Current State of Asset Management
and
Asset Management Implementation
for
the San Francisco Public Utilities Commission

December 1, 2015
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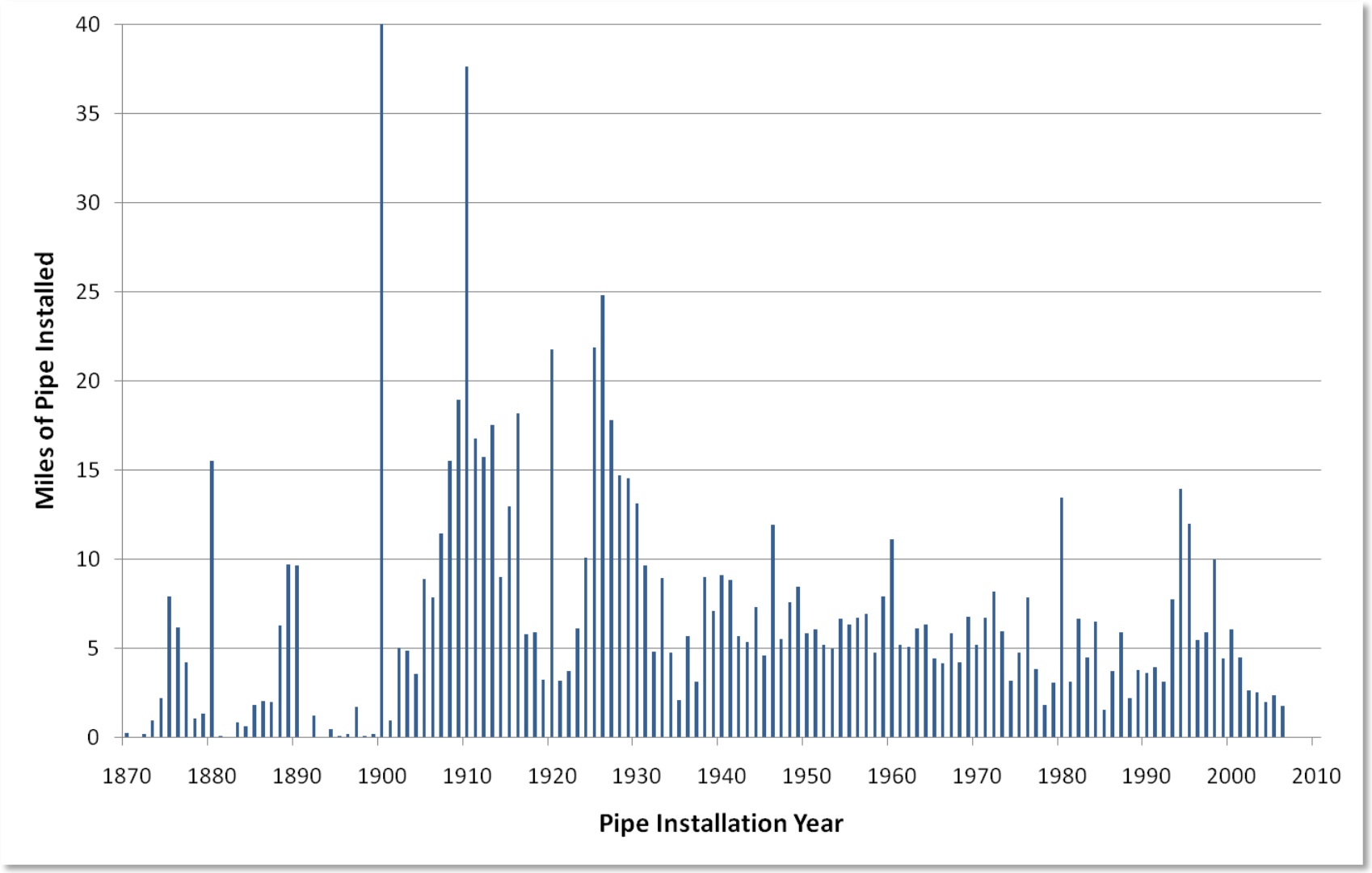
Strategic Asset Management
San Francisco Public Utilities Commission

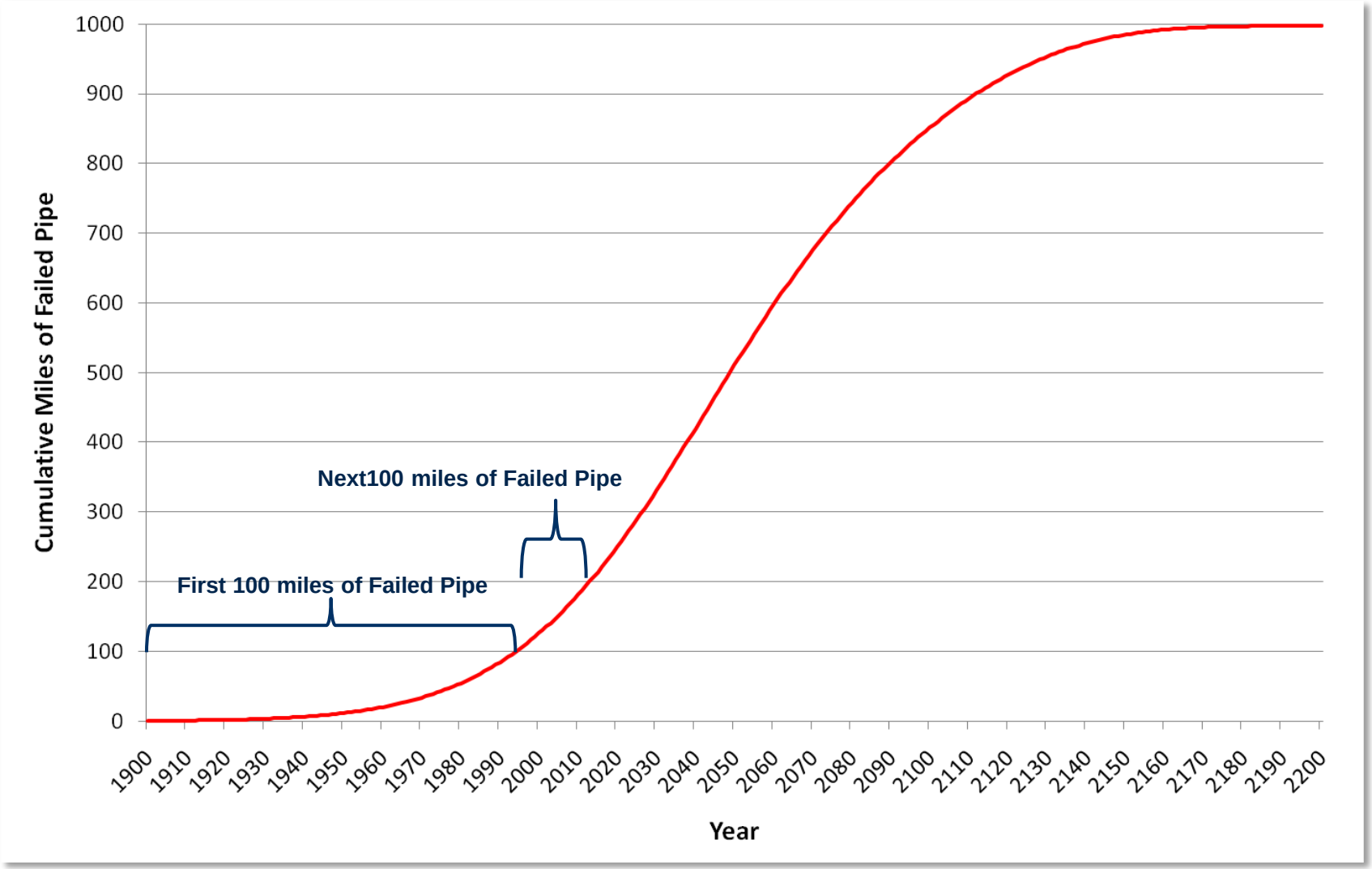
San Francisco Water Power Sewer

Why Do Asset Management?

Construction History of San Francisco Sewer System



Sewer System in Crisis



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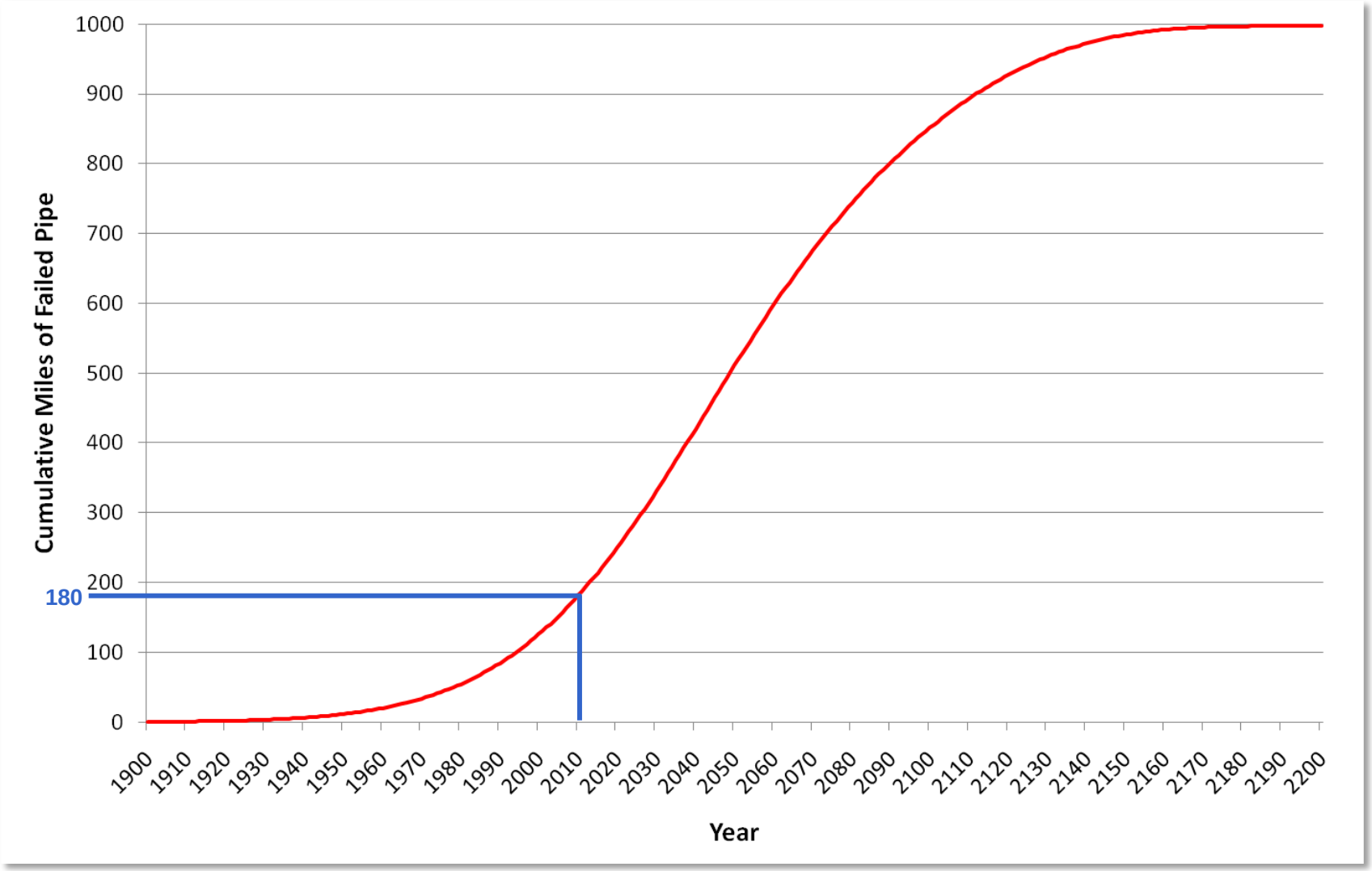
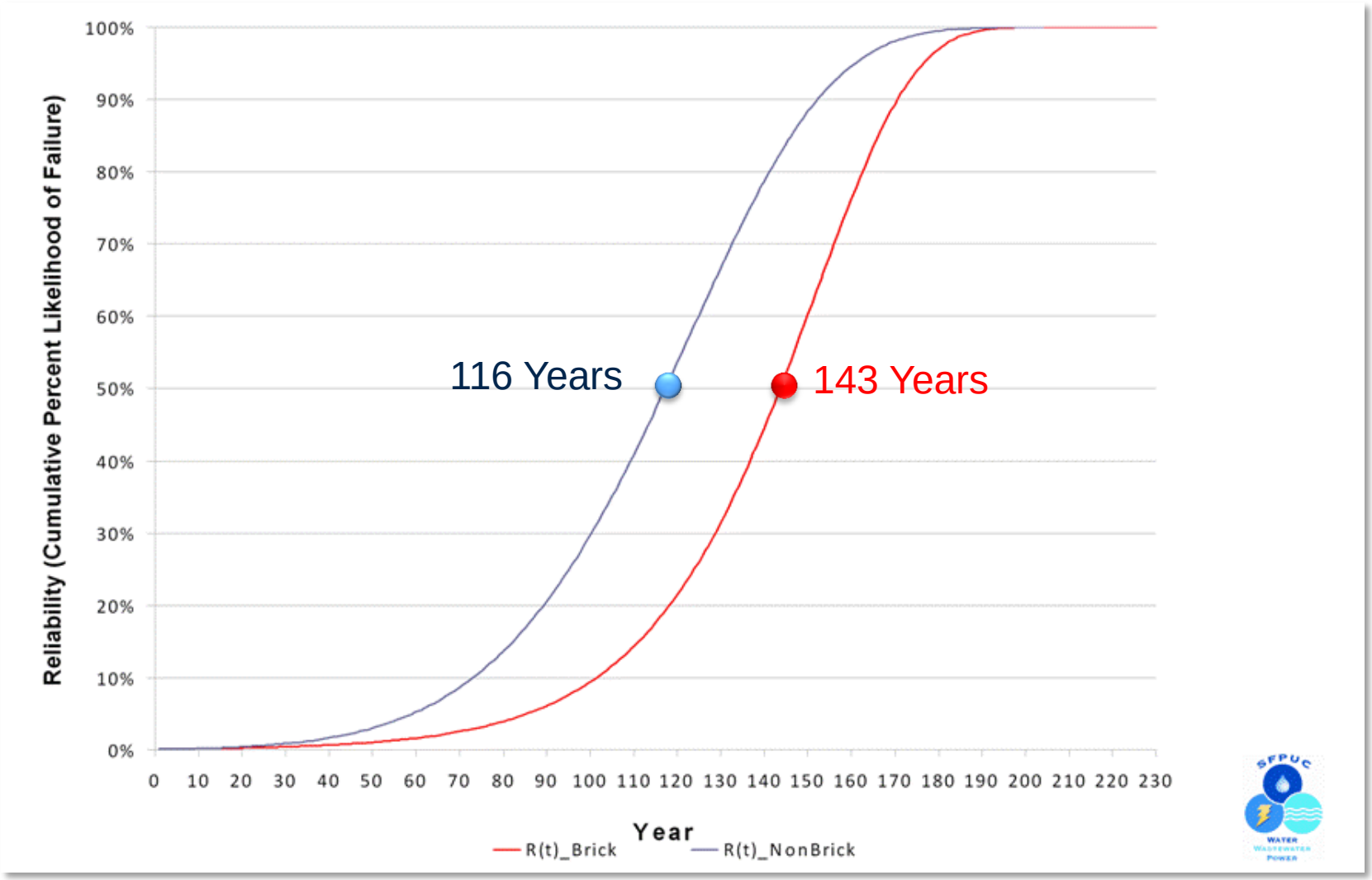
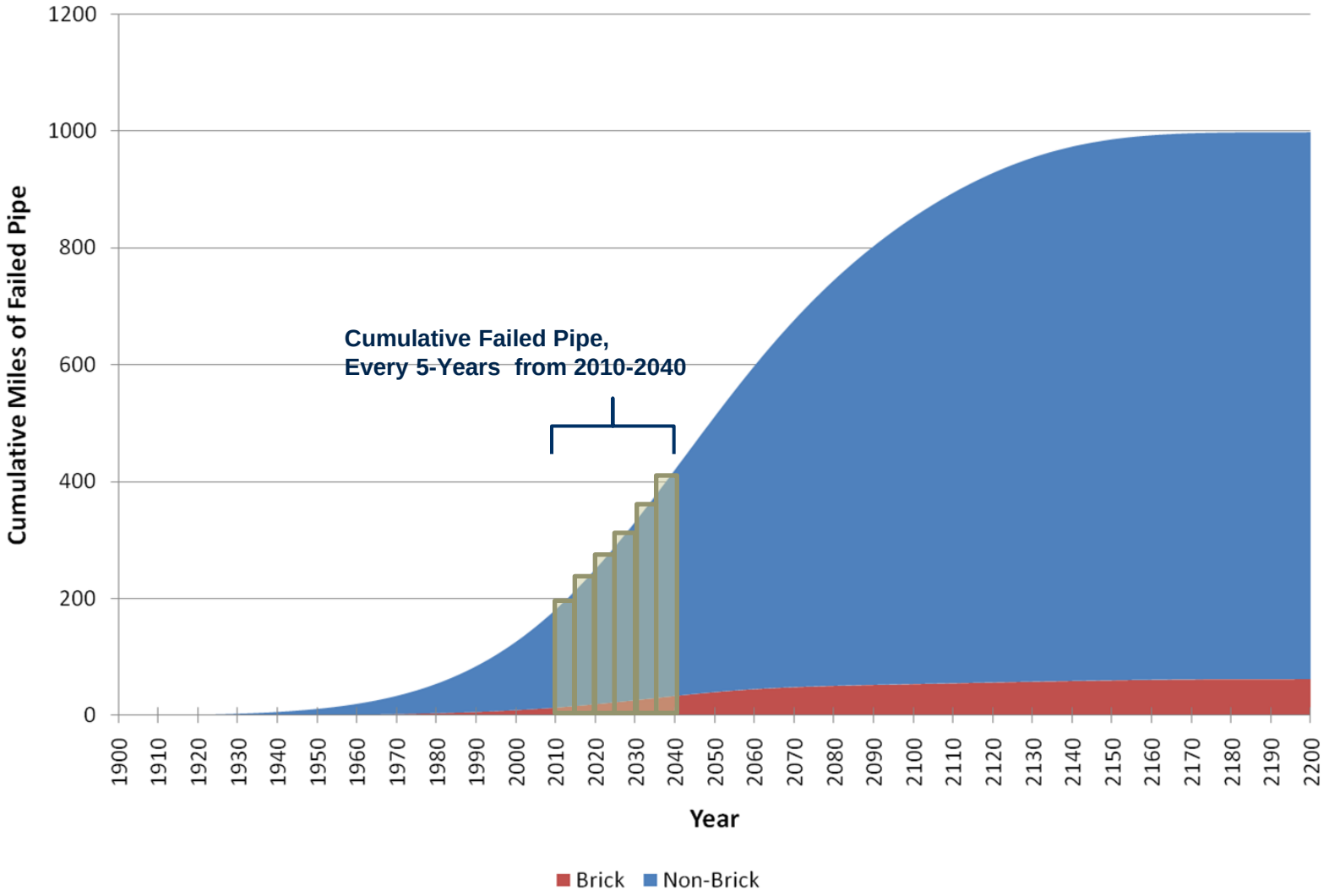


