and resilience assessment certification.

If you have any questions please email us at dwresilience@epa.gov.

Thank you.

United States Environmental Protection Agency

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America's Water Infrastructure Act (Sec. 2013(a)) / Risk and Resilience Assessment Certification Statement

I **Robert Emmons** hereby certify that

ALBANY, CITY OF , serving a population of

56100 , has

conducted, reviewed, or reviewed and revised an assessment of the risks to, and resilience of, its system. This assessment included an assessment of:

- The risk to the system from malevolent acts and natural hazards;
- The resilience of the pipes and constructed conveyances, physical barriers, source water, water collection and intake, pretreatment, treatment, storage and distribution facilities, electronic, computer, or other automated systems (including the security of such systems) which are utilized by the system;
- The monitoring practices of the system;
- The financial infrastructure of the system;
- The use, storage, or handling of various chemicals by the system;
- The operation and maintenance of the system; and
- May include an evaluation of capital and operational needs for risk and resilience management for the system.

Date of certification: **10/5/2020 3:48:33 PM**

The U.S. EPA and the authorized official signing this document agree that this certification may be signed electronically. The parties agree that the typed electronic signature that appears on this certification is the same as a handwritten signature for the purposes of validity, enforceability, and admissibility.

Once you have submitted your risk and resilience assessment certification, EPA will send an email acknowledging receipt of your certification. If you have any problems, please email us at dwresilience@epa.gov (mailto:dwresilience@epa.gov).

Risk and Resiliency Assessment

Background

Dependable and safe water infrastructure is essential to the health and the economy of the nation. On October 23, 2018, America's Water Infrastructure Act (AWIA) was signed into law. AWIA Section 2013 requires community (drinking) water systems serving more than 3,300 people to develop Risk and Resiliency Assessments and Emergency Response Plans (ERPs). The law specifies the components the Risk and Resiliency Assessments and ERPs must address and establishes deadlines by which water systems must certify to EPA completion of the plans.

Requirements

Each community water system serving more than 3,300 persons shall submit to the Environmental Protection Agency (EPA) Administrator a certification that the system has conducted a Risk and Resilience Assessment (RRA) in accordance with the Act. The City of Albany (population of 50,000 to 100,000) must submit the RRA prior to December 31, 2020. In addition, each community water system shall also certify its completion of an ERP as soon as reasonably possible, but no later than six months after certifying completion of its RRA.

Each community water system submitting a RRA must review its plan at least once every five years to determine if it should be revised. Upon completion of such a review, the system must submit to the EPA a certification that it has reviewed its assessment and revised it, if applicable.

Goals

To determine if the RRA is truly effective, the following goals and objectives are established which are used to measure the success of the plan.

- Improve the resiliency of Albany's water system
  - Identify major water system assets
  - Identify major threats to the water system
- Evaluate countermeasures to help protect the health and safety of Albany.
- Establish baseline information to develop an Emergency Response Plan.
- Enhance economic resilience to reduce the impact on the local economy.

Purpose

This Risk and Resilience Assessment of City of Albany Water System was performed on March 20, 2020 using the U.S. EPA Vulnerability Self-Assessment Tool (VSAT) Web Version 2.0. EPA developed and maintains VSAT Web to serve as an all-hazards risk and resilience assessment tool for water and wastewater utilities of all sizes. Specifically, EPA designed Version 2.0 of VSAT Web to assist community water systems with meeting the requirements for risk and resilience assessments in America's Water Infrastructure Act of 2018 (AWIA).

VSAT Web 2.0 can help water sector owners and operators with identifying the threats that present the highest risks to their facilities and with evaluating the costs and benefits of countermeasures to reduce those risks.

Methodology

VSAT Web 2.0 addresses malevolent acts, natural hazards, and dependency/proximity threats to water sector operations and analyzes the cost-effectiveness of countermeasures to reduce risk. The methodology in VSAT Web 2.0 is based on assessing the risk to a water system asset from a specific threat or hazard (i.e., an Asset-Threat Pair), where risk is defined as follows:

Monetized Risk (R) = Threat (T) X Vulnerability (V) X Consequences (C)

- T = Likelihood that the threat will be perpetrated or occur against the asset;
- V = Likelihood that the threat will damage the asset, considering the effectiveness of countermeasures; and
- C = Economic (cost to the utility and region) and public health (injuries and deaths) impacts resulting from damage to the asset.

A monetary value of statistical illness and value of statistical life are assigned to injuries and deaths, respectively, so that risk can be determined as a single monetized value. AWIA requires community water systems to assess the risks to and resilience of specified assets from both malevolent acts and natural hazards. Accordingly, VSAT Web 2.0 begins with a characterization of water system resilience using the Utility Resilience Index, as described in the following sections.

Beginning the evaluation, a qualitative assessment of risks from malevolent acts and natural hazards was conducted to all the assets required in AWIA. This step ensures the assessment may be certified as compliant with AWIA.

Following the qualitative assessment, assets and threats underwent a quantitative risk assessment, involving estimates of threats, vulnerability, and consequences. The quantitative risk assessment may include a broad spectrum of assets encompassing the entire water system or be limited to those assets at highest risk. For threat selection, VSAT Web 2.0 includes all the malevolent acts, natural hazards, and dependency/proximity threats listed in the AWWA J100-10 Standard (as recommended by the EPA), along with source water and finished water contamination. After completing a quantitative risk assessment under the current (baseline) conditions for the water system, an optional assessment of potential countermeasures was conducted. VSAT Web 2.0 provides a suite of countermeasures from which to select, however, countermeasures most appropriate for our system were choosen. This analysis resulted in a profile of existing risk and a benefit/cost analysis of potential countermeasures.

Utility Overview

Table 1 – Utility Information

Utility Type and Information	
Utility Type	Drinking Water
Utility Name	City of Albany Water System
State	Oregon
Zip Code	97321
Population Served	54,120
Ownership	Public
Average Daily Water Service (MGD)	6.6
Average Rate ($/1000 gallons) March 2020	$5.86
Comments	Ave. Rate per 1000 gallons does not include base charge.

Utility Resilience Index

The Utility Resiliency Index (URI) is a risk management tool that can assess a utility's capability to respond to and recover from an incident that impacts critical operations.[1] The URI is a valuable complement to the risk assessment performed in VSAT Web 2.0. A utility can use the URI together with the risk assessments results when developing an overall risk management plan.

