Asset Management Criteria and Scales

Asset Management Information Session - Presented to Metropolitan Water Pollution Abatement Advisory Committee

July 22, 2020

Asset Management - Conveyance

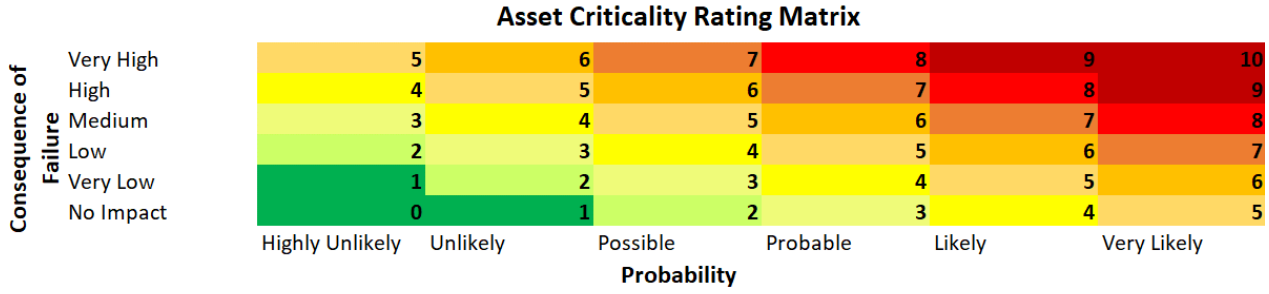
Criterion	Weight
Asset Criticality	66%
Condition of Asset	34%

Asset Criticality

The relative degree of risk mitigation in terms of the probability and consequence of failure. The following factors are considered: visual inspection results, pH, Dissolved Oxygen measurements (DO), Dissolved Solids measurements (DS), and physical characteristics of area that would be impacted by a failure.

The ranking team uses a heat map to determine score based on the combination of probability and consequence of failure, up to a score of 10 for highest combination of probability and consequence of failure.

Heat Map



Single Component Rating	Total Rating	Label	Description
0.0	0.0	Probability: Highly Unlikely Consequence: Lowest	Probability: Pipes show no corrosion, and a pH of ≥ 7 / Dissolved Oxygen (DO) ≥ 1.0 / Dissolved Solids (DS) ≤ 0.1 Consequence: Potential overflow would be less than 5 Million Gallons per Day (MGD), would not impact any environmentally sensitive areas, would flow into agricultural

Single Component Rating	Total Rating	Label	Description
			zones (low human density), and would have low infrastructure and traffic impacts.
1.0	2.0	Probability: Very Low Consequence: Very Low	Probability: Pipes show 'Coarse Aggregate surface with spalling surface score,' and a pH of 6 / DO 1.1 / DS 0.1 Consequence: Potential overflow would be 5-10 MGD, would impact saltwater bodies (very low environmental sensitivity areas), would flow into open space (low human density), and/or would have low infrastructure and traffic impacts.
2.0	4.0	Probability: Low Consequence: Low	Probability: Pipes show 'Rebar shadowing visible in places throughout section,' and a pH of 5 / DO 1.0 / DS 0.2 Consequence: Potential overflow would be 10-25 MGD, would impact lakes (low environmental sensitivity areas), would flow into industrial zones (medium human density), and/or would have low infrastructure and traffic impacts.
3.0	6.0	Probability: Medium Consequence: Medium	Probability: Pipes show 'Rebar profile visible in places of this section,' and a pH of 4 / DO 0.9 / DS 0.3 Consequence: Potential overflow would be 25-40 MGD, would impact rivers (medium environmental sensitivity areas), would flow into residential or commercial zones (medium human density), and/or would have medium infrastructure and traffic impacts
4.0	8.0	Probability: High Consequence: High	Probability: Pipes show 'Rebar visible with wall loss between bars,' and a pH of 3 / DO 0.8 / DS 0.4 Consequence: Potential overflow would be 40-50 MGD, would impact creeks and streams (high environmental sensitivity areas), would flow into hospital zones (high

Single Component Rating	Total Rating	Label	Description
			human density), and/or would have high infrastructure and traffic impacts.
5.0	10.0	Probability: Very High Consequence: Very High	Probability: Pipes show 'All bond lost behind rebar at several locations of this section,' and a pH of ≤ 2 / DO ≤ 0.7 / DS ≥ 0.5 Consequence: Potential overflow would be greater than 50 MGD, would impact wetlands (high environmental sensitivity areas), would flow into urban zones (high human density), and/or would have high infrastructure and traffic impacts.

Condition of Asset

The relative condition of the linear/conveyance asset and/or the remaining life. The score is based on the defects that have been identified through visual inspection.