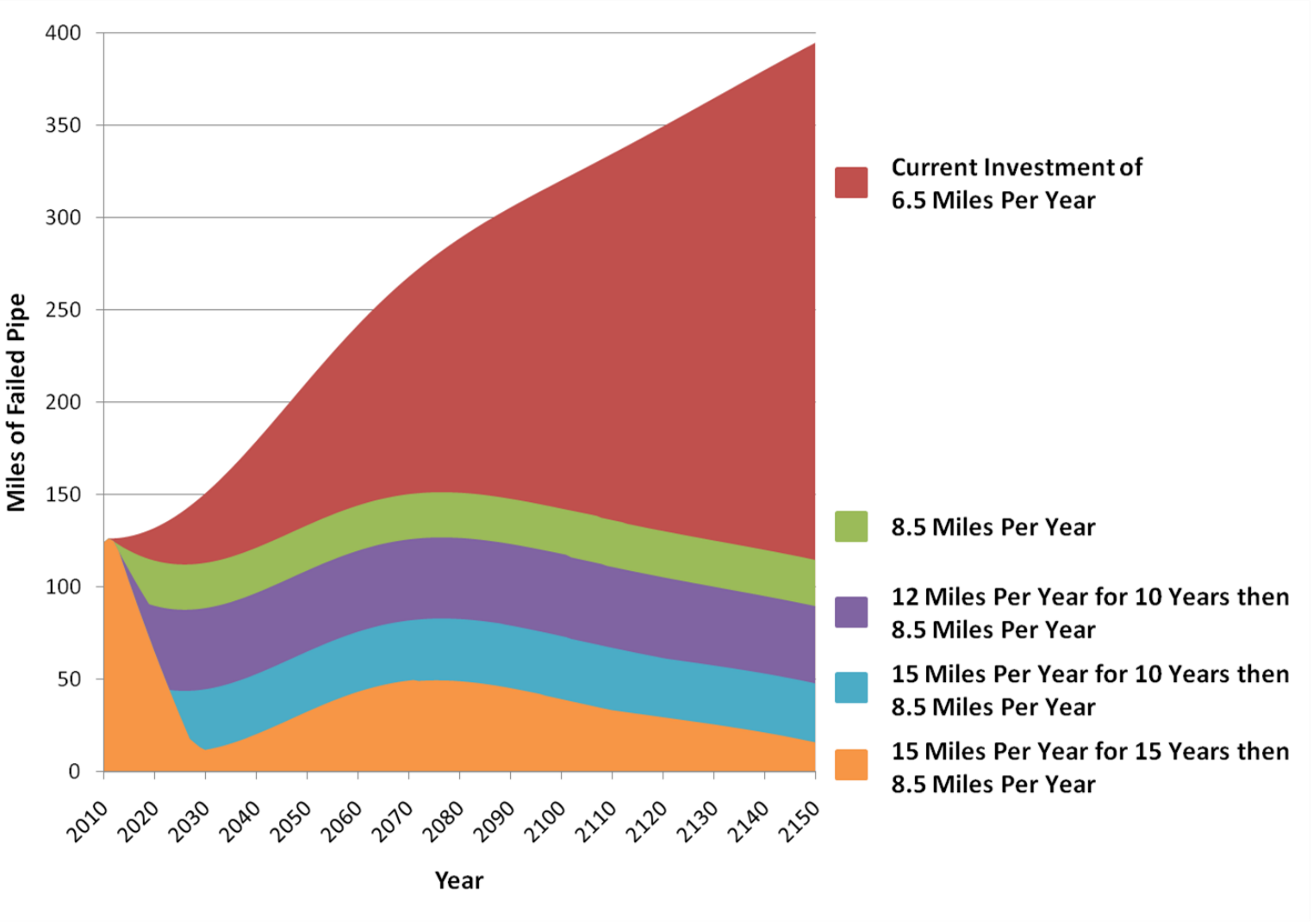
Cumulative Likelihood of Failure Comparison – Brick Versus Non-Brick



Cumulative Miles of Failed Pipe by Year Brick verses Non-Brick



Cumulative Miles of Failed Pipe for Various Investment Scenarios



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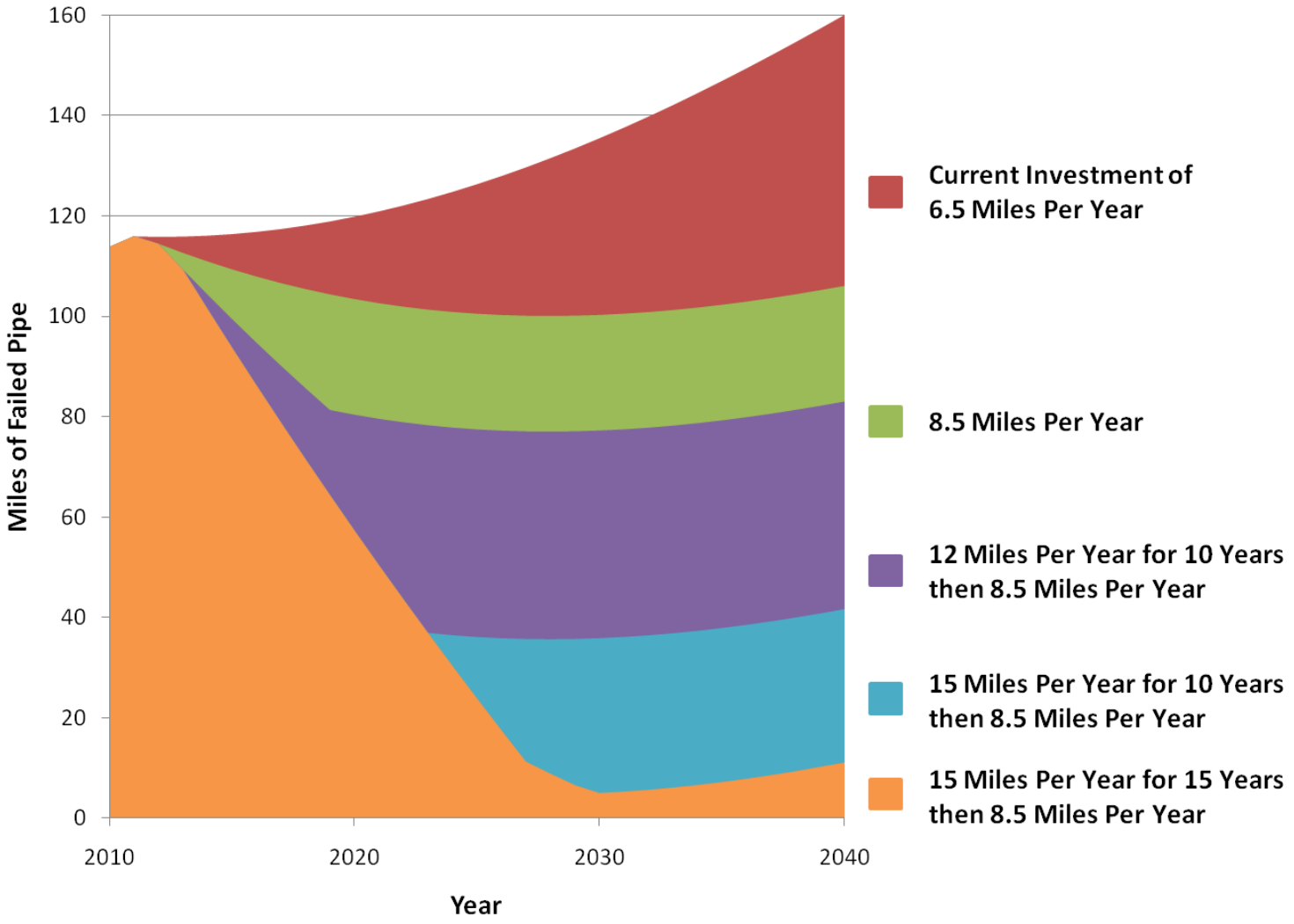
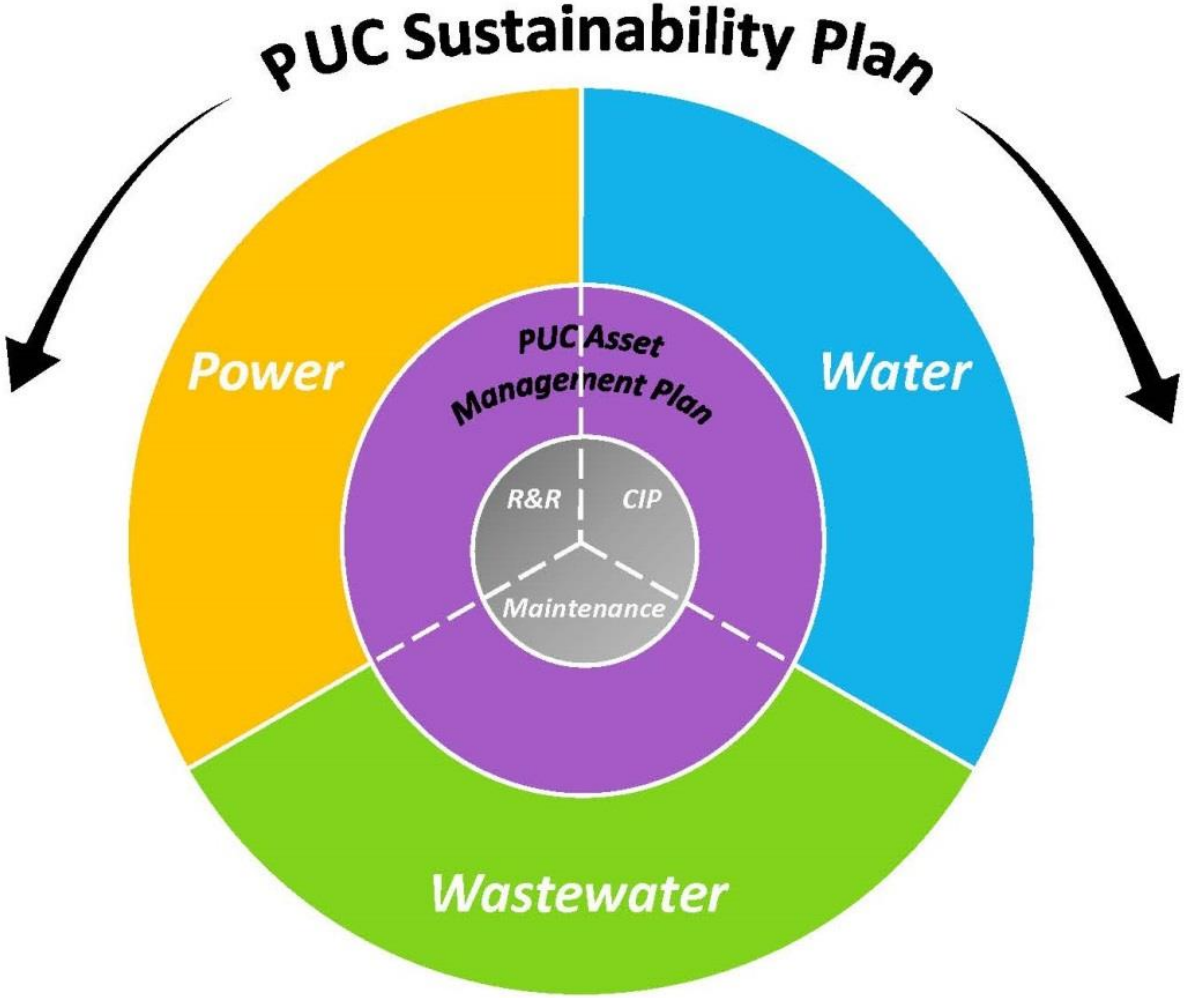


