Reference Guide
for
Asset Management Inventory
and
Risk Analysis

Prepared by the Southwest Environmental Finance Center

Document's Intended Use: This document provides suggestions on the type of information to be collected, by asset category, when completing an asset inventory for a drinking water or stormwater system. For each asset category, following the inventory table, there is a table providing suggestions for where the data may be found. Following the Data Locations information is a table for factors that could be considered when defining what impacts Probability of Failure and Consequence of Failure when determining an asset's criticality (or risk). The lists provided are not intended to be all inclusive nor do they purposefully exclude any items. Certainly, you will come up with other things that are important to your system. This guide is intended to help you get started.

SOUTHWEST ENVIRONMENTAL FINANCE CENTER

Hydrants
(Fire, Flush, Flow Test)

Inventory

Necessary Data	Optional Data
☐ Asset size - diameter ☐ Asset location ☐ Installation date ☐ Condition - Visible inspection, then update as needed with maintenance history, repairs, problems, etc. ☐ Useful life (varies with type, if unknown a rough estimate is 50 years) ☐ Flow Rate	☐ Redundancy – is another hydrant accessible? ☐ Model number ☐ Manufacturer ☐ Supplier name & phone ☐ Under warranty (yes or no) ☐ Warranty expiration date ☐ Manufacturer's recommended O&M ☐ Maintenance records: last date hydrant was flushed or exercised ☐ Operational status ☐ Color (if useful) ☐ Were design specifications followed? ☐ Asset use(s)

Possible Available Data Sources

☐ Aerial photographs	☐ Interview current and former operators
☐ As-built record drawings	☐ Site visit
☐ Existing utility maps	☐ Photographs
☐ Visible inspection	☐ Contact contractors or engineers familiar with the system
☐ Repair, maintenance, and inspection records	
☐ Purchase records	
☐ O&M Manual	

Note: Data may not be available for all sources- record what is available

Risk Assessments

Factors Affecting Probability of Failure	Factors Affecting Consequence of Failure
☐ Condition - rusting, corrosion, leaking seal? ☐ Frequency of use - is it opened at least annually as part of a flushing or testing program? ☐ Routine maintenance completed? ☐ Pipe size connected to - less than 6 inch may cavitate ☐ Tools needed to open readily available to fire department and water department? ☐ Age	☐ Inability to fight a fire - loss of property, loss of life ☐ Inability to properly flush system - health concerns ☐ Water damage to nearby structures ☐ Reduced level of service ☐ Redundancy (can another hydrant provide fire flow or flushing if needed?)

SOUTHWEST ENVIRONMENTAL FINANCE CENTER

Meters

(Commercial, Master, Residential, Source, Well)

Inventory

Necessary Data	Optional Data
☐ Asset size – diameter ☐ Optimal flow range (from manufacturer) ☐ Asset location ☐ Installation date ☐ Condition - Visible inspection, then update as needed with gallons flowed, Maintenance history, system knowledge) ☐ Useful life (varies with type, if unknown a rough estimate is 15 years)	☐ Redundancy - are spare meters/parts always available for repair/replacement ☐ Model Number ☐ Serial Number - if not tied to address in billing or other records ☐ Manufacturer ☐ Operational status ☐ Supplier Name and Phone ☐ Under warranty (yes or no) ☐ Warranty Expiration Date ☐ Maintenance records – primarily for larger commercial and master meters ☐ Design specifications followed

Possible Available Data Sources

☐ Billing Records	☐ O&M Manual
☐ Aerial photographs	☐ Interview current and former operators
☐ As-built record drawings	☐ Site visit
☐ Existing utility maps	☐ Photographs
☐ Visible inspection	☐ Contact contractors or engineers familiar with the system
☐ Repair, maintenance and inspection records	
☐ Purchase records	

Note: Data may not be available for all sources- record what is available

Risk Assessments

Factors Affecting Probability of Failure	Factors Affecting Consequence of Failure
☐ Properly sized (meter size not always equal to pipe size) ☐ Properly installed (distance to elbows, tees, etc.) ☐ Flow rate within optimal range ☐ Condition ☐ Clogging issues ☐ Air in lines ☐ Maintenance History ☐ Age	☐ Impacts to revenue (typically meters fail by under-reading = lost revenue) ☐ Inability to understand water loss ☐ Reduced level of service ☐ Cost of the failure ☐ Stopped meters may cause estimated bills (lost revenue and/or angry customers)

SOUTHWEST ENVIRONMENTAL FINANCE CENTER

Pipe

(Asbestos Concrete, Cast Iron, Concrete, Ductile Iron, Polyvinyl Chloride (PVC), Steel, Transmission Main)