The URI uses 12 indicators to calculate the index. Responses to the indicators are assigned values and weights, which are aggregated to provide a characterization of a utility's resilience on a scale from 0% to 100%. A low URI score indicates a low capability of the utility to respond to and recover from an incident, while a high URI score indicates a greater capability to do so. If multiple statements under one indicator apply to the utility, select the statement at the highest resilience level. Statements are arranged from lowest to highest resilience level under each indicator.

The URI for City of Albany Water System is: 49%

[1] *Adapted from Morley, K. M. (2012). Evaluating resilience in the water sector: Application of the Utility Resilience Index (URI). (http://www.worldcat.org/oclc/801849602) and used with permission.*

1. **Emergency Response Plan (ERP)**
   An ERP provides a tactical level plan for immediate response to incidents of all types. Select the statement below that best describes the utility's ERP.

   An ERP has been developed

2. **National Incident Management System (NIMS) Compliance**
   NIMS establishes a common framework for defining roles and responsibilities to enhance incident response. NIMS applies the Incident Command System (ICS) to provide the support structure for response activities. Select the statement below that best describes the utility's NIMS compliance.

   Utility certified as NIMS compliant

3. **Mutual Aid and Assistance (MAA)**
   MAA agreements between other utilities and jurisdictions help to provide rapid response to incidents. Participation in such agreements is traditionally at no cost and does not obligate signatories to respond. An example is the Water/Wastewater Agency Response Network (WARN). Select the statement below that best describes the utility's MAA agreements.

   Intrastate (e.g., WARN)

4. **Emergency Power for Critical Operations (EPCO)**
   EPCO is a minimum benchmark of 72 hours for backup power for critical operations and assets. Select the statement below that best describes the utility's EPCO.

   No backup power or backup power status unknown

5. **Minimum Daily Demand/Treatment (MDDT)**
   MDDT is the ability to meet minimum daily demand or treatment when the production or treatment plant is non-functional. For example, a drinking water utility typically has some level of in-system storage that can provide minimum daily flows for a time even though a treatment plant may be non-functional. Select the statement below that best describes the utility's MDDT.

   Up to 24 hours

6. **Critical Parts and Equipment (CPA)**

   CPA is the lead time for repair, replacement, or recovery of operationally critical parts or equipment. Critical parts are defined as components of the system that upon failure may have the potential to impair the ability to produce, distribute, or treat drinking water or wastewater, including both physical and cyber/process control systems. Select the statement below that best describes the utility's CPA.

3 days to less than 7 days

7. Critical Staff Resilience (CSR)

CSR is the percentage of response-capable staff who are cross-trained in critical operations and maintenance positions and available as staff backup. This indicator is primarily related to pandemic flu planning. Select the statement below that best describes the utility's CSR.

Less than 10% or unknown

8. Business Continuity Plan (BCP)

A BCP provides an overall indicator of a utility's commitment to integrating risk management principles into the management culture that supports their operations. These plans address the potential financial effects of a crisis, as well as the utility's flexibility to adapt human resource policies to meet the changing needs of employees. Select the statement below that best describes the utility's BCP.

No BCP or unknown

9. Utility Bond Rating (UBR)

UBRs are assigned by Moody's and indicate a utility's ability and willingness to satisfy financial obligations. The rating includes five primary factors related to municipal finance, which include market position, financial position, debt levels, governance, and covenants. Some utilities may not have a bond rating since they do not seek additional investment capital from the market. Select the statement below that best describes the utility's UBR.

Double A (AA)

10. Government Accounting Standards Board (GASB) Assessment

A GASB Assessment determines how much infrastructure has been evaluated to provide an indication of the utility's overall commitment to proper asset management. The assessment coverage is calculated as: 100 x total number of critical assets categorized into condition categories divided by the total number of critical assets as determined in the asset characterization step of the J100 standard. Select the statement below that best describes the utility's GASB Assessment.

Less than 20% Assessed or unknown

11. Unemployment

Unemployment is a general socioeconomic indicator of a community's economic health. The Bureau of Labor Statistics (BLS) maintains a database of state and local rates (see http://www.bls.gov/lau/tables.htm) which provides a consistent source for determining this indicator. The value for this indicator is based on the

unemployment level in the community served by the utility. Select the statement below that best describes the unemployment rate in the service area.

+/- 2% National Average

12. Median Household Income (MHI)

MHI is a socioeconomic indicator of the wealth of the community served by the utility. This indicator provides insight on the fragility of a community to withstand a significant incident that could threaten the financial stability of the utility. The U.S. Census Bureau maintains a database for each state and county (see https://www.census.gov/quickfacts/fact/table/ US/PST045218). Select the statement below that best describes the MHI in the service area.

5 - 9% below State Median

Quantitative Risk Assessment

Shown below in Tables 2 and 3, are the City of Albany's major water system assets and threats. The tables are not meant to be a complete list of assets and threats, rather lists those recommended by the EPA to have the greatest potential to cause disruption or harm to community water systems.

Table 2 - Assets

Asset Category (EPA Defined)	Asset (City Assigned)
Physical Barriers	Security Fencing - All Security Gates - All
Source Water	North and South Santiam Watersheds Canal Drainage
Pipe & Constructed Conveyances, Intake	Vine -Diversion Dam Vine - Intake Structure Vine - Canal AM - Santiam Intake AM - Raw Water Pump Station AM - Raw waterline
Pretreatment and Treatment	Vine - WTP AM - WTP
Storage and Distribution	Various Reservoirs Distribution System Pump Stations
Computer or other Automated Systems	SCADA System
Monitoring Practices	Safety Inspections
Financial Infrastructure	Utility Billing Software
Chemical Storage, Use and Handling	Chemical Totes and Storage
Utility Operation and Maintenance	Personnel

Table 3 - Threats

Threat Category (EPA Defined)	Threat Type (EPA assigned)
Malevolent Acts	Assault on Utility - Physical Contamination of Finish Water - Accident or deliberate Contamination of Source Water- Accident or deliberate Theft or Diversion Cyber Attack on Business System Cyber Attack on Process Control System Sabotage - Physical
Natural Hazards	Earthquake Flood Windstorm/Ice Storm – causing severe power outage Wildfire Pandemic Volcanic Ash
Dependency Threats	Key Customers Key Employees Key Suppliers Transportation Utilities

The EPA recommends that a quantitative risk assessment be limited to a small number of the assets and threats that present the highest risk. Attempting to analyze a high number of asset/threat pairs in a single assessment will render the assessment difficult to complete and make the interpretation of results challenging. Strategies to reduce the number of asset/threat pairs include grouping similar assets into a single asset category and limiting threats to those with the highest likelihood of occurrence or cause the most harm.