Sustainability Plan and Asset Management



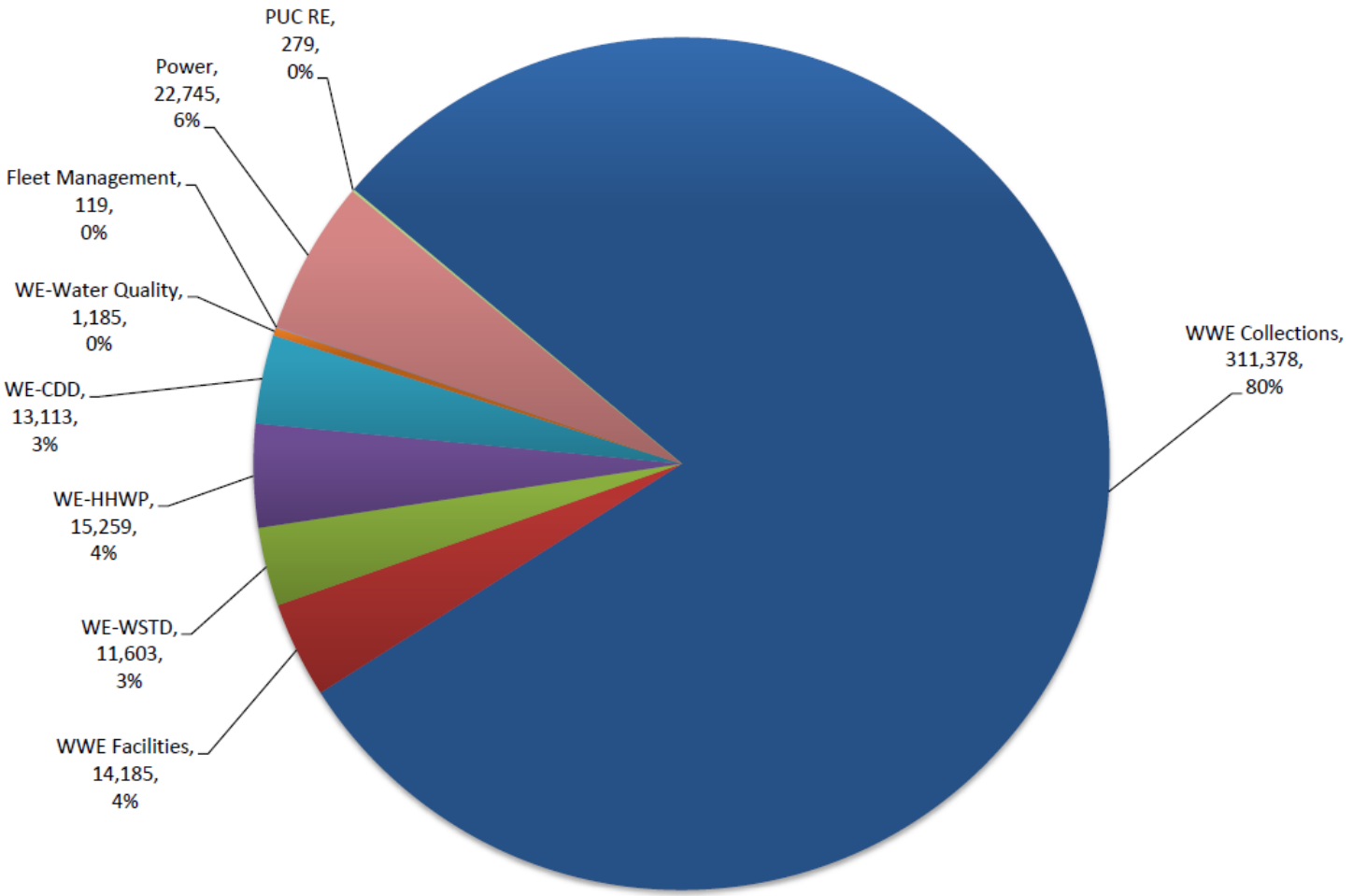
Asset Management Vision Statement

Develop a world-class, risk-based asset management system that is auditable, provides consistency throughout the organization, is comprehensive and cohesive, which supports a world-class maintenance and capital program for the ratepayers of the SFPUC.

Anticipated Benefits

- Improved stewardship and accountability
- Improved communication of assets and risks
- Improved risk management
- Improved financial efficiency
- Improved and coordinated design and construction risk analysis
- Reduction in emergencies and critical asset failures

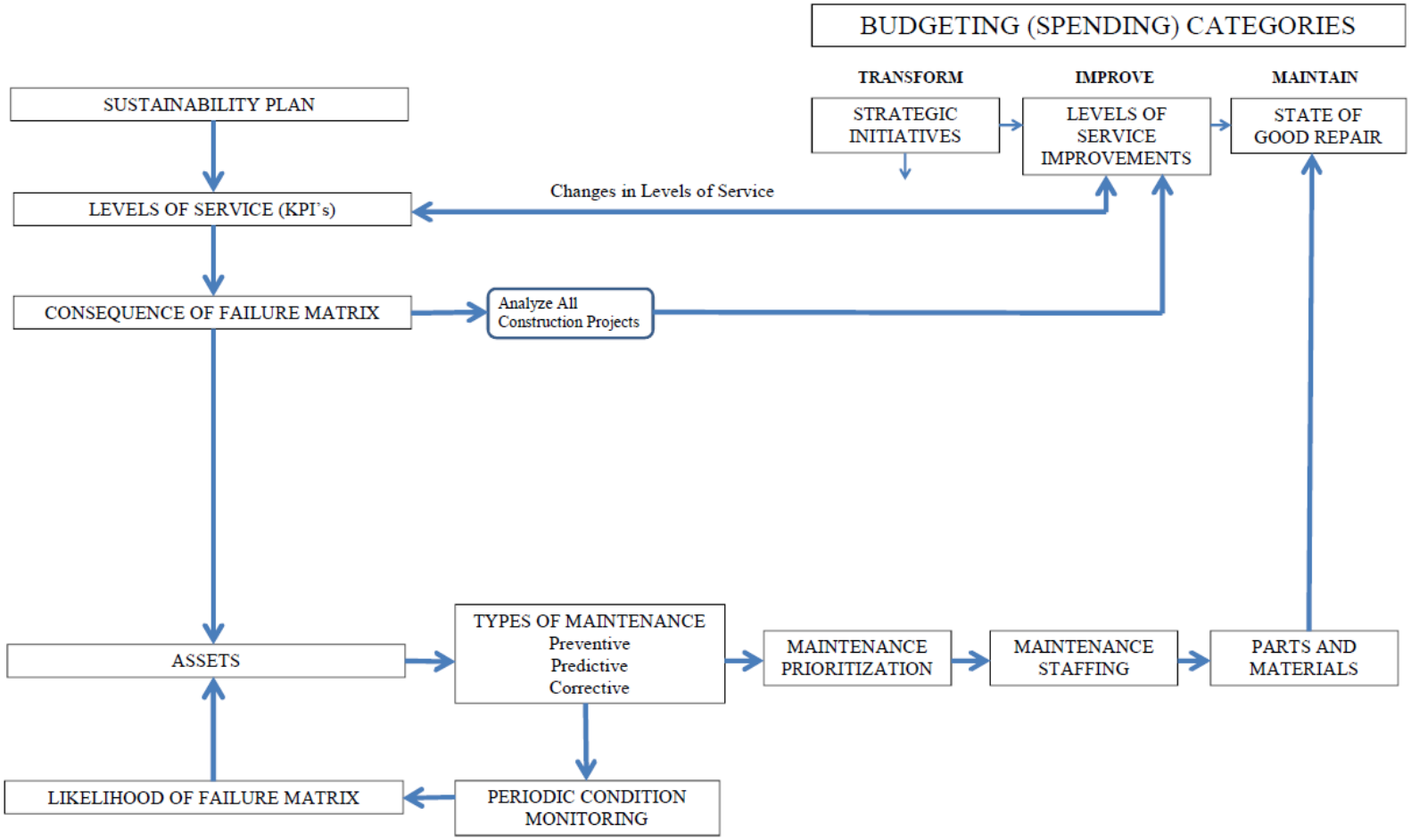
PUC Asset Characterization



TOTAL SFPUC ASSETS = 389,866

AS OF SEPTEMBER 2014

Budgeting Priorities and Process Diagram



Budgeting (Spending) Priority Categories:

State of Good Repair

Levels of Service Improvements

Strategic Initiatives

San Francisco Water Power Sewer

AM POLICIES & GUIDELINES

Derived from the Environmental Protection Agency, International Infrastructure Management Manual, and ISO 55001.

AM Policy Statements

- **AM program**
  - All divisions shall support and work towards the development of a SFPUC-wide Risk-based AM program to achieve a common goal for the future of the organization.
- **Likelihood of failure ratings**
  - All assets shall have a Likelihood of Failure rating that complies with a unified scoring system.
- **Consequence of failure rating**
  - All assets hall have a Consequence of Failure rating that complies with a unified scoring system.
- **Assets in CMMS**
  - All assets valued over $5,000 and with an expected life > 1year or any value with a COF score of 4 or greater, as well as all new assets shall be entered into the CMMS.
- **Critical asset monitoring and reporting**
  - All assets with specific COF and LOF scores shall be assessed, monitored and eventually reported in the manor prescribed in the appropriate AM policy.

Current State

To determine the current state of AM within each of the SFPUC divisions, a survey was performed. The survey asked specific questions regarding if and how assets are identified, assessed, recorded and maintained. The survey revealed that each enterprise/division had varying states of AM programs established. The methods used to perform the tasks also varied between the divisions.

Gap Analysis

The data collected in the survey was utilized in the development of a GAP analysis comparing each division's current state to a list of requirements needed to achieve a fully realized AM program as defined in the AM implementation plan developed from current reputable industry standard guidelines. This chart summarizes the findings and visually represents the tasks each of the divisions has already completed or has partially accomplished.

SFPUC AM Gap Analysis

Summary of SFPUC-Wide Asset Management Implementation Plan

- Create SFPUC-wide Asset Management Group
- Create Asset Management Council
- Develop Asset Management Implementation Group
- Support Enterprises & Operating Divisions w/developing COF & LOF rating systems
- Determine IT needs for SFPUC database requirements
- Coordinate SFPUC consultant tasks
- Annual review of SFPUC Operating Divisions staffing to maintain assets
- Annual review of SFPUC Capital Program
- List of LOS w/KPI's
- Annual Asset Management Report/Plan
- SOP for smart numbering system
- SOP for planning, design, construction procedures & OEM requirements for assets installed, modified or impacted through a construction project
- SOP for asset turnover
- SOP for critical asset monitoring methodology
- SOP for critical asset reporting system
- SOP for reporting failure of critical assets
- Establish SFPUC-wide Asset Mapping System
- Develop Asset Characterization Report
- Annual update to SFPUC Sustainability Plan
- Develop & Implement Asset Management formal training program
- Ensure SFPUC Asset Management Program complies w/ISO 55001 AM Standard
- Represent SFPUC at industry conferences
- Develop detailed budget instructions based on AM principles

Summary of SFPUC Gap Analysis

	WWE FACILITIES	WWE COLLECTIONS	REGIONAL WATER	LOCAL WATER	HH WATER & POWER	POWER	INFRASTRUCTURE
AM Council	●	●	●	●	●	●	●
Implementation Group	○	○	○	○	○	○	○
COF Scoring Matrix	●	●	○	○	○	○	N/A
LOF Scoring Matrix	●	●	○	○	◉	◉	N/A
Consultant Task Coordination	○	○	○	○	○	○	○
AM-Based Maintenance Staffing Plan	○	○	○	○	○	○	N/A
AM-Based Capital Improvement Plan	○	○	○	○	○	○	○
LOS w/KPI's	○	○	○	○	○	○	○
Enterprise AM Plan	◉	◉	○	○	○	○	N/A
Asset Hierarchy	●	●	●	◉	◉	○	N/A
MAXIMO OLC	●	●	●	○	◉	○	○
AM Project Review	○	○	○	○	○	○	○
Master Asset List for Construction	●	●	○	○	○	○	○
Asset Turnover SOP	●	●	○	○	○	○	○
Critical Asset Monitoring	○	○	○	○	○	○	N/A
Critical Asset Reporting	○	○	○	○	○	○	○
Critical Asset Failure Reporting	○	○	○	○	○	○	○
Asset Mapping	○	●	○	○	○	○	○
Populate MAXIMO	◉	◉	◉	◉	◉	◉	N/A
AM Based Asset Maintenance Plan	◉	●	○	○	○	○	N/A
Critical Asset Job Plans	◉	●	○	○	○	○	N/A

● Task Completed ○ Task Incomplete ◉ Task Partially Completed

Implementation Plan

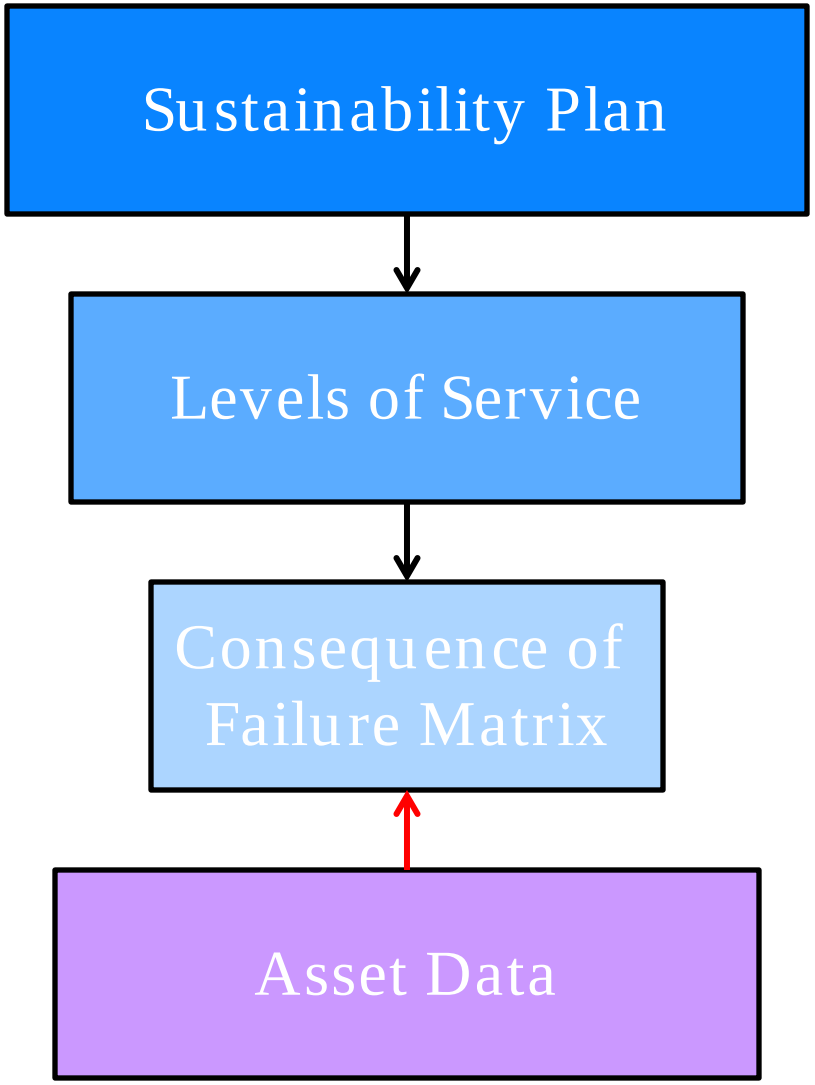
- **Organizational**
  - Creation of AM group, council, implementation group
  - Provide support to divisions developing COF and LOF scoring matrices
  - Develop IT needs
  - Coordinate consultant tasks
  - Perform annual reviews to determine staffing needs
  - Develop capital program and budget instructions
- **Levels of Service (LOS)**
  - Comprehensive list of regulations
  - Consolidated list of all LOS with Key Performance Indicators (KPIs)
- **Asset Management Plan**
  - Prepare annual AM plan
- **Standard Operating Procedures**
  - Develop SOP leading to standardization of AM Policies and Procedures
  - Establish SFPUC-wide asset MAXIMO OLC Smart Numbering system
  - Develop SOP for turnover of assets after planning, design and construction

Implementation Plan (Cont.)