Inventory	
Necessary Data	**Optional Data**
☐ Asset size ☐ Pipe type ☐ Asset location ☐ Installation date ☐ Condition – base on break history or any visible inspection or repair data, then update when inspection is possible or new information is known ☐ Useful life (varies with type, if unknown a rough estimate is 75 to 125 years)	☐ Operational status - is this pipe in use or valved off? Is it standby? ☐ Redundancy - can water still reach all customers if this pipe fails? ☐ Manufacturer ☐ Supplier Name and Phone ☐ Under Warranty (yes or no) ☐ Warranty Expiration Date ☐ Manufacturer's recommended installation and operation (pressure within specified rating) ☐ Maintenance records - break records ☐ Adequate Construction methods followed

Possible Available Data Sources	
☐ As-built record drawings ☐ Existing utility maps ☐ Visible inspection – valve locations used to indicate pipe locations ☐ Repair, maintenance, and inspection records ☐ Purchase records	☐ Interview current and former operators ☐ Photographs ☐ Contact contractors or engineers familiar with the system

Note: Data may not be available for all sources- record what is available

Risk Assessments	
Factors Affecting Probability of Failure	**Factors Affecting Consequence of Failure**
☐ Number of breaks	☐ Importance of lost water
☐ Time between breaks	☐ Damage to nearby structures
☐ Bedding (type, amount, condition)	☐ Damage to environment (sink holes, chlorinated water entering a natural waterway, etc.)
☐ Vibration	☐ Revenue loss during the outage
☐ Temperature change	☐ Customer inconvenience
☐ Depth of Bury	☐ Reduced level of service
☐ Soil corrosivity	☐ Cost of the failure
☐ Electrolysis	☐ Number and type of customers out of water
☐ Subject to pressure transients	
☐ Age	

SOUTHWEST ENVIRONMENTAL FINANCE CENTER

Pumps
(Booster, Chemical, Metering, Pressure, Transfer, Well)

Inventory

Necessary Data	Optional Data

☐ Asset size – diameter
☐ Flow range (operational and design)
☐ Asset location
☐ Condition – visible inspection, maintenance history, amount of usage, operating within design parameters, etc.
☐ Installation date
☐ Useful life (varies with type, a rough estimate is 5 - 15 years)
	☐ Operational status
	☐ Model number
	☐ Serial number
	☐ Manufacturer
	☐ Supplier name & phone
	☐ Under warranty (yes or no)
	☐ Warranty expiration date
	☐ Manufacturer's recommended O&M
	☐ Maintenance completed regularly
	☐ Redundancy- Spare pump/parts always available if this pump fails?
	☐ Were design specifications followed?
	☐ Electrical Data:
	  ☐ Variable speed?
	  ☐ Nameplate horsepower (used to calculate power consumption)
	☐ Average run time

Possible Available Data Sources

☐ Aerial photographs
☐ As-built record drawings
☐ Existing utility maps
☐ Visible inspection
☐ Repair, maintenance, and inspection records
☐ Purchase records
☐ O&M Manual
☐ Interview current and former operators
☐ Site visit
☐ Photographs
☐ Contact contractors or engineers familiar with the system
☐ Maintenance Records

Note: Data may not be available for all sources- record what is available

Risk Assessments

Factors Affecting Probability of Failure	Factors Affecting Consequence of Failure
☐ Condition ☐ Maintenance history - routine maintenance performed? Correct lubricants used? etc. ☐ Installation – vibration or alignment concerns ☐ Running as designed w/in the pump curve ☐ Properly sized? ☐ Age	☐ Reduced level of service ☐ Health concerns ☐ Inability to provide water ☐ Time to repair may be lengthy - spare parts on hand? ☐ Cost of the failure ☐ Number and type of customers impacted

Valves (Air Release (ARV), Air Vacuum, Ball, Butterfly, Check, Gate, Pressure Relief (PRV))

Inventory

Necessary Data	Optional Data
☐ Asset size – diameter, flow rate or settings ☐ Asset location ☐ Installation date ☐ Condition – visible inspection, maintenance history, age, etc ☐ Useful Life (if unknown an estimate is 15 years for check valve, 20 for all others)	☐ Operational - is this valve operational? Distribution system valves may need more than yes/or no answer - 100% flow stoppage, allows break to be repaired, etc. ☐ Redundancy – will water service continue normally if this valve becomes unavailable? ☐ Model Number ☐ Serial Number ☐ Manufacturer ☐ Supplier Name & Phone ☐ Under Warranty ☐ Warranty Expiration Date ☐ Manufacturer's Recommended O&M ☐ Maintenance completed regularly (exercised, cleaned)? ☐ Design Specifications followed?