1. For each asset category, a specific asset that is at risk is chosen. This could be the asset category itself (e.g., physical barriers), a piece of equipment or a facility (e.g., a storage tank) or an entire system (e.g., a treatment train). Multiple assets for each asset category can also be chosen.
2. Next, a specific threat is selected which may be a malevolent act, natural hazard, or dependency/proximity threat, for each asset selected. EPA recommends that you complete at least one baseline risk assessment for one A/T pair in each asset category.
3. By assigning a specific threat to an asset, an asset/threat (A/T) pair is created. For each A/T pair, an existing baseline monetized risk assessment is completed using current in-place countermeasures.
4. Once the baseline monetized risk assessments are complete, A/T pairs are evaluated to determine if a potential countermeasure will be evaluated to mitigate the baseline monetized risk.

Table 4 - Asset-Threat Pairs

Assets Category	Threats
Physical Barriers	
Security Fencing - All	Physical Sabotage - Damage Fence and Gates
Security Gates - All	Physical Sabotage - Damage Fence and Gates
Source Water	
North and South Santiam Watersheds	Contamination of Source water - Cyanotoxins or Volcanic Ash
Canal	Contamination - Deliberate
Pipe & Constructed Conveyances, Intake	
Vine -Diversion Dam	Earthquake PGA 0.8-1.1
Vine - Intake Structure	Earthquake & Break-in & Damage Building /Equip
Canal	"
AM - Santiam Intake	"
AM - Raw Water Pump Station	"
AM - Raw waterline	"
Pretreatment and Treatment	
Vine - WTP	Sustained Power Outage
AM - WTP	"
Storage and Distribution	
Various Reservoirs	Earthquake PGA 0.4-0.8
Distribution System	"
Pump Stations	"
Electronic or other Automated Systems	
SCADA System	Cyber Attack
Monitoring Practices	
Safety Inspections	Dependency - Pandemic Key Employees out
Financial Infrastructure	
Utility Billing Software	Cyber Attack
Chemical Storage, Use and Handling	
Chemical totes /storage	Dependency - Supply shortage
Utility Operation and Maintenance	
Personnel	Dependency - Pandemic Key Employees out

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Table 5 – Assessment Summary Table

The Table below shows the monetized risk and capitalized cost summary for each asset/threat pair. Baseline results show existing countermeasures and potential countermeasures reflect enhanced mitigation with new proposed countermeasures in place. See Appendix A for details of each Asset/Threat pair evaluation.

		Assigned Threats																			
		A		B		C		D		E		F		G		H		I		J	
		Vandalism Damage to Fencing and Gates		Intentional / Accidental Contamination of Canal		Cyanotoxins in Raw Water		Wildfire/Volcanic Ash in Raw Water		Earthquake PGA 0.8-1.1		Vandalism Break-in and Damage Building		Dependent - Sustained Power Outage		Cyber Attack Disables U.B. Financial System		Dependent- Pandemic Key Employees Out		Dependent- Key Supplies Not Available	
		Countermeasures		Countermeasures		Countermeasures		Countermeasures		Countermeasures		Countermeasures		Countermeasures		Countermeasures		Countermeasures		Countermeasures	
		Baseline Existing	Potential Proposed	Baseline Existing	Potential Proposed	Baseline Existing	Potential Proposed	Baseline Existing	Potential Proposed	Baseline Existing	Potential Proposed	Baseline Existing	Potential Proposed	Baseline Existing	Potential Proposed	Baseline Existing	Potential Proposed	Baseline Existing	Potential Proposed	Baseline Existing	Potential Proposed
	Assets Category	Security Cameras, Intrusion Alarms, Emergency Call-out	None	None	Continious Water Quality Monitoring	Cyanotoxin Monitoring Protocol	None	Monitor Raw Wtr., Adjust Treatment, Water curtailment/rationing	None	None	Eearthquake Automatic Shut-Off Reservoir Valves	Security Cameras, Intrusion Alarms, Emergency Call-out	None	None	Install Back-up Generators at Key Facilities	IT Security Systems	None	Employee Cross Training	Additional Employee Cross Training	None	None
1	Physical Barriers Security Fencing, Gates at all Key Facilities	$200,000																			
2	Source Water Canal Drainage Santiam Watershed			$2,000,000	$425,000	$200,000		$1,000,000													
3	Pipe & Constructed Conveyances, Intake Vine - Intake Structure & Diversion Dam Vine -Canal AM - Santiam Intake AM - Raw Water Pump Station AM - Raw waterline									$11,225,000		$300,000									
4	Pretreatment and Treatment Vine - WTP AM - WTP									$55,000,000 $35,000,000				$100,000 $100,000	$750,000						
5	Storage and Distribution Various Reservoirs Distribution System Pump Stations									$8,000,000	$1,250,000										
6	Electronic, Computer or Automated Systems (security) SCADA System																				
7	Monitoring Practices Safety Inspections																				
8	Financial Infrastructure Utility Billing Software															$350,000					
9	Chemical Storage, Use and Handling Chemical totes /storage																			$200,000	
10	Utility Operation and Maintenance Personnel																	$200,000	$500,000		
	Regional Economic Consequence	$0		$3,847,900	$0	$0		$0		$865,782,200	$432,891,100	$0		$7,695,800	$0	$0		$44,443,500	$0	$134,677,200	
	Vulnerability Likelihood % (x100)	0.50		1.00	0.50	0.06		0.43		1.00	1.00	0.50		0.24	0.03	0.75		0.62	0.53	0.81	
	Annual Threat Likelihood	5.00E-02		1.00E-06	1.00E-06	5.00E-02		1.00E-02		1.10E-05	1.10E-05	5.00E-02		5.00E-02	5.00E-02	3.00E-01		1.00E-02	1.00E-02	5.00E-03	
	***Monetized Risk Annual Cost**	**$5,000**		**$5.85**	**$0.21**	**$600**		**$4,300**		**$39,343**	**$4,776**	**$7,500**		**$93,550**	**$1,125**	**$78,750**		**$276,790**	**$2,650**	**$546,253**	
	Capitalized Cost of Proposed Countermeasure	NA		NA	**$658,333**	NA		NA		NA	**$1,283,333**	NA		NA	**$1,416,667**	NA		NA	**$1,333,333**	NA	
	Capitalized Cost - Total	**$166,667**		**$195**	**$658,340**	**$20,000**		**$143,333**		**$1,311,433**	**$1,442,533**	**$250,000**		**$3,118,320**	**$1,454,167**	**$2,625,000**		**$9,226,323**	**$1,421,666**	**$18,208,422**	