- Develop SFPUC-wide SOP for asset turnover to division responsible for maintenance and monitoring of the assets
- Develop SFPUC-wide SOP for critical asset monitoring methodology
- Develop SFPUC-wide SOP for critical asset failure reporting

- **Asset Database**
  - Establish SFPUC-wide asset mapping system utilizing GIS for all assets
- **Reporting**
  - Develop Asset Characterization report showing the extent of use of MAXIMO in each enterprise and operating division
  - Provide an annual update to SFPUC sustainability plan
- **Training**
  - Develop and implement a formal training program to support the implementation of AM throughout SFPUC
- **Industry Coordination**
  - Maintain relationships with other Federal, State and Local entities, as well as other industry experts to keep AM program on the leading edge
  - Represent SFPUC at industry conferences and develop relationships with other organizations and individuals in the AM field

COF Matrix Development



Top-Down Bottom-Up Approach

COLLECTION SYSTEM – EXAMPLE RISK SCORING

Establish Levels of Service from WWE Mission

Mission

"To provide our customers with high quality, efficient and reliable water, power and wastewater services in a manner that is inclusive of environmental and community interests and sustains the resources entrusted to our care"

Vision

"We strive to be the utility leader, delivering superior results in service, sustainability and innovation"

Values

Service: We focus on customer satisfaction, health and safety

Level of Service (LOS) Category	Goals
Protect the Public	Protect the public from exposure to pathogens and toxins
Preserve and Improve Quality of Life	Minimize public impacts
Be Cost Effective	Deliver levels of service at lowest long term cost (or competitive with other agencies)
Provide Excellent Customer Service	High level of customer satisfaction
Be Environmentally Responsible	Protect the environment and meet regulations

Levels of Service & Risk Score

LOS Category	Negligible = 1	Low = 4	Moderate = 7	Severe = 10
Protect the Public	•Low likelihood of public exposure	•Low to moderate likelihood of public exposure (near BART station, MUNI, etc)	•Moderate likelihood of public exposure (high foot traffic area, etc)	•Located next to public facility (school, hospital, etc)
	<15 inches in diameter	15 ≤ 36 inches in diameter	36 ≤ 60 inches in diameter	>60 inches in diameter
Preserve and Improve Quality of Life	•Minimal to no commercial impacts or public annoyance	•Impact to cable car, MUNI Diesel, highway approach, or neighborhood commercial district	•Impact to major arterial, primary transportation route, MUNI electric, or major commercial district	•Impact to emergency transportation route, bridge approach roadway, MUNI Rail, or downtown core
	•Impact to residential street	•Within potential or known slide area or liquefaction zone	•Known subsidence area	•Connection between pile-supported and non-pile supported sewer
Be Cost Effective	•Under asphalt street, not under moratorium	•Under concrete street	•Opportunity to coordinate with other infrastructure projects •Easement sewers	•Under moratorium street •Easement sewer near building or a steep slope
	•No history of repairs	•1 point repair per 300 feet in maintenance history	•2 point repairs per 300 feet in maintenance history	•≥3 point repairs per 300 feet
Provide Excellent Customer Service	•Can restore service in <4 hours	•Can restore service in 4 to <8 hours	•Can restore service in 8 to < 24 hours	•More than 24 hours to restore service
Be Environmentally Responsible	•Flows back to combined system	•Flows to surface water	•Flows to MS4 facility or CDS structure	•Impacts emergency drinking water supply
	•100% compliance with permits and regulations	•Technical violation without an enforcement action	•Violation with potential for enforcement action	•Past history of violations and/or potential for enforcement action and fines

San Francisco Water Power Sewer

Sewer Failure - Example

Consequence × Likelihood = Total Risk

LOS Category	Goals	Negligible = 1	Low = 4	Moderate = 7	Severe = 10
Protect the Public	Protect the Public from exposure to pathogens and toxins	•Low likelihood of public exposure	•Low to moderate likelihood of public exposure (near BART station, MUNI, etc)	•Moderate likelihood of public exposure (high foot traffic area, etc)	•Located next to public facility (school, hospital, etc)
	Protect the Public from Exposure to Pathogens and toxins	•Size Class I sewers (<15 inches in diameter)	•Size Class II sewers (15 ≤ 36 inches in diameter)	•Size Class III sewers (36 ≤ 60 inches in diameter)	•Size Class IV sewers (>60 inches in diameter)
Preserve and Improve Quality of Life	Minimize commercial impacts or public annoyance	•Minimal to no commercial impacts or public annoyance	•Impact to cable car, MUNI Diesel, highway approach, or neighborhood commercial district	•Impact to major arterial, primary transportation route, MUNI electric, or major commercial district	•Impact to emergency transportation route, bridge approach roadway, MUNI Rail, or downtown core
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Be Environmental Responsible	Protect the Environment	•Flows back to combined system	•Flows to surface water	•Flows to MS4 facility or CDS structure	•Impacts emergency drinking water supply
	Meet Regulations	•100% compliance with permits and regulations	•Technical violation without an enforcement action	•Violation with potential for enforcement action	•Past history of violations and/or potential for enforcement action and fines

Market at Embarcadero

LOS Category	Goals	Negligible = 1	Low = 4	Moderate = 7	Severe = 10
Protect the Public	Protect the Public from exposure to pathogens and toxins	•Low likelihood of public exposure	•Low to moderate likelihood of public exposure (near BART station, MUNI, etc)	•Moderate likelihood of public exposure (high foot traffic area, etc)	•Located next to public facility (school, hospital, etc)
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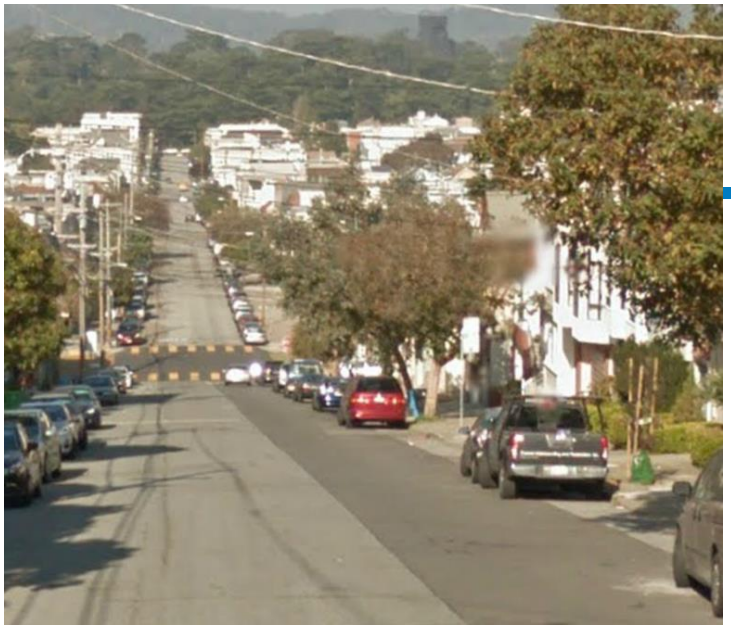

Sunset District (12th Avenue)

LOS Category	Goals	Negligible = 1	Low = 4	Moderate = 7	Severe = 10
Protect the Public	Protect the Public from exposure to pathogens and toxins	•Low likelihood of public exposure	•Low to moderate likelihood of public exposure (near BART station, MUNI, etc)	•Moderate likelihood of public exposure (high foot traffic area, etc)	•Located next to public facility (school, hospital, etc)
	Protect the Public from Exposure to Pathogens and toxins	•Size Class I sewers (<15 inches in diameter)	•Size Class II sewers (15 ≤ 36 inches in diameter)	•Size Class III sewers (36 ≤ 60 inches in diameter)	•Size Class IV sewers (>60 inches in diameter)
Preserve and Improve Quality of Life	Minimize commercial impacts or public annoyance	•Minimal to no commercial impacts or public annoyance	•Impact to cable car, MUNI Diesel, highway approach, or neighborhood commercial district	•Impact to major arterial, primary transportation route, MUNI electric, or major commercial district	•Impact to emergency transportation route, bridge approach roadway, MUNI Rail, or downtown core
	Minimize public impacts	•Impact to residential street	•Within potential or known slide area or liquefaction zone	•Known subsidence area	•Connection between pile-supported and non-pile supported sewer
Be Cost Effective	Deliver levels of service at lowest long term cost (or competitive with other agencies)	•Under asphalt street ,not under moratorium	•Under concrete street	•Opportunity to coordinate with other infrastructure projects •Easement sewers	•Under moratorium street •Easement sewer near building or a steep slope
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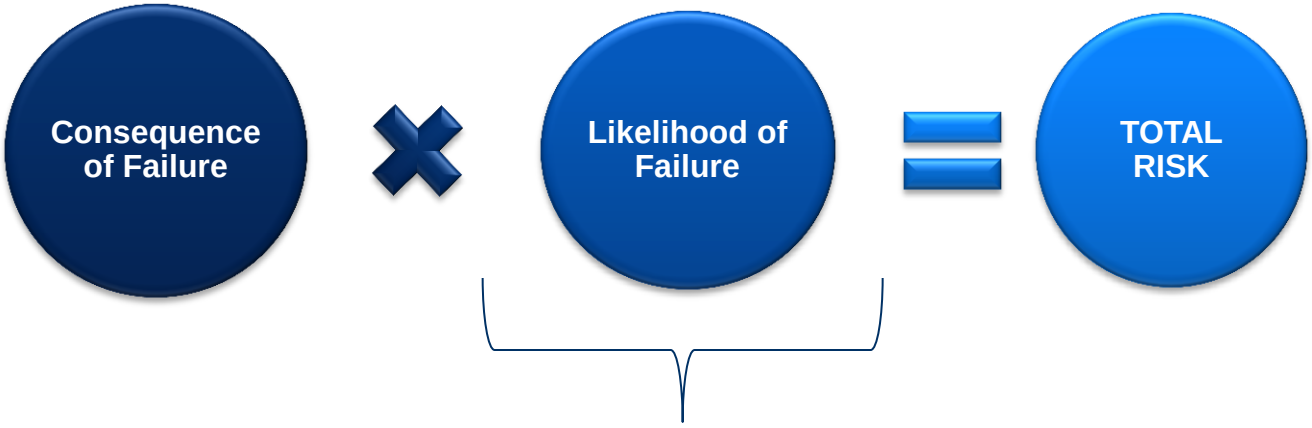
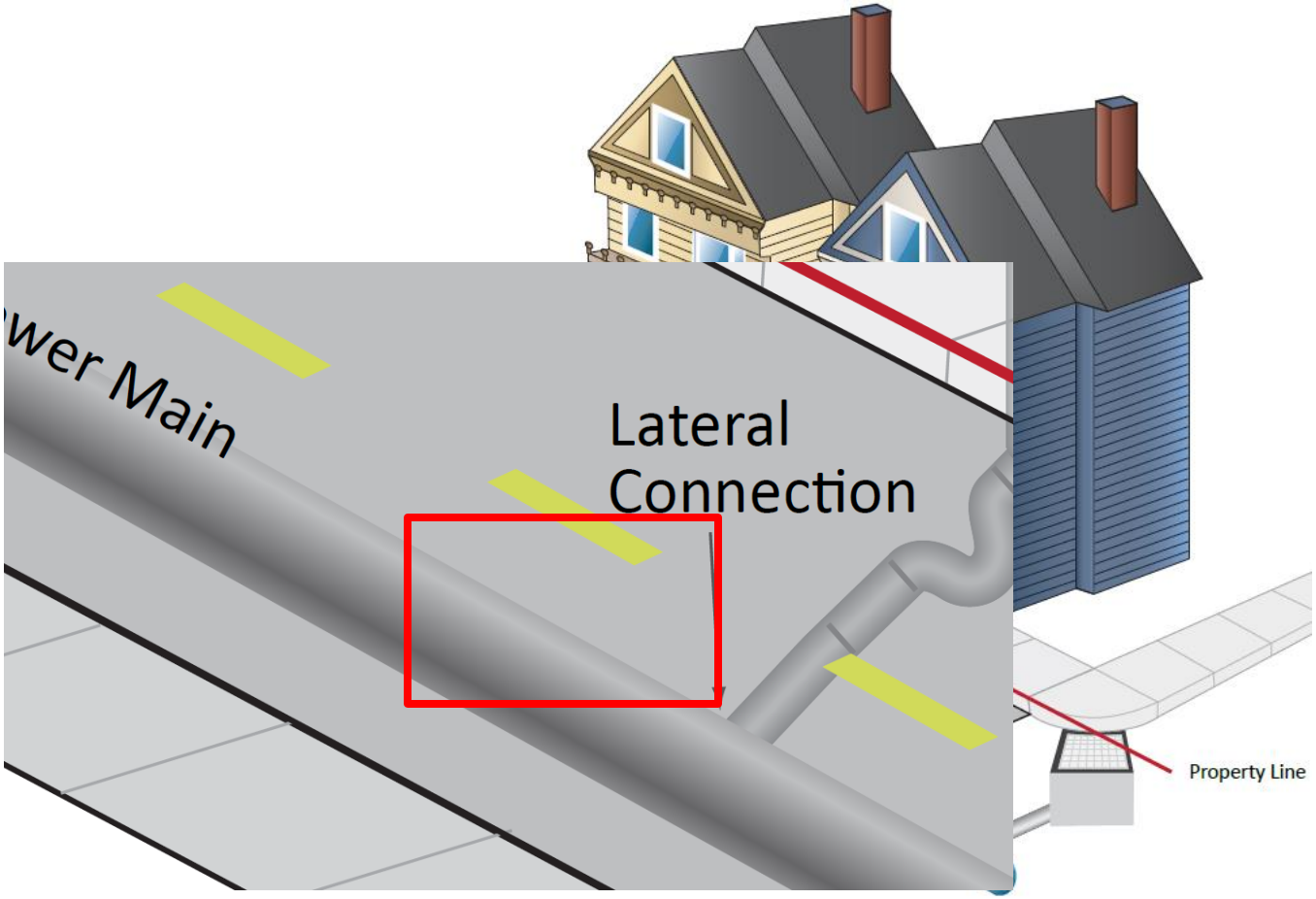
Risk Based Approach to Asset Management