Possible Available Data Sources

☐ Aerial photographs	☐ O&M Manual
☐ As-built record drawings	☐ Interview current and former operators
☐ Existing utility maps	☐ Photographs
☐ Visible inspection	☐ Contact contractors or engineers familiar with the system
☐ Repair, maintenance and inspection records	
☐ Purchase records	

Note: Data may not be available for all sources- record what is available

Risk Assessments

Factors Affecting Probability of Failure	Factors Affecting Consequence of Failure
☐ Condition ☐ Maintenance History (exercised regularly, pressure gauges inspected regularly, etc.) ☐ Clogging ☐ Water Hammer ☐ Age	☐ Backflow concerns ☐ Pressure concerns ☐ Health concerns ☐ Level of Service Failures ☐ Maintenance concerns

Storage Tanks/Structures

(Concrete, Earthen Basin, Fiberglass, Metal, Plastic/Polymer)

Inventory

Necessary Data	Optional Data
☐ Asset size - diameter and/or capacity ☐ Asset location ☐ Installation date ☐ Condition - Visible inspection, maintenance history, age, etc. ☐ Useful life (varies with type, if unknown an estimate is 50 years)	☐ Operational - is this storage tank in use? ☐ Redundancy ☐ Model Number ☐ Serial Number ☐ Manufacturer ☐ Supplier Name & Phone ☐ Under Warranty ☐ Warranty Expiration Date ☐ Manufacturer's Recommended O&M ☐ Maintenance completed regularly (inspected, painted, cleaned)? ☐ Design Specifications followed?

Possible Available Data Sources

☐ Aerial photographs	☐ O&M Manual
☐ As-built record drawings	☐ Interview current and former operators
☐ Existing utility maps	☐ Photographs
☐ Visible inspection	☐ Contact contractors or engineers familiar with the system
☐ Repair, maintenance and inspection records	
☐ Purchase records	

Note: Data may not be available for all sources- record what is available

Risk Assessments

Factors Affecting Probability of Failure	Factors Affecting Consequence of Failure
☐ Condition ☐ Inspection and Maintenance History ☐ Location / elevation ☐ Size ☐ Exposure to corrosive or damaging elements - sun for plastic tanks, chlorine for metal tanks, etc. ☐ Age	☐ Level of Service Failures ☐ Health concerns ☐ Inability to provide water or sufficient pressure ☐ Time to repair ☐ Cost of the failure ☐ Environmental concerns ☐ Flooding/washout concerns

Treatment

(Chlorination System, Contamination Removal, Disinfection System, Filtration, Ozonation System, Reverse Osmosis, Sedimentation System, Ultraviolet System)

Inventory

Necessary Data

- ☐ Asset size – diameter, capacity and/or flow rate
- ☐ Asset location
- ☐ Installation date
- ☐ Condition - Visible inspection, maintenance history, age, etc.
- ☐ Useful life (varies with type, if unknown an estimate is 10-30 years)

Optional Data

- ☐ Operational - is treatment unit in use?
- ☐ Redundancy - can the water continue treatment if this asset becomes unavailable?
- ☐ Model Numbers
- ☐ Serial Numbers
- ☐ Manufacturer
- ☐ Supplier Name & Phone
- ☐ Under Warranty
- ☐ Warranty Expiration Date
- ☐ Manufacturer's Recommended O&M
- ☐ Maintenance completed regularly?
- ☐ Design Specifications followed?
- ☐ Electrical Data
- ☐ Variable Speed?
- ☐ Nameplate Horsepower (used to calculate power consumption)
- ☐ Measured power consumption per month or year
- ☐ Average run time (used to calculate annual hours of operation)
- ☐ Hours of operation per year
- ☐ Peak Energy Demand

Possible Available Data Sources

- ☐ As-built record drawings
- ☐ Existing utility maps
- ☐ Visible inspection
- ☐ Repair, maintenance and inspection records
- ☐ Purchase records
- ☐ O&M Manual
- ☐ Interview current and former operators
- ☐ Photographs
- ☐ Contact contractors or engineers familiar with the system

Note: Data may not be available for all sources- record what is available

Risk Assessments

Factors Affecting Probability of Failure	Factors Affecting Consequence of Failure
☐ Condition	☐ Reduced Level of Service
☐ Maintenance History	☐ Health Concerns
☐ Frequency of Inspection	☐ Customer Inconvenience (e.g., boil notices)
☐ SOPs developed and followed	☐ Inability to provide water
☐ Chemical Supplies on-hand and ability to obtain in timely manner	☐ Length of Repair Time - spare parts on hand?
	☐ Cost of the failure