Rating	Label	Description
0.0	Not Surveyed	This condition indicates the pipeline was not surveyed due to inaccessibility, unsafe conditions, high flows, or other factors
2.0	Good Condition	This condition indicates the pipeline has no defects
4.0	Fair Condition	This condition indicates the pipeline may show minor signs of defects such as corrosion (surface roughness increase or surface aggregate visible), sediment accumulation of less than 10%, roots fine, or infiltration stains and drippers. These conditions described are minor in nature and no change in inspection frequency is recommended.
6.0	Poor Condition	This condition indicates the pipeline exhibits moderate signs of defects such as corrosion (surface aggregate projecting and surface aggregate missing), cracks, corroded metal pipe, sediment accumulation of 10-20% that would justify cleaning, roots that would justify

Rating	Label	Description
		removal, or infiltration runners that would justify grouting. This condition rating may lead to an increased frequency of inspections.
8.0	Very Poor Condition	This condition indicates the pipeline exhibits serious signs of defects such as corrosion (surface reinforcement visible or surface reinforcement projecting), missing brickwork, fractures, sediment accumulation of 20-30% that requires cleaning, root intrusion that is impeding flow and threatens to block the trunk, interceptor or side sewer, or infiltration gushers that require attention. This condition rating may lead to increased frequency of inspections and/or rehabilitation work.
10.0	Unserviceable Condition	This condition indicates the pipeline has severe signs of defects such as corrosion (surface reinforcement corroded or surface missing wall), root intrusion that blocks flow of side sewers, trunk and/or interceptors, and continuous infiltration gushers. This condition is used when immediate attention is required, or the Trunk or Interceptor is at risk of failing.

Asset Management – Plants

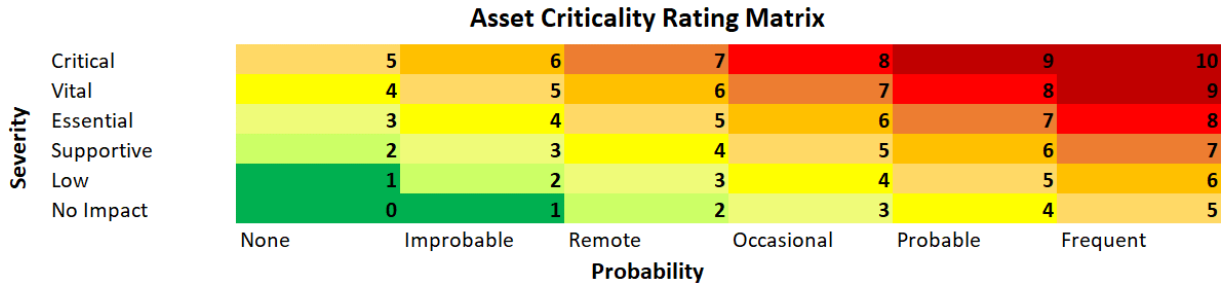
Criterion	Weight
Asset Criticality	35%
Organizational Impacts	29%
Condition of Asset	21%
Asset Obsolescence	15%

Asset Criticality

The relative degree of asset risk mitigation considering both the probability of failure and importance to the system. The factors considered include impacts to the system, life safety, environment, and community, as well as considerations of likelihood of asset obsolescence, condition assessment(s), and end of service dates.

The ranking team uses a heat map to determine score based on the combination of probability failure and importance to the system, up to a total of 10 for highest combination of probability of failure and importance to the system.

Heat Map



Single Component Rating	Total Rating	Label	Description
0.0	0.0	Probability: NA Importance: No Impact	Probability: N/A Importance: The asset has no impact on the process. This includes assets that have been retired, parent assets, or business-type assets that have no implications to operations.
1.0	2.0	Probability: Improbable Importance: Low Importance	Probability: Frequency is less than 1 occurrence in 20 years. Importance: The asset is of relatively low importance to the system or it has not already been classified.
2.0	4.0	Probability: Remote Importance: Supportive Importance	Frequency is relatively remote and is 1 occurrence between every 5 to 20 years. Importance: The asset is of supportive importance to the system and includes all other assets such as building systems whose prolonged outage would adversely affect working conditions.
3.0	6.0	Probability: Occasional Importance: Essential Importance	Probability: Frequency is occasional and is 1 occurrence every 5 years. Importance: The asset is of essential importance to the system and the prolonged outage could lead to additional operating cost.
4.0	8.0	Probability: Probable Importance: Vital Importance	Probability: Frequency is relatively probable and is 1 occurrence per year. Importance: The asset is of vital importance to the system and continued outage could lead to safety or permit violations, capacity loss, could cause health problems, or produce undesirable operating or environmental conditions.
5.0	10.0	Probability: Frequent Importance: Critical Importance	Probability: Frequency is greater than 1 occurrence per month. Importance: The asset is of critical importance to the system and outage results in immediate capacity loss,

Single Component Rating	Total Rating	Label	Description
			environmental damage, reportable permit violations, safety violations, or potential serious injury or even potential loss of life.