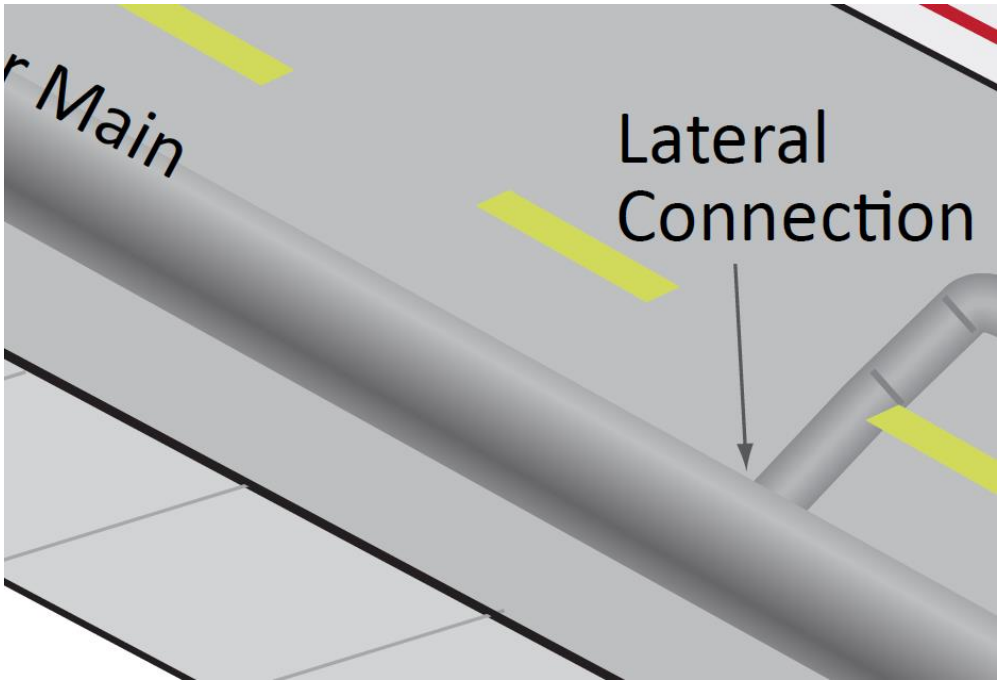
Likelihood of Failure

Consequence × Likelihood = Total Risk



Likelihood of Failure

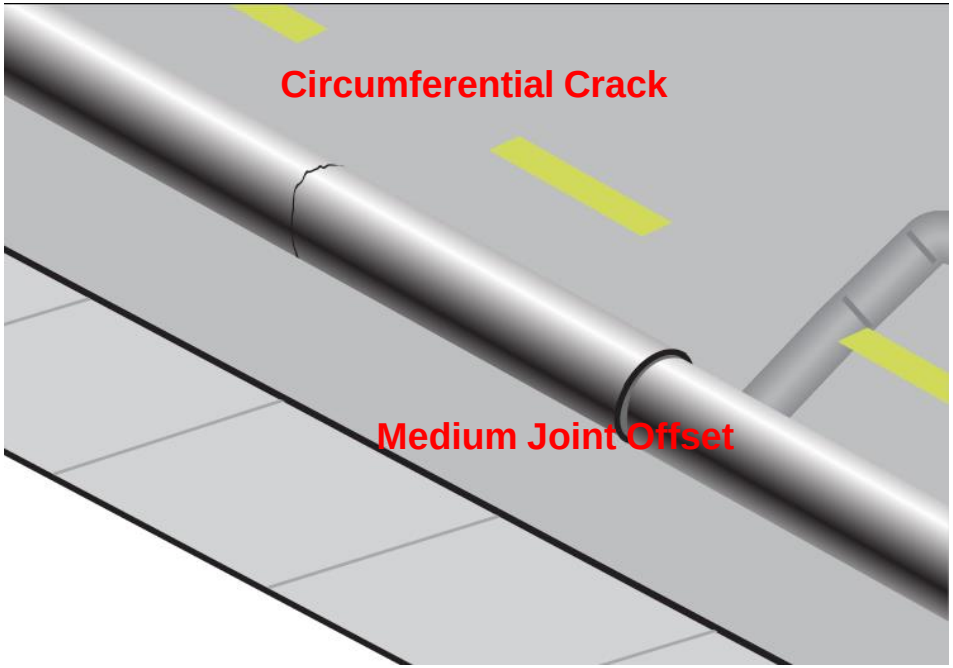
Consequence Likelihood Total Risk



PACP SCORE	1	2	3	4	5
Likelihood of Failure (CSAMP)	1	2	4	7	10

Likelihood of Failure

Consequence × Likelihood = Total Risk



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Likelihood of Failure

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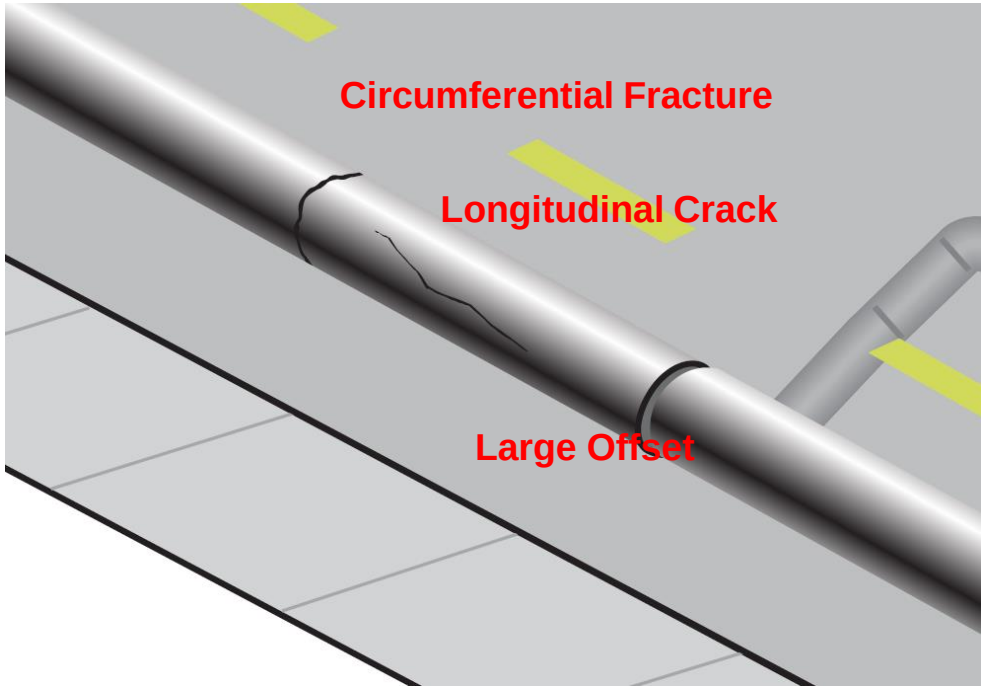

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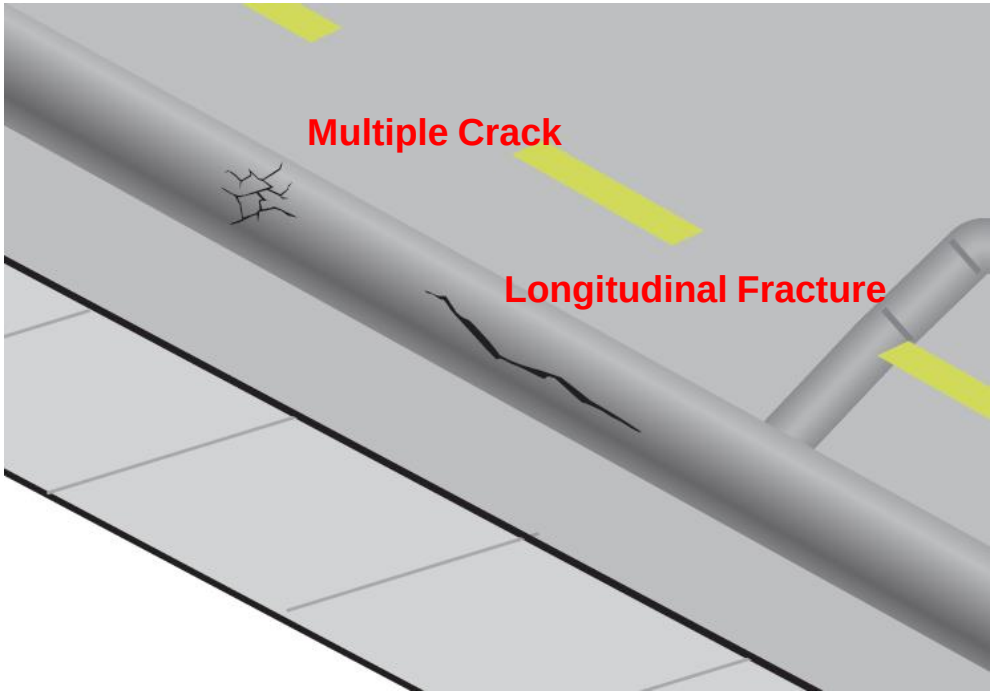

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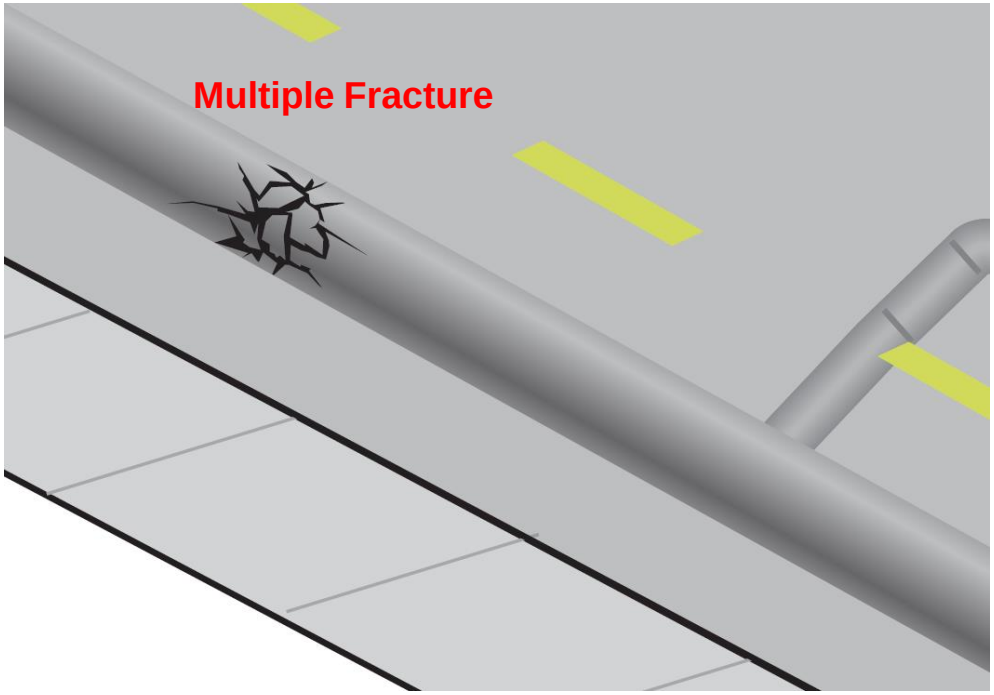
Likelihood of Failure

Consequence Likelihood Total Risk



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Likelihood of Failure

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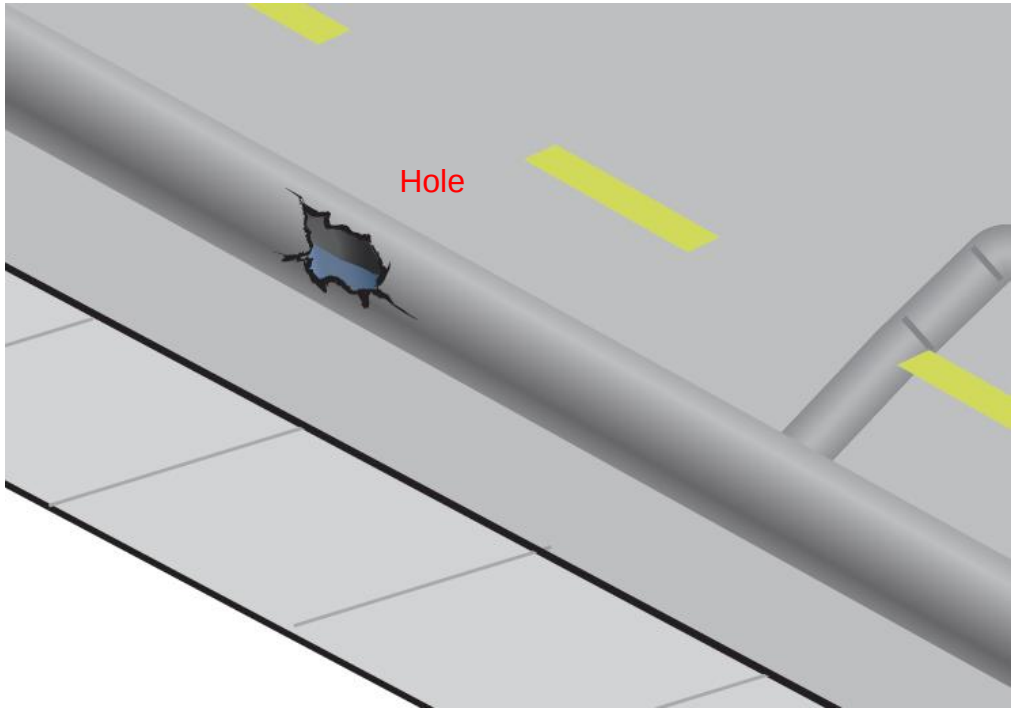
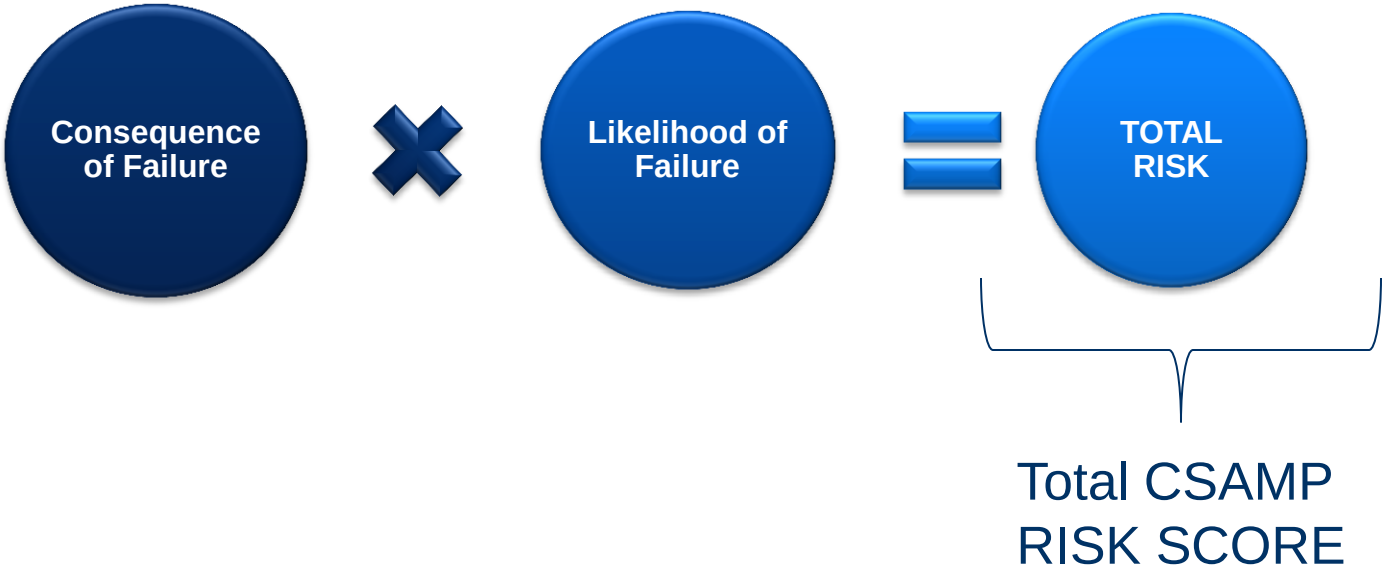