***Monetized Risk Annual Cost = Annual Threat Likelihood x Vulnerability Likelihood x Financial Consequence**

Countermeasures Analysis

Countermeasures are put in place to protect the water systems assets. In selecting the proper countermeasures, it makes good fiscal sense to find countermeasures that are also the most cost-effective. To determine whether the proposed countermeasures show a benefit to the water system, it is helpful to compare the Capitalized Cost of the baseline countermeasures to the Capitalized Cost of the proposed countermeasures. Capitalized Cost is simply converting an annual cashflow which goes for an infinite period to a present worth value.

For the baseline countermeasures, the capitalized cost is determined by converting EPA's Annual Monetized Risk to a present worth value. For proposed countermeasures, the Capitalized Cost not only includes the present worth of EPA's Annual Monetized Risk for the proposed countermeasure, but also includes the countermeasures capital project cost and the present worth of annual O&M costs. This is done for each Asset-Threat Pair which has a proposed countermeasure.

If the Capitalized Cost of the Proposed Countermeasure is greater than the Baseline Countermeasure, the proposed countermeasure is not economically beneficial to the water system. Conversely, if the Capitalized Cost of the Proposed Countermeasure is less than the Baseline Countermeasure, it is economically beneficial to the water system. Writing this as a mathematical equation is as follows:

CCBC – CCPC > VC Proposed Countermeasure is Beneficial to the Water System
CCBC – CCPC < VC Proposed Countermeasure is Not Beneficial to the Water System

Where:
VC = Value of Countermeasure
CCBC = Capitalized Cost of Baseline Countermeasure
CCPC = Capitalized Cost of Proposed Countermeasure

Table 6 below shows the Capitalized Cost for the proposed countermeasures. Both the capital and operations & maintenance (O&M) costs are shown. The annualized cost assumes a 3% finance rate over a 25-year period.

Table 6 – Countermeasure Capitalized Cost

Potential Countermeasures	Initial Capital Cost	Yearly O&M Costs	Present Worth of Yearly O&M	Capitilized Cost: Initial Capital Cost + PW of Yearly O&M
B2: Toxicity Monitoring for Canal	$425,000	$7,000	$233,333	$658,333
E5: Auto Shut-Off Valves on Reservoirs	$1,250,000	$1,000	$33,333	$1,283,333
G4: Install Backup Power Generation	$750,000	$20,000	$666,667	$1,416,667
I10: Additional Cross Train WTP Operations Staff	$500,000	$25,000	$833,333	$1,333,333

The comparison of the Baseline Countermeasure Capital Cost to the Proposed Countermeasure Capital Cost is shown at the bottom of Table 5. If the Proposed Countermeasure is beneficial to the water system, it is highlighted in green. If not, it is highlighted in red. The needs identified in the plan are advisory and will be considered alongside other capital planning and strategic planning efforts.

There are also other factors to consider whether a proposed countermeasure should be implemented. These include: will it increase the overall safety of the community and/or will it increase the reliability of the water system? These factors need to be considered in addition to the cost effectiveness of the countermeasures. These issues are not evaluated in this document as they should be part of a more in-depth discussion which is outside the scope of the Risk and Resilience Assessment.

Appendix A

Quantitative Risk Assessment Details

Asset Threat Pair A1

Asset:
Physical Barriers – Fencing and Gates

Threat:
Vandals Damage Fencing and Gates at Canal Headworks

Scenario:
The security fencing and gates at the Canal headworks are damaged by vandals. Much of the fencing has been damaged and the main gate has been torn away and is inoperable. Alarm system notified on-call staff who notified police. Police response helped minimized the damage.

Utility Financial Consequence:
Canal headworks main gate is replaced and damaged fencing repaired/replaced as necessary.

Existing Countermeasures:
Security cameras and remote alarm

Proposed Countermeasures:
None

Assessment Summary:

Risk Metrics	Baseline Analysis w/Existing Countermeasures	Countermeasure Analysis w/Proposed Countermeasures
Utility Financial Consequence	$200,000	None
Duration of Service (Asset) Outage	7 days	"
Customers without Water Service	0	"
Fatalities	0	"
Injuries	0	"
Regional Economic Consequence[1]	$0	"
Threat Likelihood[2]	0.05	"
Vulnerability Likelihood[3]	50%	"
Monetized Risk[4]	MR = 0.05 x 0.5 x $200,000 = $5000	"

1. Determined by EPA on the following: Utility information, percentage and duration and of service outage, # of fatalities and injuries.
2. Assigned by EPA
3. Can we Detect Threat: Certain, Probable, Possible, None
   Can we Delay Consequences: Very Strong, Strong, Limited, No Delay
   Cities Response to Threat: Fast, Variable, Slow, None
4. Monetized Risk (MR) = Threat Likelihood x Vulnerability Likelihood x Financial Consequence

Asset Threat Pair B2

Asset:

Source Water – Canal Drainage

Threat:

Intention/Accidental Contamination of Canal

Scenario:

An unknown contaminate enters the Canal sometime during the night. The contaminate causes a visible sheen on the water surface and has a slight smell but goes undetected during the night and enters the Vine Street WTP. In the morning, operators notice a smell and sheen in the Plant and immediately shut down the Plant. Through testing it is determined the contaminate did not enter the distribution system. However, in making this determination, the surrounding distribution system was isolated, flushed, chlorinated and put back on-line affecting 500 customers. The Plant needed flushing, cleaning and the replacement of the mixed media filters.