Sources – Gray Infrastructure (Intake Structure, Well Casing)

Inventory

Necessary Data	Optional Data
☐ Asset size – diameter, depth and/or flow rate, ☐ Asset location ☐ Installation date ☐ Condition - Visible inspection if possible, age, maintenance history, etc. ☐ Useful life (varies with type, if unknown an estimate is 20-50 years)	☐ Operational - is this source in use? ☐ Redundancy - is another intake structure if water levels drop below the intake or there are other problems? ☐ Model Number ☐ Serial Number ☐ Manufacturer ☐ Supplier Name & Phone ☐ Under Warranty ☐ Warranty Expiration Date ☐ Manufacturer's Recommended O&M ☐ Maintenance records ☐ Design Specifications followed?

Possible Available Data Sources

☐ As-built record drawings	☐ Purchase records
☐ Well Logs	☐ O&M Manual
☐ Existing utility maps	☐ Interview current and former operators
☐ Visible inspection	☐ Photographs
☐ Repair, maintenance and inspection records	☐ Contact contractors or engineers familiar with the system

Note: Data may not be available for all sources- record what is available

Risk Assessments

Factors Affecting Probability of Failure	Factors Affecting Consequence of Failure
☐ Condition ☐ Maintenance History ☐ Installation ☐ Clogging ☐ Age ☐ Water Levels	☐ Level of Service Failures ☐ Health concerns ☐ Inability to provide water ☐ Time to repair may be lengthy - spare parts on hand? ☐ Monetary cost of failure

SOUTHWEST ENVIRONMENTAL FINANCE CENTER

Water Sources
(Streams, Rivers, Reservoirs, Wells)

Inventory

Necessary Data	Optional Data
☐ Asset size - length and number of stream segments, streamflow, maximum and storage, max/min discharge, well depth ☐ Asset location ☐ Date – when well was drilled, when reservoir was built, when river/stream started to be used for source water ☐ Condition - Visible inspection if possible, maintenance history, water level, recharge, water quality (contaminants, erosion, nutrient load, turbidity) ☐ Useful life – drought projections, population projections	☐ Operational - is this source in use? ☐ Redundancy - is another source accessible if this source becomes unavailable? ☐ Maintenance records ☐ Ownership of the area surrounding the source water e.g. forest (impacts quality of the source water) ☐ Design Specifications followed for the gray infrastructure components?

Possible Available Data Sources

- ☐ Aerial photographs
- ☐ As-built record drawings
- ☐ Well Logs
- ☐ Existing system maps
- ☐ Visible inspection
- ☐ Repair, maintenance, inspection and restoration records
- ☐ Purchase records
- ☐ Photographs
- ☐ Contact contractors, engineers, city officials, conservation groups etc. familiar with the source

Note: Data may not be available for all sources- record what is available

Risk Assessments

Factors Affecting Probability of Failure	Factors Affecting Consequence of Failure
☐ Condition ☐ Maintenance History ☐ Contamination ☐ Population ☐ Weather – snowpack, precipitation	☐ Level of Service Failures ☐ Health concerns ☐ Inability to provide water ☐ Time to repair or switch sources may be lengthy ☐ Cost of the failure – trucking in water, boil water order, cost of repair

SOUTHWEST ENVIRONMENTAL FINANCE CENTER

Engineered Green
(Green Roof, Blue Roof, Gabion, Permeable Pavement, Rain Barrels & Cisterns, Sand & Organic Filters)

Inventory

Necessary Data	Optional Data
☐ Asset size – flow/retention capacity, rate of filtration, maximum storage, etc. ☐ Asset location ☐ Installation date ☐ Condition – visible inspection, maintenance history, ability to perform desired functions etc. ☐ Useful Life **(green assets may improve over time)** ☐ Maintenance completed regularly (drains/filters cleaned out, irrigation when needed, check for leaks, weeding etc.). Will help accurately assess condition and useful life	☐ Redundancy – is there one or more GI assets in the area that can take on additional capacity if a specific GI asset fails? ☐ Restoration date (may not be needed depending on asset type) ☐ Manufacturer, Model Number, Serial Number, Supplier Name & Phone* ☐ Construction Warranty Information – vender, expiration date, contact information ☐ Maintenance Contract (if not internal) - contact information, maintenance type and frequency, cost ☐ Design Specifications followed?