PACP SCORE	1	2	3	4	5
Likelihood of Failure (CSAMP)	1	2	4	7	10

Total Risk Score



Total Risk Score

Let's say the likelihood of failure score for each of our two examples is "7"

Example 1 "Market/Embarcadero"

Example 2 "Sunset"

Risk Class Matrix

	1	2	4	7	10
10	10	20	40	70	100
7	7	14	28	49	70
4	4	8	16	28	40
1	1	2	4	7	10

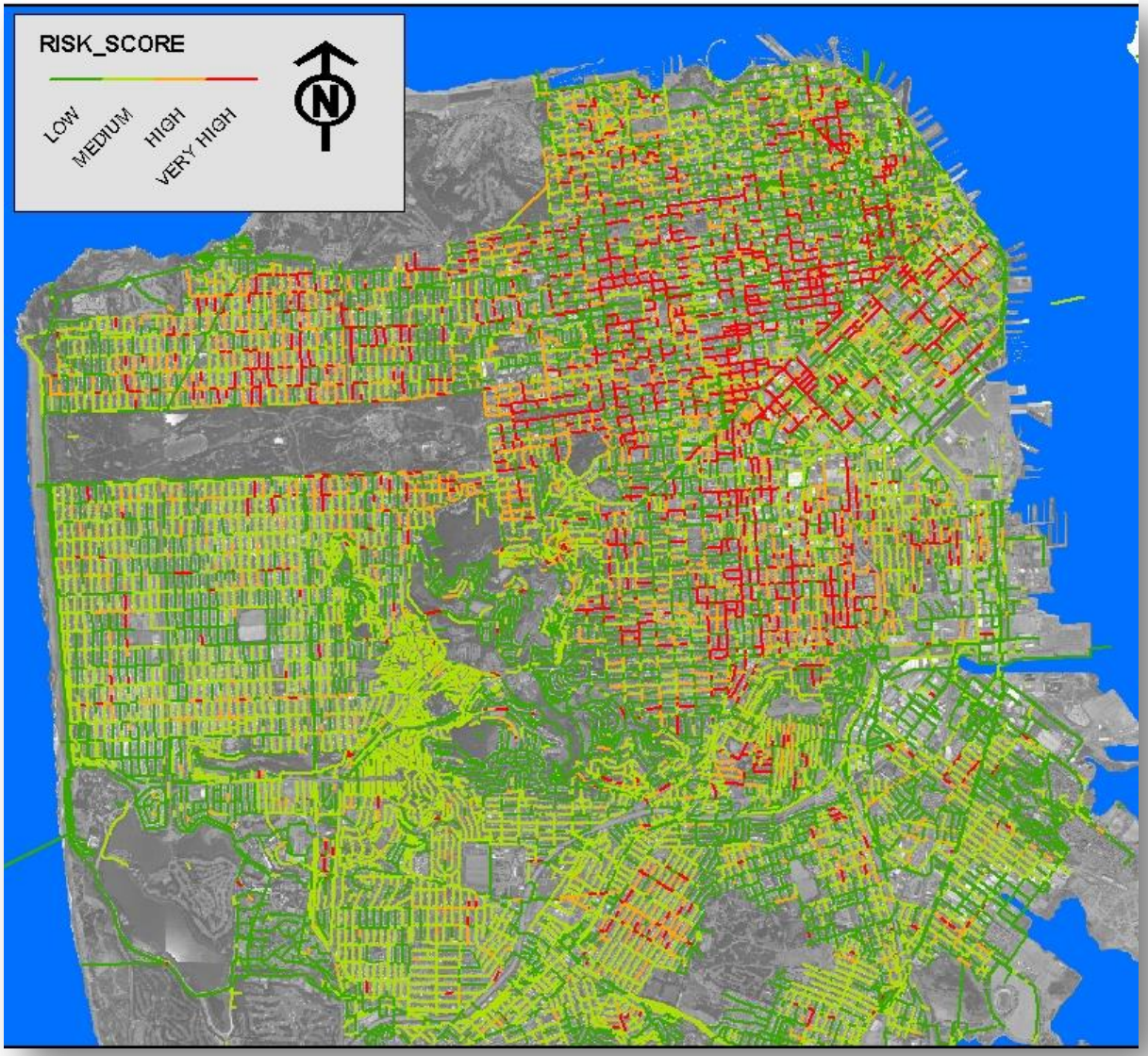
RISK CLASS	RISK SCORE	MILES
Very High	≥100	160
High	≥70<100	171
Medium	≥10<70	566
Low	<10	62

⇦ First 10 Years

⇦ Next 20 Years

Total CSAMP Risk Score

Consequence Likelihood Total Risk



San Francisco Water Power Sewer

WASTEWATER TREATMENT FACILITIES EXAMPLE

Southeast Plant (SEP)

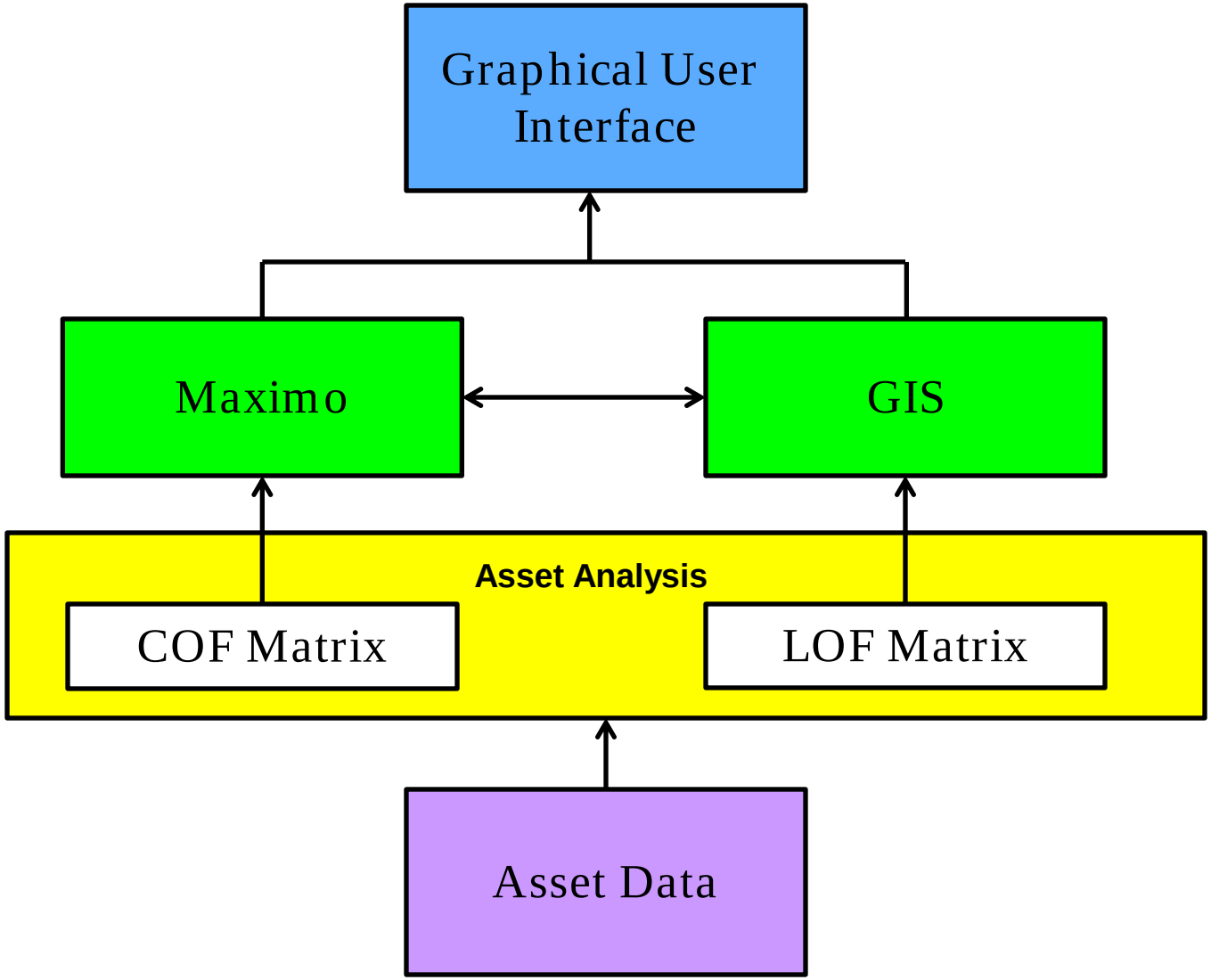
TREATMENT FACILITIES - COF SCORING

RISK IMPACT SCORE						
RATING	**OPERATIONAL**	**FINANCIAL**	**REGULATORY**	**SAFETY**	**PUBLIC IMPACT**	**COF SCORE**
5 - Extreme	0 Hours	>$100,000	100% Probability	Loss of Life	General Flood/Odor	10
4 - Major	< 6 Hours	>$50,000	75% Probability	IDLH	Significant	7
3 - Moderate	< 24 Hours	>$25,000	50% Probability	Significant	Localized Flood/Odor	4
2 - Minor	< 1 Week	>$10,000	25% Probability	Minor	Minor	2
1 - Insignificant	> 1 Week	<$10,000	0% Probability	None	None	1

TREATMENT PLANTS – LIKELIHOOD OF FAILURE SCORING

ASSESS CONDITION OF ASSET			
RATING	CONDITION SIGNATURE		LOF SCORE
0	ABANDONED	NO LONGER IN SERVICE	0
1	EXCELLENT	ROUTINE MAINTENANCE REQ'D	1
2	VERY GOOD	MINOR MAINTENANCE REQ'D	2
3	GOOD	SIGNIFICANT MAINTENANCE REQ'D	4
4	FAIR	RENEWAL/UPGRADE REQ'D	7
5	POOR	REPLACEMENT REQ'D	10

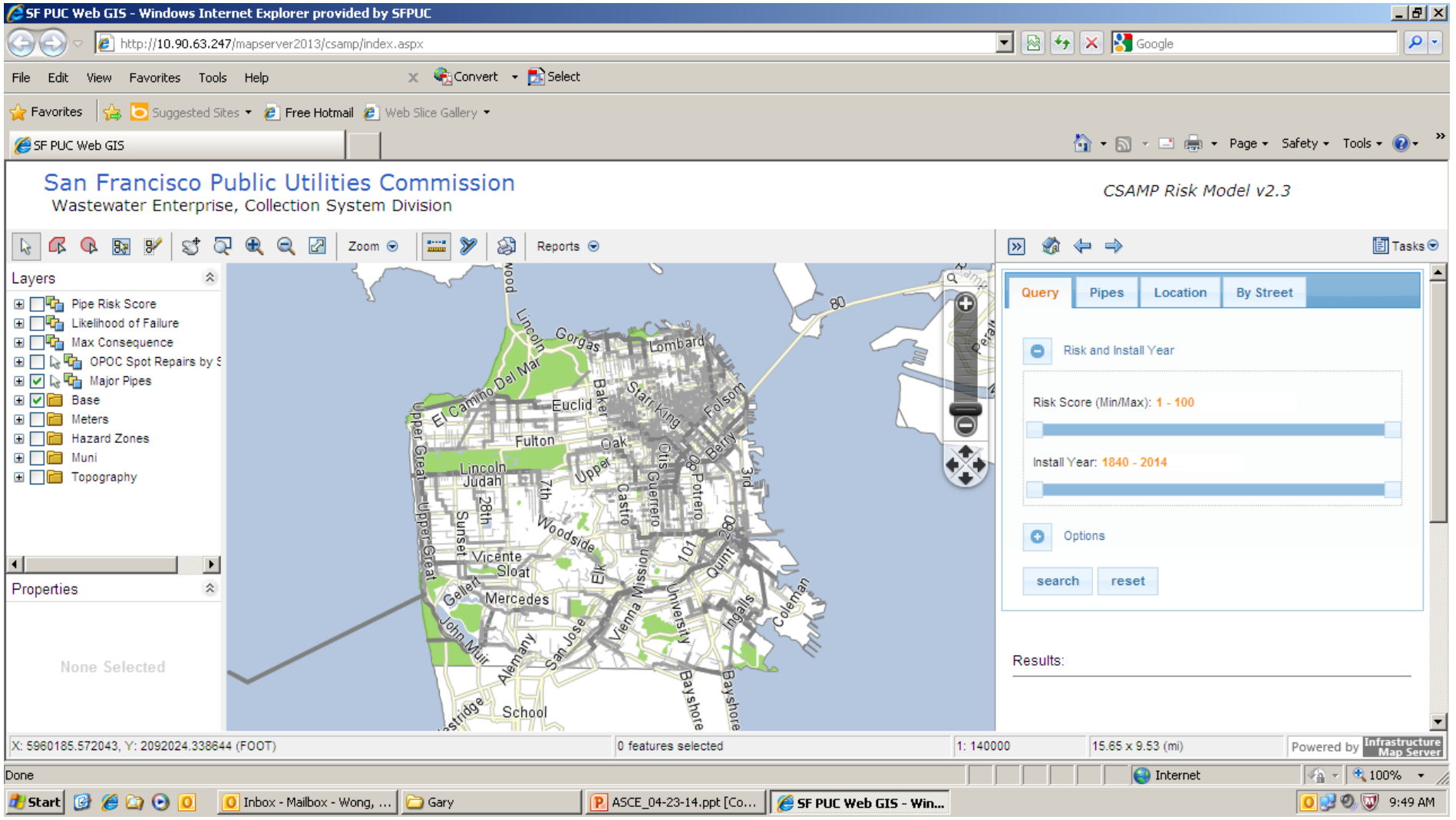
Graphical User Interface/Asset Management