Utility Financial Consequence:

Baseline: Cost to flush, chlorinate and test the water lines around the Vine WTP; replace the mixed media filters and clean the remaining affected portions of the WTP.

Countermeasure: Cost to install 2 water quality monitoring stations

Existing Countermeasures:

None

Proposed Countermeasures:

Install continuous water quality monitoring stations at key locations along the Canal. Information from these stations can alert the WTP of a change in water quality (measured parameters) which can help reduce risk of WTP contamination.

Assessment Summary:

Risk Metrics	Baseline Analysis w/Existing Countermeasures	Countermeasure Analysis w/Proposed Countermeasures
Utility Financial Consequence	$2,000,000	$425,000
Duration of Service (Asset) Outage	14 days Vine St. A-M acts as backup	0
Customers without Water Service	500 for 2-4 days as surrounding lines are tested and chlorinated	0
Fatalities	0	0
Injuries	0	0
Regional Economic Consequence[1]	$3,847,900	$0
Threat Likelihood[2]	$1x10^{-6}$	$1x10^{-6}$
Vulnerability Likelihood[3]	100%	50%
Monetized Risk[4]	$1x10^{-6}$x 1 x ($2,000,000+$3,847,900) = $5.85	$1x10^{-6}$x 0.50 x$425,000 = $0.21

1. Determined by EPA on the following: Utility information, percentage and duration and of service outage, # of fatalities and injuries.
2. Assigned by EPA
3. Can we Detect Threat: Certain, Probable, Possible, None — Certain, Probable, Possible, None
   Can we Delay Consequences: Very Strong, Strong, Limited, No Delay — Very Strong, Strong, Limited, No Delay
   Cities Response to Threat: Fast, Variable, Slow, None — Fast, Variable, Slow, None
4. Monetized Risk (MR) = Threat Likelihood x Vulnerability Likelihood x Financial Consequence

Asset Threat Pair C2

Asset:
Source Water – Santiam Drainage
Threat:
Cyanotoxins in Raw Water

Scenario:

A long dry hot spring and summer yields the detection of cyanotoxins in the Detroit Reservoir and Foster Reservoir. The toxins have made their way into the Santiam River system and our testing protocol has detected them at the Canal head gates and the A.M. intake. Further testing has not detected them in the finish water. Treatment plants are successful at removing the toxins through existing treatment processes.

Utility Financial Consequence:
Includes the increase cost to test the raw water and finish water for the duration of the warm weather season.

Existing Countermeasures:
Test for toxins in river at diversion/intake

Proposed Countermeasures:
None

Assessment Summary:

Risk Metrics	Baseline Analysis w/Existing Countermeasures	Countermeasure Analysis w/Proposed Countermeasures
Utility Financial Consequence	$200,000	None
Duration of Service (Asset) Outage	0	"
Customers without Water Service	0	"
Fatalities	0	"
Injuries	0	"
Regional Economic Consequence[1]	0	"
Threat Likelihood[2]	0.05	"
Vulnerability Likelihood[3]	6%	"
Monetized Risk[4]	MR = 0.05 x 0.06 x $200,000 = $600	"

1. Determined by EPA on the following: Utility information, percentage and duration and of service outage, # of fatalities and injuries.
2. Assigned by EPA
3. Can we Detect Threat: Certain, Probable, Possible, None
   Can we Delay Consequences: Very Strong, Strong, Limited, No Delay
   Cities Response to Threat: Fast, Variable, Slow, None
4. Monetized Risk (MR) = Threat Likelihood x Vulnerability Likelihood x Financial Consequence

Asset Threat Pair D2

Asset:
Source Water – Santiam Drainage
Threat:
Wildfire/Volcanic Ash in Raw Water
Scenario:
A prolonged draught leads to a catastrophic wildfire (100-year event) in the Santiam watershed. The fire has destroyed much of the under-story which leads to significant amounts of ash and soil erosion to enter the Santiam River watershed.
Utility Financial Consequence:
Includes cost to protect equipment as part of the existing countermeasures, increased cost to monitor raw water and purchase additional chemicals as needed, and repair/replace filers due to anticipated damage.
Existing Countermeasures:
Cover outdoor WTP equipment, place filers on Storage Reservoir vents and building HVAC intakes during fire and ash fall out. Adjust WTP chemicals to account for a change in raw water chemistry, shut down WTP production to let the most significant ash and soil contaminated water flow pass water intakes.

Proposed Countermeasures:
None

Assessment Summary:

Risk Metrics	Baseline Analysis w/Existing Countermeasures	Countermeasure Analysis w/Proposed Countermeasures
Utility Financial Consequence	$1,000,000	None
Duration of Service (Asset) Outage	Intermittent: 1-day total	"
Customers without Water Service	none	"
Fatalities	0	"
Injuries	0	"
Regional Economic Consequence[1]	0	"
Threat Likelihood[2]	0.01	"
Vulnerability Likelihood[3]	43%	"
Monetized Risk[4]	M.R.=0.01x0.43x$1,000,000= $4,300	"

1. Determined by EPA on the following: Utility information, percentage, and duration and of service outage, # of fatalities and injuries.
2. Assigned by EPA
3. Can we Detect Threat: Certain, Probable, Possible, None
   Can we Delay Consequences: Very Strong, Strong, Limited, No Delay
   Cities Response to Threat: Fast, Variable, Slow, None
4. Monetized Risk (MR) = Threat Likelihood x Vulnerability Likelihood x Financial Consequence

Asset Threat Pair E3

Asset:
Intake structures, raw water conveyance pipes and pump stations
Threat:
Strong Earthquake PGA 0.8-1.1

Scenario:
A strong Cascadia Subduction Zone earthquake strikes western Oregon with significant ground movement causing widespread damage. The earthquake causes damage to most of the raw water conveyances and other structures. Multiple repairs need to be made to the Canal headworks, raw water pump stations and raw water conveyance pipes. Estimated 25% of the city is without on-site water delivery for 180 days.
Utility Financial Consequence:
Includes rough costs to make unspecified repairs to the Canal headworks, raw water conveyance pipes and pump stations.
Existing Countermeasures:
None
Proposed Countermeasures:
No proposed countermeasures to mitigate damage to raw water structures or systems.