**May not be applicable to all green infrastructure*

Possible Available Data Sources

☐ Aerial photographs ☐ Existing system maps ☐ Visible inspection ☐ Repair, maintenance and inspection records ☐ Purchase records ☐ O&M Manual	☐ Interview current and former maintenance staff ☐ Photographs ☐ Contact contractors, engineers, water utility employees, volunteers familiar with the asset

Risk Assessments

Factors Affecting Probability of Failure	Factors Affecting Consequence of Failure
☐ Condition ☐ Maintenance History (weeding, sediment removal, trash removal etc.). Low levels of preventative maintenance. ☐ Clogging/sediment accumulation ☐ Age ☐ Weather (rain/freeze-thaw cycle) ☐ Traffic load/type (for street-based GI) ☐ Location (near buildings, sidewalks, etc.)	☐ Backflow concerns ☐ Pressure concerns ☐ Health concerns (tripping hazards, flooding hazards) ☐ Level of Service Failures ☐ Maintenance concerns ☐ Odor ☐ Visually unappealing ☐ Cost of repair or replacement

Enhanced Green
(Bioretention area, dry detention basin, drainage ditch, infiltration basin, infiltration planter, infiltration trench, rain gardens, recharge basin, tree trench, urban agriculture, vegetated filter strips, swales, wet detention)

Inventory

Necessary Data	Optional Data
☐ Asset size – flow/retention capacity, rate of filtration, maximum storage etc. ☐ Asset location ☐ Installation date ☐ Condition – visible inspection, maintenance history, age, ability to perform desired function etc. ☐ Useful Life (green assets may improve over time and can often be restored to full functionality) ☐ Maintenance completed regularly (drains/filters cleaned out, irrigation when needed, check for leaks, mowing/trimming, dredging etc.). Will help accurately assess condition and useful life	☐ Restoration date (may not be needed depending on asset type) ☐ Redundancy – is there one or more GI assets in the area that can take on additional capacity if a specific GI asset fails? ☐ Manufacturer, Model Number, Serial Number, Supplier Name & Phone ☐ Construction Warranty Information – vender, expiration date, contact information ☐ Maintenance Contract (if not internal) - contact information, maintenance type and frequency, cost ☐ Design Specifications followed?

Possible Available Data Sources

☐ Aerial photographs
☐ Existing system maps
☐ Visible inspection
☐ Repair, maintenance and inspection records
☐ Purchase records
☐ O&M Manual
☐ Interview current and former maintenance staff
☐ Photographs
☐ Contact contractors, engineers, water utility employees, volunteers familiar with the asset

Risk Assessments

Factors Affecting Probability of Failure	Factors Affecting Consequence of Failure
☐ Condition	☐ Backflow concerns
☐ Maintenance History (weeding, sediment removal, trash removal etc.). Low levels of preventative maintenance.	☐ Pressure concerns
☐ Clogging/sediment accumulation	☐ Health concerns (tripping hazards, flooding hazards)
☐ Age	☐ Level of Service Failures
☐ Weather (rain/freeze-thaw cycle)	☐ Maintenance concerns
☐ Location (near buildings, sidewalks, etc.)	☐ Odor
☐ Poor design or construction	☐ Visually unappealing
	☐ Cost of repair or replacement

SOUTHWEST ENVIRONMENTAL FINANCE CENTER

Natural Green
(Constructed or Natural Wetland, Forest, Revegetation Zone, Riparian Buffers, Riparian Restoration Zone, Soil Management, Targeted Land Protection Area)

Inventory

Necessary Data	Optional Data
☐ Asset size – length and number of segments, acreage of forest or restoration area etc. ☐ Asset location ☐ Asset ownership – Forest Service, private land, BLM, etc. ☐ Installation/restoration project start date ☐ Condition – visible inspection, maintenance history, protection status etc. ☐ Useful Life – green assets may improve over time and can often be restored to full functionality ☐ Maintenance completed regularly – litter removed, invasive species control, irrigation when needed, erosion issues addressed, etc.	☐ Owner/stewarding agency's recommended O&M ☐ Design Specifications followed? (for constructed wetlands and revegetation)

Possible Available Data Sources

☐ Aerial photographs	☐ O&M Manuals
☐ Existing maps	☐ Interview current and former stewards or volunteers
☐ Visible inspection	
☐ Repair, maintenance and inspection records	☐ Photographs
☐ Purchase records	☐ Contact owner or forest personnel

Risk Assessments

Factors Affecting Probability of Failure	Factors Affecting Consequence of Failure
☐ Condition ☐ Protection status ☐ Drought conditions, fire danger ☐ Contaminants ☐ Erosion	☐ Health concerns ☐ Level of Service Failures ☐ Maintenance concerns ☐ Proximity to source water ☐ Monetary and social costs of rehabilitation, replacement, or abandonment