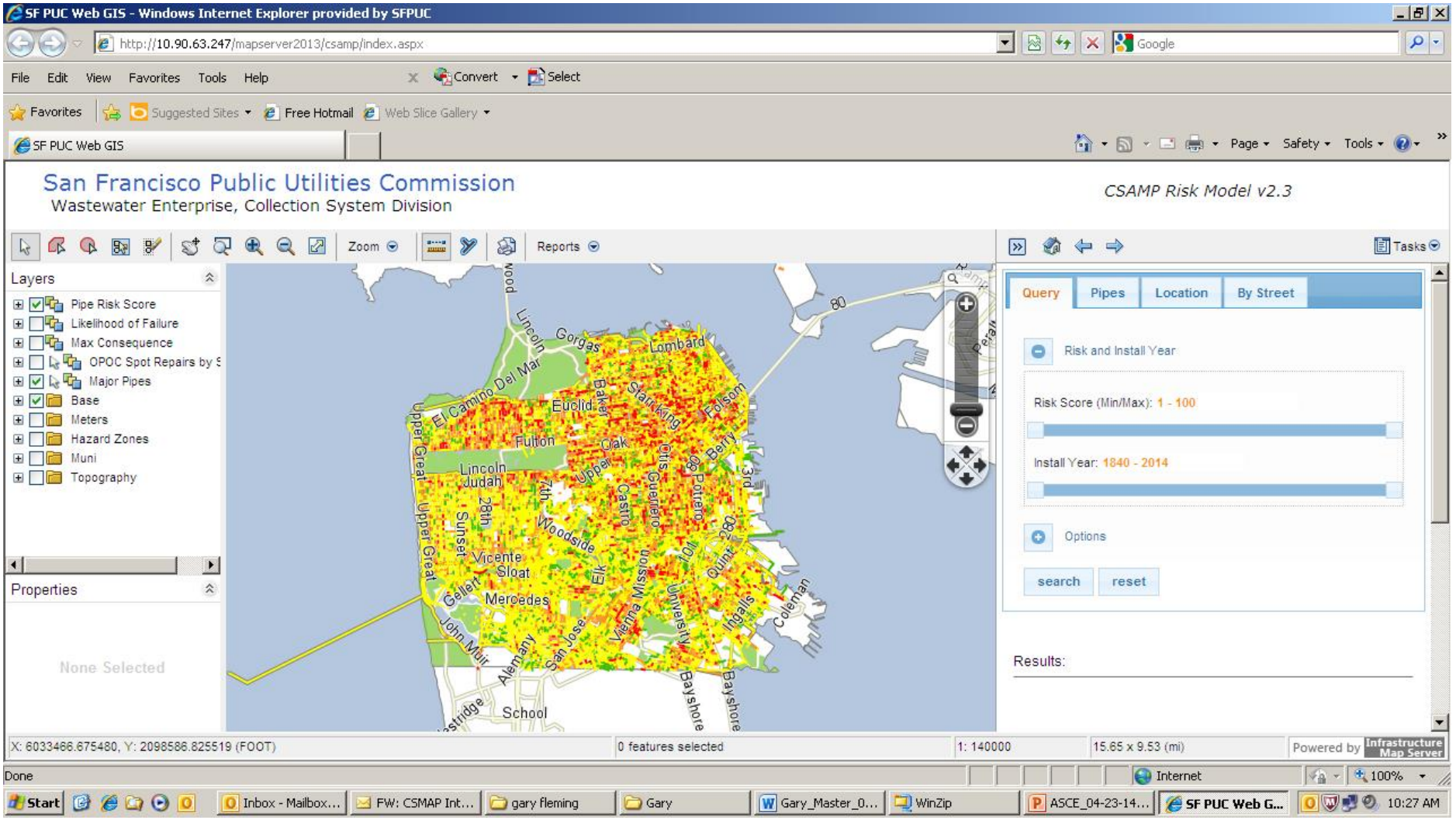
CSAMP – USER INTERFACE

http://10.90.63.247/mapserver2013/csamp/index.aspx

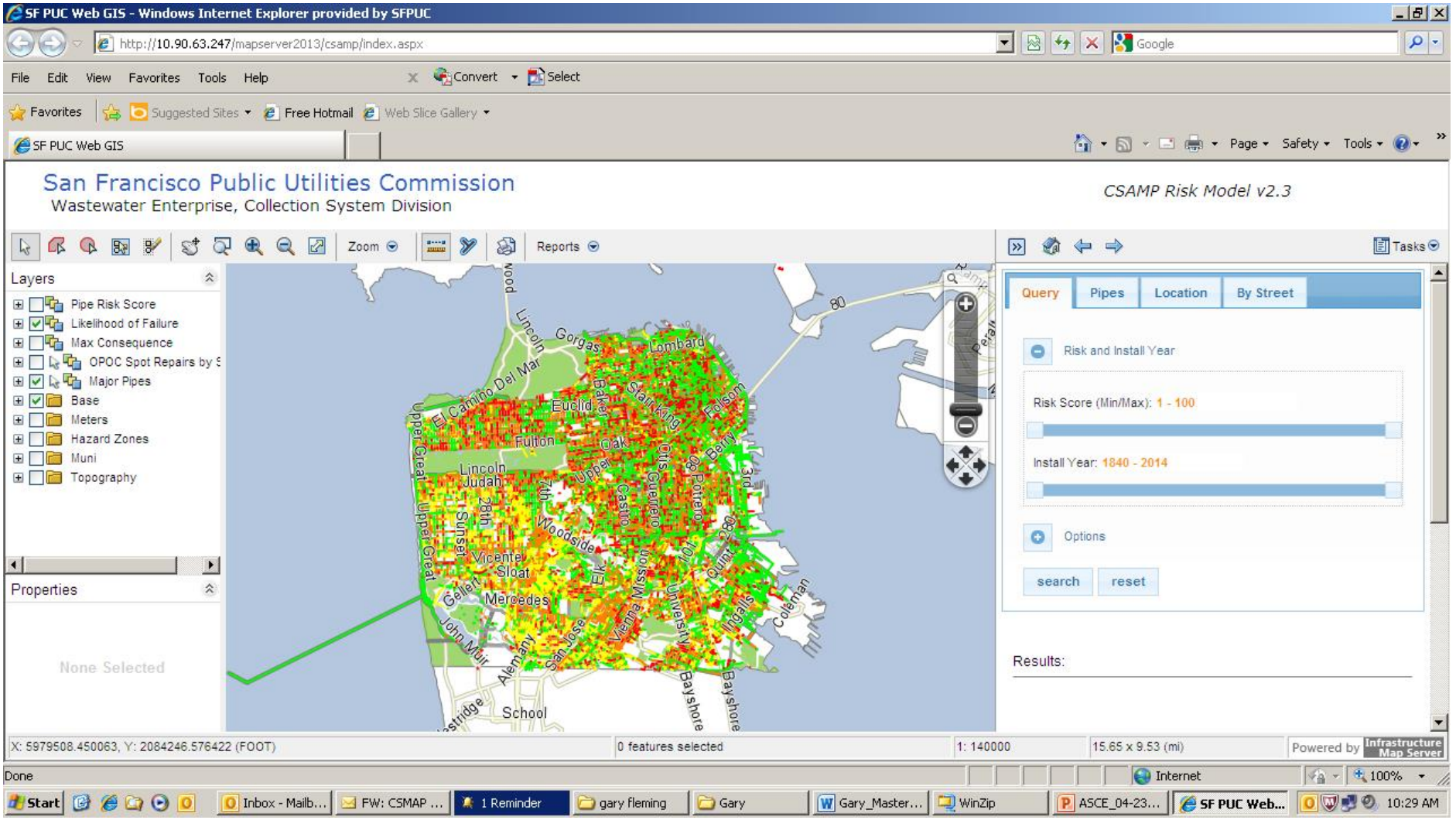
San Francisco Water Power Sewer



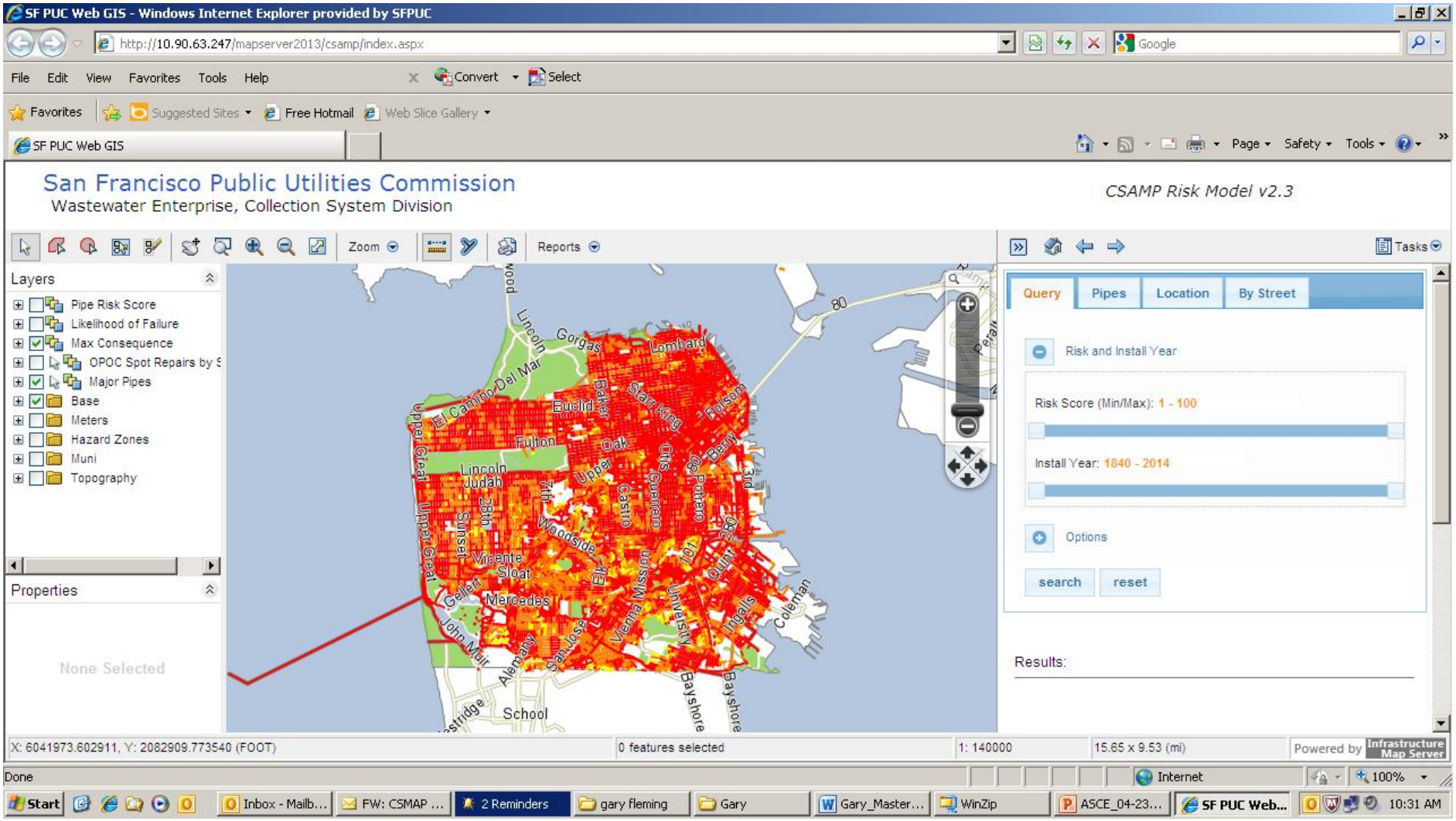
San Francisco Water Power Sewer



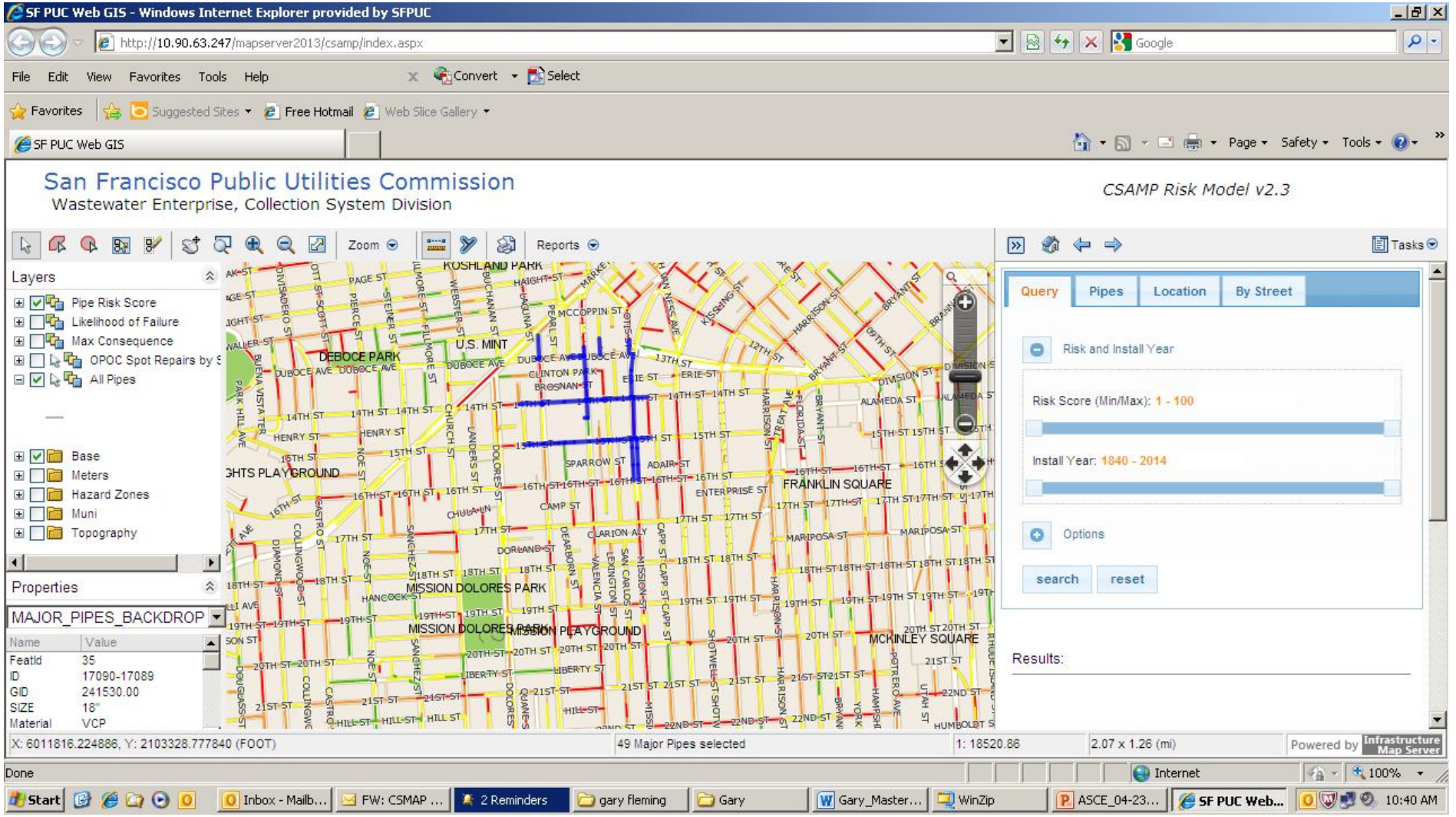
San Francisco Water Power Sewer



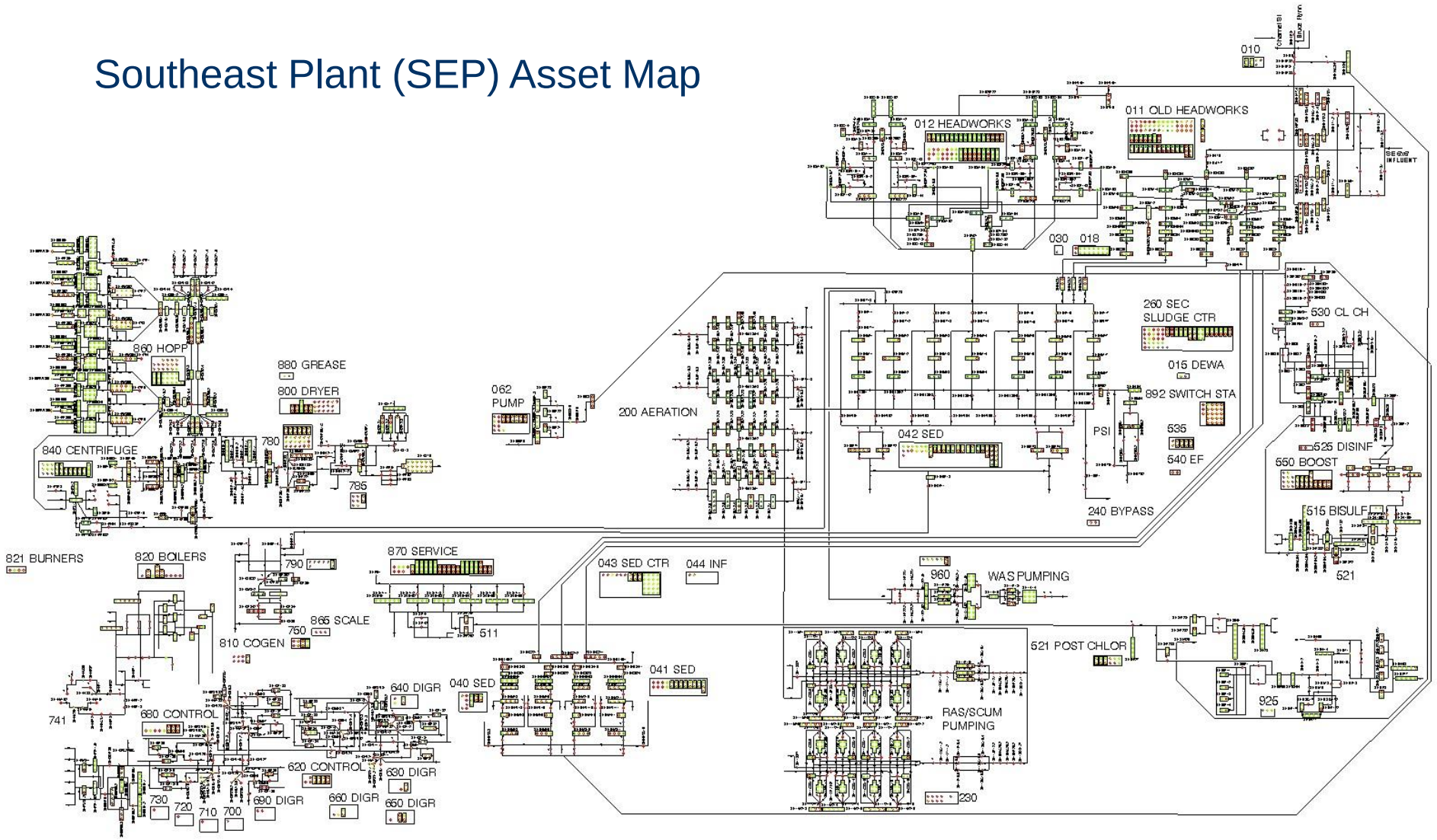