Assessment Summary:

Risk Metrics	Baseline Analysis w/Existing Countermeasures	Countermeasure Analysis w/Proposed Countermeasures
Utility Financial Consequence	$11,225,000	None
Duration of Service (Asset) Outage	180 days	"
Customers without Water Service	25%	"
Fatalities	0	"
Injuries	0	"
Regional Economic Consequence[1]	$865,782,200 (not cumulative for same event)	"
Threat Likelihood[2]	$1.1x10^{-5}$	"
Vulnerability Likelihood[3]	100%	"
Monetized Risk[4]	MR = $1.1x10^{-5}$ x 1 x $866,904,700 = $9,536	"

1. Determined by EPA on the following: Utility information, percentage and duration and of service outage, # of fatalities and injuries.
2. Assigned by EPA
3. Can we Detect Threat: Certain, Probable, Possible, None
   Can we Delay Consequences: Very Strong, Strong, Limited, No Delay
   Cities Response to Threat: Fast, Variable, Slow, None
4. Monetized Risk (MR) = Threat Likelihood x Vulnerability Likelihood x Financial Consequence

Asset Threat Pair E4

Asset:
Pretreatment and Treatment Plants – Vine Street WTP
Threat:
Strong Earthquake PGA 0.8-1.1

Scenario:
A strong Cascadia Subduction Zone earthquake strikes western Oregon with significant ground movement causing widespread damage. The earthquake damages the Vine Street WTP. The damage is severe and causes significant damage to the Plant. Through work arounds and packaged WTP, service to most of the City is provided. However, it is assumed 25% of the city is without water delivered to their homes/businesses for 180 days.
Utility Financial Consequence:
Includes rough costs to make unspecified repairs to the Vine Street Plant including setting up a packaged WTP as the repairs are made to the existing plant.

Existing Countermeasures:
Emergency Operations Manual, Mutual Aid Assistance agreements (ORWARN)
Proposed Countermeasures:
No proposed countermeasures to mitigate damage to the Vine Street Water Plant.

Assessment Summary:

Risk Metrics	Baseline Analysis w/Existing Countermeasures	Countermeasure Analysis w/Proposed Countermeasures
Utility Financial Consequence	$55,000,000	None
Duration of Service (Asset) Outage	180 days	"
Customers without Water Service	25%	"
Fatalities	0	"
Injuries	0	"
Regional Economic Consequence[1]	$865,782,200 (not cumulative for same event)	"
Threat Likelihood[2]	$1.1x10^{-5}$	"
Vulnerability Likelihood[3]	100%	"
Monetized Risk[4]	MR = $1.1x10^{-5}$ x 1 x $920,782,200 = $10,286	"

1. Determined by EPA on the following: Utility information, percentage and duration and of service outage, # of fatalities and injuries.
2. Assigned by EPA
3. Can we Detect Threat: Certain, Probable, Possible, None
   Can we Delay Consequences: Very Strong, Strong, Limited, No Delay
   Cities Response to Threat: Fast, Variable, Slow, None
4. Monetized Risk (MR) = Threat Likelihood x Vulnerability Likelihood x Financial Consequence

Asset Threat Pair E4

Asset:
Pretreatment and Treatment Plants – A.M. WTP
Threat:
Strong Earthquake PGA 0.8-1.1

Scenario:
A strong Cascadia Subduction Zone earthquake strikes western Oregon with significant ground movement causing widespread damage. The earthquake damages the A.M. WTP. The damage causes significant damage to the Plant. Through work arounds and portable WTP we are able to resume service to most of the City. However, it is assumed 25% of the city is without water delivered to their homes/businesses for 180 days.
Utility Financial Consequence:
Includes rough costs to make unspecified repairs to the AM Plant. Repair costs for the AM plant are less costly than for the Vine Street plant due to more stringent earthquake codes in place during construction of the AM plant. Damage is expected to be less severe than for the Vine Street Plant.
Existing Countermeasures:
Emergency Operations Manual, Mutual Aid Assistance agreements (ORWARN)
Proposed Countermeasures:
No proposed countermeasures to mitigate damage to the A.M. Water Plant.

Assessment Summary:

Risk Metrics	Baseline Analysis w/Existing Countermeasures	Countermeasure Analysis w/Proposed Countermeasures
Utility Financial Consequence	$35,000,000	None
Duration of Service (Asset) Outage	180 days	"
Customers without Water Service	25%	"
Fatalities	0	"
Injuries	0	"
Regional Economic Consequence[1]	$865,782,200 (not cumulative for same event)	"
Threat Likelihood[2]	$1.1x10^{-5}$	"
Vulnerability Likelihood[3]	100%	"
Monetized Risk[4]	MR = $1.1x10^{-5}$ x 1 x $900,782,200 = $9,909	"

1. Determined by EPA on the following: Utility information, percentage and duration and of service outage, # of fatalities and injuries.
2. Assigned by EPA
3. Can we Detect Threat: Certain, Probable, Possible, None
   Can we Delay Consequences: Very Strong, Strong, Limited, No Delay
   Cities Response to Threat: Fast, Variable, Slow, None
4. Monetized Risk (MR) = Threat Likelihood x Vulnerability Likelihood x Financial Consequence

Asset Threat Pair E5

Asset:
Storage and Distribution – Distribution System
Threat:
Strong Earthquake PGA 0.8-1.1

Scenario:

A strong Cascadia Subduction Zone earthquake strikes western Oregon with significant ground movement causing widespread damage. The earthquake damages the underground distribution system, storage reservoirs and water pump stations. The entire distribution system will need chlorinated and multiple repairs made. The earthquake is assumed to eliminate water service to 25% of the city for 180 days.

Utility Financial Consequence:
Includes rough costs to make unspecified repairs to the storage reservoirs, water pump stations and distributions system.

Existing Countermeasures:
Earthquake automatic shutoff valves on Broadway and AM reservoirs; Emergency operations manual; Mutual Aid Assistance agreements (ORWARN)

Proposed Countermeasures:
Install Earthquake automatic shutoff valves on all remaining reservoirs. This keeps water in reservoirs and aids in suppling water to residence thus reducing the duration of the service outage.