Organizational Impacts

The relative degree of impact an asset failure will have on typical operations. The factors considered include estimates of asset failure on the workforce assignment plan, budget plan, other projects, other operational work, audits, strategic reports/reviews, organizational reputation, additional oversight and reporting, fines, or litigation.

Rating	Label	Description
0.0	Minimal	Organizational impacts of an asset failure are not noticeable but beyond the typical efforts required.
2.0	Low	Organizational impacts of an asset failure are relatively low but are apparent to be up to a 20% increase beyond typical efforts required. No redirection of staff is required.
4.0	Moderate	Organizational impacts of an asset failure are moderate and are generally apparent to be up to a 40% increase beyond typical efforts required. This could result in minor redirection of staff.
6.0	High	Organizational impacts of an asset failure are high and are very apparent to be up to a 60% increase beyond typical efforts required. This could result in moderate redirection of staff but may not incur any immediate challenges in permit compliance and/or safety (plant and public)/operations.
8.0	Very High	Organizational impacts of an asset failure are very high and are very apparent to be up to an 80% increase beyond typical efforts required. This could result in considerable redirection of staff and significant challenges in permit compliance and/or safety (plant and public)/operations.
10.0	Extreme	Organizational impacts of an asset failure are the highest level and far beyond typical efforts by as much as double (or more), requiring significant redirection of staff and probable challenges in permit compliance and/or safety (plant and public)/operations.

Condition of Asset

The relative condition of the assets and/or the remaining life. The score is based on physical condition assessments and historical maintenance data. In cases where the asset cannot be assessed for condition, the score is based on the engineered estimate of end of life.

Rating	Label	Description
0.0	Full Operating Condition	The asset is functionally operational and predictive maintenance/failure rate does not indicate it is within 6 years of its predicted end of life.
2.0	Good Condition	The asset is functionally operational and predictive maintenance/failure rate indicates it is outside of the 6 years of its predicted end of life with some deficiencies noted but is not in need of immediate corrective action.
4.0	Fair Condition	The asset is functionally operational and predictive maintenance/failure rate indicates it is within 6 years of its predicted end of service life with some deficiencies noted and service life could be extended outside of the 6-year window through enhanced upkeep, refurbishment, shift in operational strategy, and/or enhanced maintenance.
6.0	Poor Condition	The asset is not reliably meeting its designed functionality in an acceptable manner and predictive maintenance/failure rate indicates it is within 2 years of the end of service life with many deficiencies noted and is in need of replacement/ refurbishment. Service life could be extended outside of the 2-year window through enhanced upkeep, refurbishment, shift in operational strategy, and/or enhanced maintenance.
8.0	Very Poor Condition	The asset is not reliably meeting its designed functionality in an acceptable manner and predictive maintenance/failure rate indicates it is within 2 years of the end of service life with many deficiencies noted and is in need of replacement/ refurbishment. Service life cannot be extended outside of the 2-year window through enhanced upkeep, refurbishment, shift in operational strategy, and/or enhanced maintenance.
10.0	Unserviceable Condition	The asset is in an unserviceable condition, has met or exceeded its usable service life, and is in a state of disrepair such that it cannot be recovered to any usable condition. The asset is no longer providing the beneficial service and originally designed functionality, which may include emergent issues.

Asset Obsolescence

The relative degree of obsolescence of an asset such that the same functionality cannot be replicated and impacts the ability to maintain the current service level for continued operations. The factors considered include the availability of parts, vendor support, support hardware, software version/support, and cyber security. For process piping, factors include material type or availability to make compatible fittings and connections.

Rating	Label	Description
0.0	Very Low	The obsolescence of the asset has no impact to the operation process or system. Basic functionality of the version of software and/or compatibility is viable.
3.0	Low	The obsolescence of the asset is approaching a state in which spare parts and the ability to maintain the asset is challenged. The obsolescence can be mitigated through retrofitting without redesign/reconfiguration by means such as new technology or other components/materials that can be readily obtained. Basic functionality of the version of software and/or compatibility supports core processes; however, enhancements and functional upgrades are constrained.
5.0	Moderate	The obsolescence of the asset is approaching a state in which spare parts and the ability to maintain the asset is challenged. The obsolescence can be mitigated by accumulation of critical spares. Basic functionality of the version of software and/or compatibility does not support some core processes and enhancements and functional upgrades are constrained.
7.0	High	The obsolescence of the asset is in a state in which spare parts and the ability to maintain the asset is not possible. The obsolescence can be mitigated by third party sourcing or refurbished components/materials that are not readily obtained. Basic functionality of the version of software and/or compatibility does not support most core processes and enhancements and functional upgrades are minimally supported.
10.0	Extremely High	The obsolescence of the asset is in a state in which there are no known spares or alternatives to maintain the asset and/or mitigate dated components/materials. Basic functionality of the version of software and/or compatibility does not support any core processes and enhancements and functional upgrades are unsupported.