San Francisco Water Power Sewer



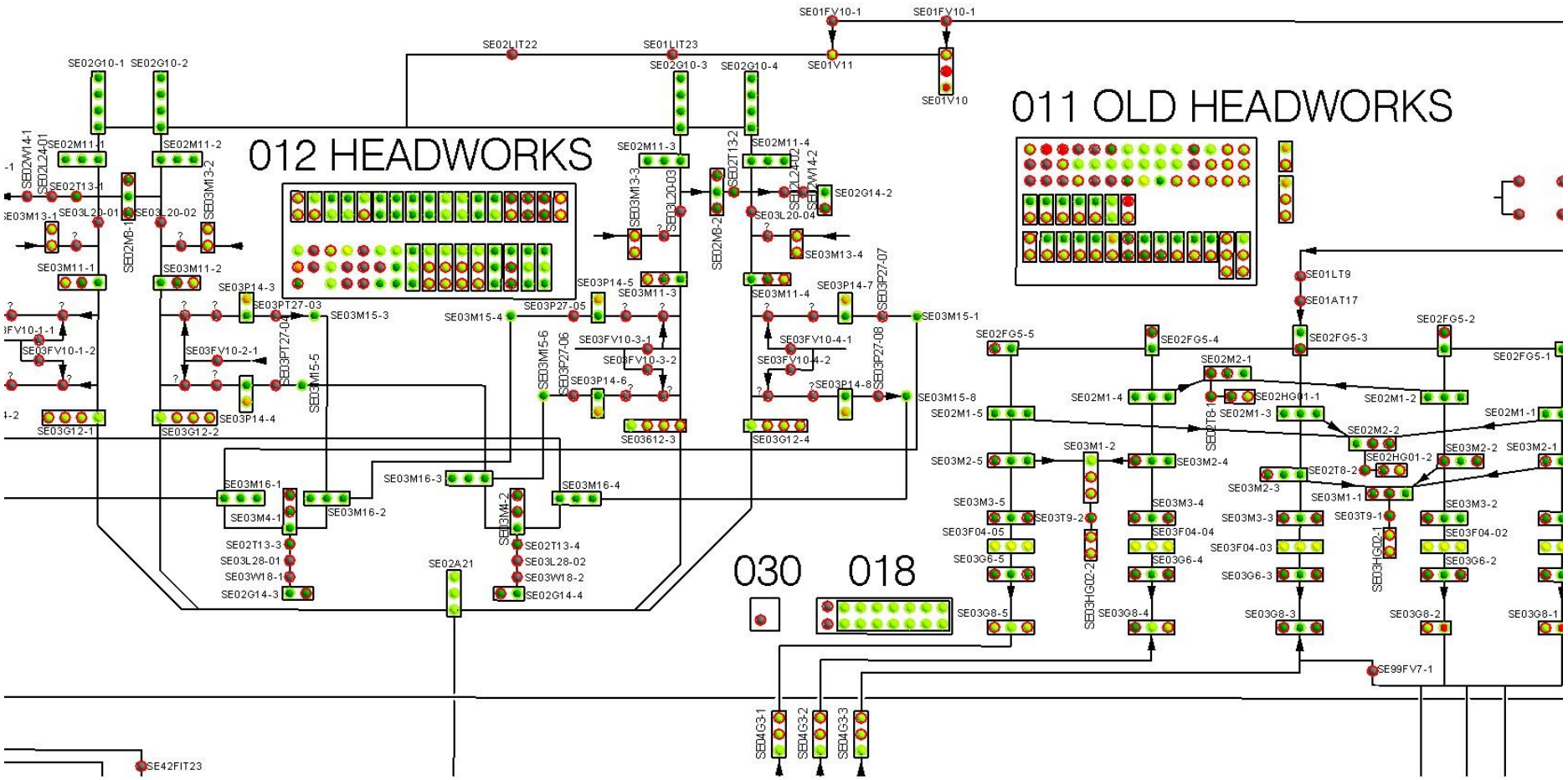
San Francisco Water Power Sewer



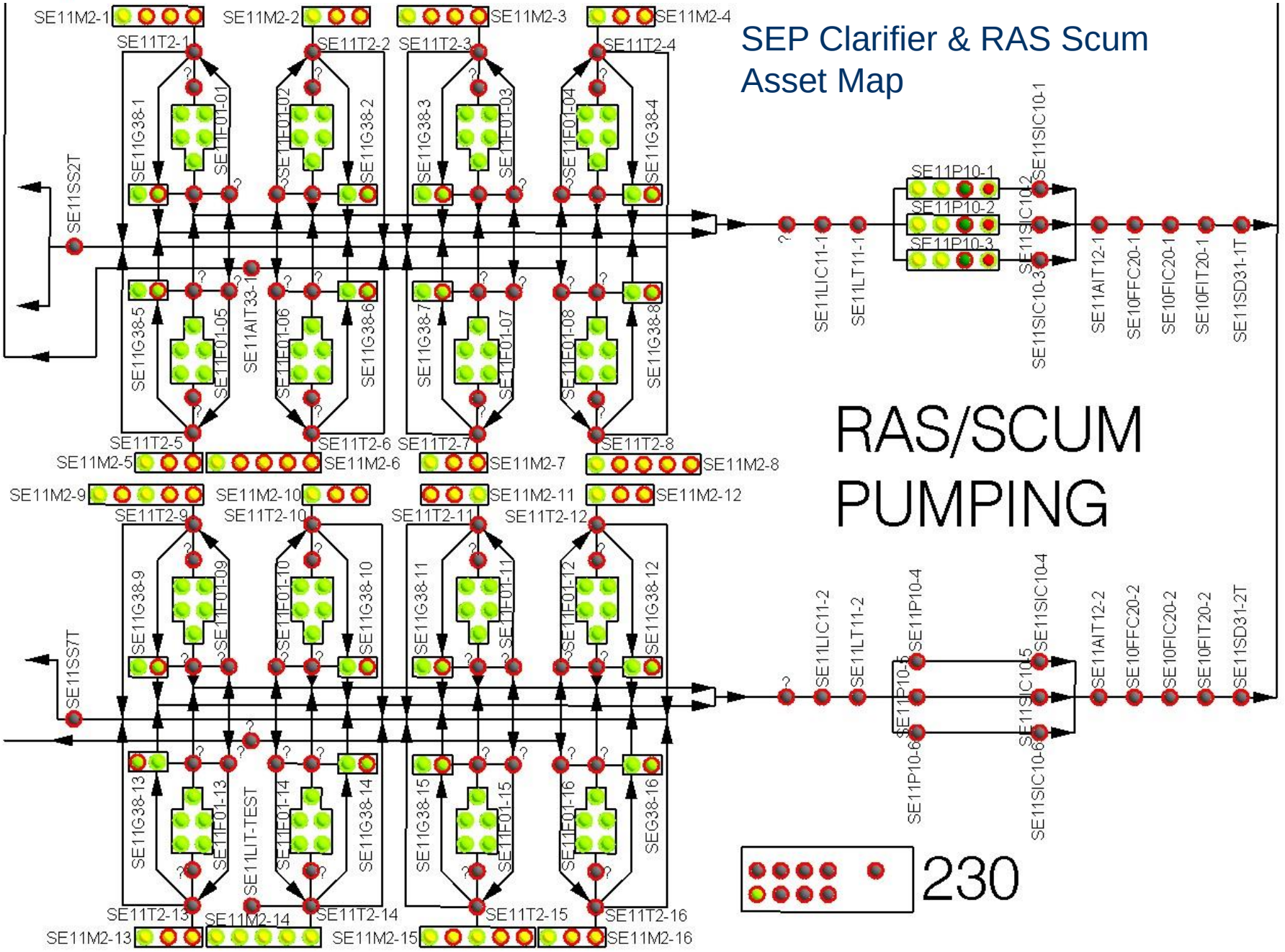
Southeast Plant (SEP) Asset Map



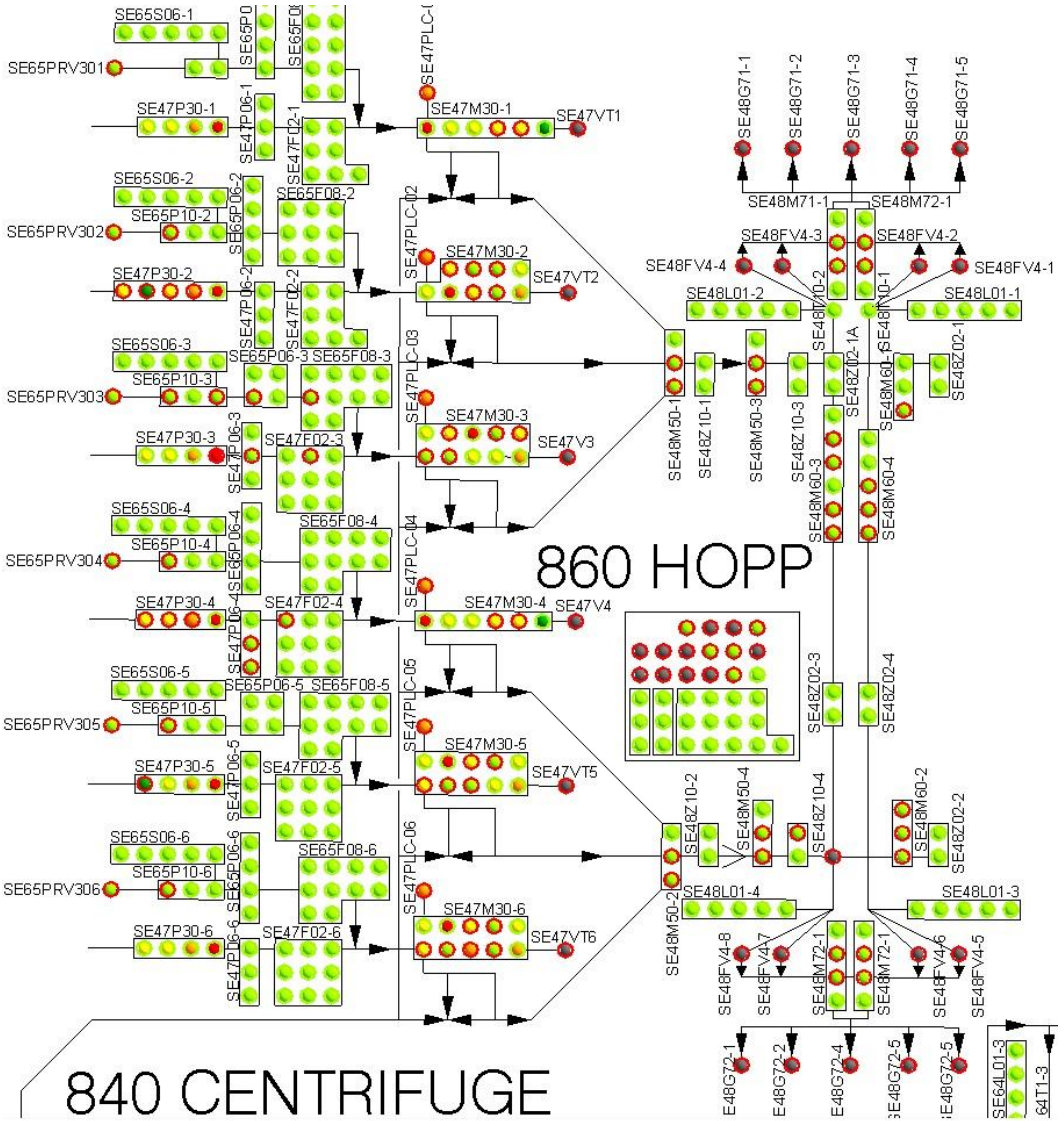
SEP Headworks Asset Map



SEP Clarifier & RAS Scum Asset Map



SEP Centrifuge & Bin Hopper Asset Map



San Francisco Water Power Sewer

QUESTIONS AND DISCUSSION

THANK YOU