Assessment Summary:

Risk Metrics	Baseline Analysis w/Existing Countermeasures	Countermeasure Analysis w/Proposed Countermeasures
Utility Financial Consequence	$8,000,000	$1,250,000
Duration of Service (Asset) Outage	180 days	90 days
Customers without Water Service	25%	25%
Fatalities	0	0
Injuries	0	0
Regional Economic Consequence[1]	$865,782,200 (not cumulative for same event)	$432,891,100
Threat Likelihood[2]	$1.1x10^{-5}$	$1.1x10^{-5}$
Vulnerability Likelihood[3]	100%	100%
Monetized Risk[4]	MR = $1.1x10^{-5}$ x 1 x $873,782,200 = $9612	MR = $1.1x10^{-5}$ x 1 x $434,141,100 = $4,776

1. Determined by EPA on the following: Utility information, percentage and duration and of service outage, # of fatalities and injuries.
2. Assigned by EPA
3. Can we Detect Threat: Certain, Probable, Possible, None — Certain, Probable, Possible, None
   Can we Delay Consequences: Very Strong, Strong, Limited, No Delay — Very Strong, Strong, Limited, No Delay
   Cities Response to Threat: Fast, Variable, Slow, None — Fast, Variable, Slow, None
4. Monetized Risk (MR) = Threat Likelihood x Vulnerability Likelihood x Financial Consequence

Asset Threat Pair F3

Asset:
Pipe and Constructed Conveyances – Canal intake structure building

Threat:
Break-in and Damage Building

Scenario:
A break-in occurs to the control building at the Canal intake structure. The thieves cut the fence, break-in to the building and cause physical damage, steal the computer and misc. equipment. Existing counter measures notify on-call staff who both call the police and respond in person. The response is too late to stop the incident.

Utility Financial Consequence:
Includes costs to repair the damage to the fence and building, replace the computer and equipment stolen, and repair damage to the interior of the building.

Existing Countermeasures:
Security Cameras, remote alarm call-out

Proposed Countermeasures:
None

Assessment Summary:

Risk Metrics	Baseline Analysis w/Existing Countermeasures	Countermeasure Analysis w/Proposed Countermeasures
Utility Financial Consequence	$300,000	None
Duration of Service (Asset) Outage	4 days	"
Customers without Water Service	0	"
Fatalities	0	"
Injuries	0	"
Regional Economic Consequence[1]	0	"
Threat Likelihood[2]	0.05	"
Vulnerability Likelihood[3]	50%	"
Monetized Risk[4]	MR = 0.05 x0.50 x $300,000 = $7,500	"

1. Determined by EPA on the following: Utility information, percentage and duration and of service outage, # of fatalities and injuries.
2. Assigned by EPA
3. Can we Detect Threat: Certain, Probable, Possible, None
   Can we Delay Consequences: Very Strong, Strong, Limited, No Delay
   Cities Response to Threat: Fast, Variable, Slow, None
4. Monetized Risk (MR) = Threat Likelihood x Vulnerability Likelihood x Financial Consequence

Asset Threat Pair G4

Asset:
Pretreatment and Treatment Plants – A.M. WTP
Threat:
Dependent Utilities – Sustained Power Outage

Scenario:

Consequences beyond the City's control result in a sustained power outage for the region. (this could be due to a severe ice storm, wildfire or a terrorist attack to the power distribution network). The utilities cannot provide power for four (4) days. There is no backup generator for the A.M. WTP and it is shut down until power is restored. Counter measure in place is the Water Curtailment Plan outlined in the Water Management and Conservation Plan. A stage 4 curtailment plan is implemented.

Utility Financial Consequence:
Includes costs incurred to notify customers of the severity of the water curtailment/rationing plan and providing drinking water to residence on wells.

Existing Countermeasures:
Water Curtailment Plan, Emergency Operation Plan, Mutual Aid Assistance agreements (ORWARN)

Proposed Countermeasures:
Install Backup Generator at A.M. Plant only. No need for a backup generator at Vine St., as the AM plant can provide water for short durations with water curtailment an option if needed.

Assessment Summary:

Risk Metrics	Baseline Analysis w/Existing Countermeasures	Countermeasure Analysis w/Proposed Countermeasures
Utility Financial Consequence	$100,000	$750,000
Duration of Service (Asset) Outage	4 days	0
Customers without Water Service	10%	0
Fatalities	0	0
Injuries	0	0
Regional Economic Consequence[1]	$7,695,800 (not cumulative for same event)	0
Threat Likelihood[2]	0.05	0.05
Vulnerability Likelihood[3]	24%	3%
Monetized Risk[4]	MR = 0.05 x0.24 x $7,906,800 = $93,550 (not cumulative for same event)	MR = 0.05 x0.03 x $750,000 = $1,125

1. Determined by EPA on the following: Utility information, percentage and duration and of service outage, # of fatalities and injuries.
2. Assigned by EPA
3. Can we Adequately Prepare?: Very High, High, Moderate, Low — Very High, High, Moderate, Low
   Can we provide an active response?: Very High, High, Moderate, Low — Very High, High, Moderate, Low
   Can we recovery quickly?: Very High, High, Moderate, Low — Very High, High, Moderate, Low
4. Monetized Risk (MR) = Threat Likelihood x Vulnerability Likelihood x Financial Consequence

Asset Threat Pair G4

Asset:

Pretreatment and Treatment Plants – Vine St. WTP

Threat:

Dependent Utilities – Sustained Power Outage

Scenario:

Consequences beyond the Cities control result in a sustained power outage for the region. (this could be due to a severe ice storm, wildfire or a terrorist attack to the power distribution network). The utilities cannot provide power. There is no backup generator for the Vine St. WTP and it is shut down until power is restored. Counter measures in place is the Water Curtailment Plan outlined in the Water Management and Conservation Plan. A stage 4 curtailment plan is implemented.

Utility Financial Consequence:

Includes costs incurred to notify customers of the severity of the water curtailment/rationing plan and providing drinking water to residence on wells.

Existing Countermeasures:

Water Curtailment Plan, Emergency Operation Plan, Mutual Aid Assistance agreements (ORWARN)

Proposed Countermeasures:

Install Backup Generator at A.M. Plant only. No need for a backup generator at Vine St., as the AM plant can provide water for short durations with water curtailment an option if needed.

Assessment Summary:

Risk Metrics	Baseline Analysis w/Existing Countermeasures	Countermeasure Analysis w/Proposed Countermeasures
Utility Financial Consequence	$100,000	None
Duration of Service (Asset) Outage	4 days	"
Customers without Water Service	10%	"
Fatalities	0	"
Injuries	0	"
Regional Economic Consequence[1]	$7,695,800,(not cumulative for same event)	"
Threat Likelihood[2]	0.05	"
Vulnerability Likelihood[3]	24%	"
Monetized Risk[4]	MR = 0.05 x0.24 x $7,795,800 = $93,550,(not cumulative for same event)	"

1. Determined by EPA on the following: Utility information, percentage and duration and of service outage, # of fatalities and injuries.
2. Assigned by EPA
3. Can we Adequately Prepare?: Very High, High, Moderate, Low
   Can we provide an active response?: Very High, High, Moderate, Low
   Can we recovery quickly?: Very High, High, Moderate, Low
4. Monetized Risk (MR) = Threat Likelihood x Vulnerability Likelihood x Financial Consequence

Asset Threat Pair H8

Asset:
Financial Infrastructure – Billing Software
Threat:
Cyber Attach Disables System

Scenario:
A Cyber attach penetrates our network security and disables the billing software system causing irreparable damage to the database and program.

Utility Financial Consequence:
Includes cost to hire a consultant to help repair/recover/reconstruct the database.

Existing Countermeasures:
System Backup, IT security measures

Proposed Countermeasures:
none

Assessment Summary:

Risk Metrics	Baseline Analysis w/Existing Countermeasures	Countermeasure Analysis w/Proposed Countermeasures
Utility Financial Consequence	$350,000	None
Duration of Service (Asset) Outage	14 days	"
Customers without Water Service	0	"
Fatalities	0	"
Injuries	0	"
Regional Economic Consequence[1]	0	"
Threat Likelihood[2]	0.30	"
Vulnerability Likelihood[3]	75%	"
Monetized Risk[4]	MR = 0.30 x .0.75 x $350,000 = $78,750	"

1. Determined by EPA on the following: Utility information, percentage and duration and of service outage, # of fatalities and injuries.
2. Assigned by EPA
3. Can we Detect Threat: Certain, Probable, Possible, None
   Can we Delay Consequences: Very Strong, Strong, Limited, No Delay
   Cities Response to Threat: Fast, Variable, Slow, None
4. Monetized Risk (MR) = Threat Likelihood x Vulnerability Likelihood x Financial Consequence

Asset Threat Pair I10

Asset:
Utility Operation and Maintenance - Personnel
Threat:
Dependent -Employee - Pandemic

Scenario:
A new virus makes the jump from animals to humans. There is no vaccine and the virus is extremely contagious. A worldwide pandemic is declared as the virus makes millions sick across the United States. Albany's work force and key chemical suppliers are severely affected. Operations staff can only keep the WTP's operating at minimum levels. As a result, a stage 4 water curtailment plan is enacted. However, there is still only minimal water available due to the prolonged nature of the pandemic. Approximately 33% of the City is without water for 7 days.
Utility Financial Consequence:
Includes costs incurred to notify customers of the severity of the water curtailment/rationing plan.
Existing Countermeasures:
Employee Cross Training, Experience from current Pandemic
Proposed Countermeasures:
Increase Employee Cross Training including increasing certifications of key employees.

Assessment Summary:

Risk Metrics	Baseline Analysis w/Existing Countermeasures	Countermeasure Analysis w/Proposed Countermeasures
Utility Financial Consequence	$200,000	$500,000
Duration of Service (Asset) Outage	7 days	0
Customers without Water Service	33%	0
Fatalities	0	0
Injuries	0	0
Regional Economic Consequence[1]	$44,443,500	0
Threat Likelihood[2]	0.01	0.01
Vulnerability Likelihood[3]	62%	53%
Monetized Risk[4]	MR = 0.01 x .0.62 x $44,643,500 = $276,790	MR = 0.01 x .0.53 x $500,000 = $2,650

1. Determined by EPA on the following: Utility information, percentage and duration and of service outage, # of fatalities and injuries.
2. Assigned by EPA
3. Can we Adequately Prepare?: Very High, High, Moderate, Low — Very High, High, Moderate, Low
   Can we provide an active response?: Very High, High, Moderate, Low — Very High, High, Moderate, Low
   Can we recovery quickly?: Very High, High, Moderate, Low — Very High, High, Moderate, Low
4. Monetized Risk (MR) = Threat Likelihood x Vulnerability Likelihood x Financial Consequence

Asset Threat Pair J9

Asset:
Chemical Storage Use and Handling – Chemical Totes and Storage
Threat:
Dependent -Key Supplies Not Available

Scenario:

A strike of national transportation workers affecting most all shipping across the nation coupled with a natural shortage of (key chemicals needed to treat raw water) result in having to limit the amount of finish water produced at both the A.M and Vine WTPs. Eventual all potable water production stops for 7 days.

Utility Financial Consequence:
Includes costs incurred to notify customers of the severity of the water curtailment/rationing plan and providing drinking water to residence on wells.

Existing Countermeasures:
Water Curtailment Plan, Emergency Operation Plan, Mutual Aid Assistance agreements (ORWARN)

Proposed Countermeasures:
none

Assessment Summary:

Risk Metrics	Baseline Analysis w/Existing Countermeasures	Countermeasure Analysis w/Proposed Countermeasures
Utility Financial Consequence	$200,000	None
Duration of Service (Asset) Outage	7 days	"
Customers without Water Service	100%	"
Fatalities	0	"
Injuries	0	"
Regional Economic Consequence[1]	$134,677,200	"
Threat Likelihood[2]	0.005	"
Vulnerability Likelihood[3]	81%	"
Monetized Risk[4]	MR = 0.005 x .0.81 x $135,169,100 = $546,253	"

1. Determined by EPA on the following: Utility information, percentage and duration and of service outage, # of fatalities and injuries.
2. Assigned by EPA
3. Can we Adequately Prepare?: Very High, High, Moderate, Low
   Can we provide an active response?: Very High, High, Moderate, Low
   Can we recovery quickly?: Very High, High, Moderate, Low
4. Monetized Risk (MR) = Threat Likelihood x Vulnerability Likelihood x Financial Consequence