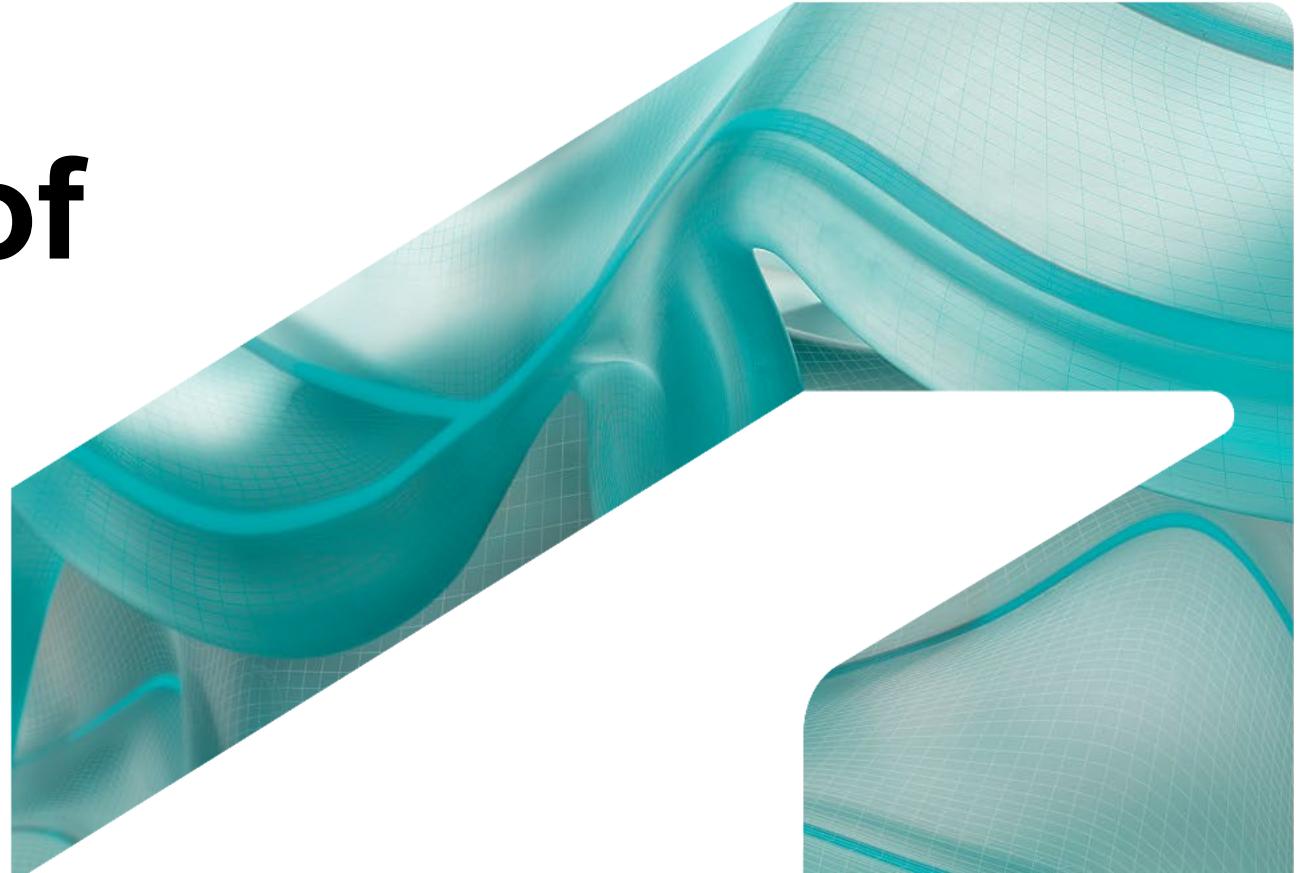


Risks and Rehabilitation of Sewer Assets

with Info360 Asset

Wen Chen and Martha Nunez
Presenter Title | @socialmedia



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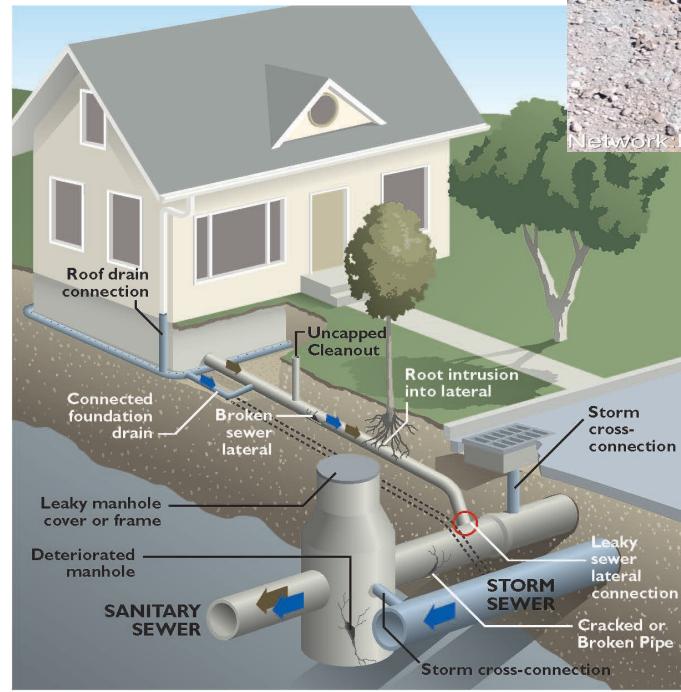
Wen Chen, PhD, PE
Supervising Civil Engineer
City of Oakland Public Works



Martha Nunez
Customer Success Manager –
Asset Management Products

Agenda

- City Sewer Collection System
- Issues & Challenges
- Management Practices
- Move to the Cloud
- Info360 Asset Implementation
- Next Steps & Conclusions



City of Oakland's Sewer System

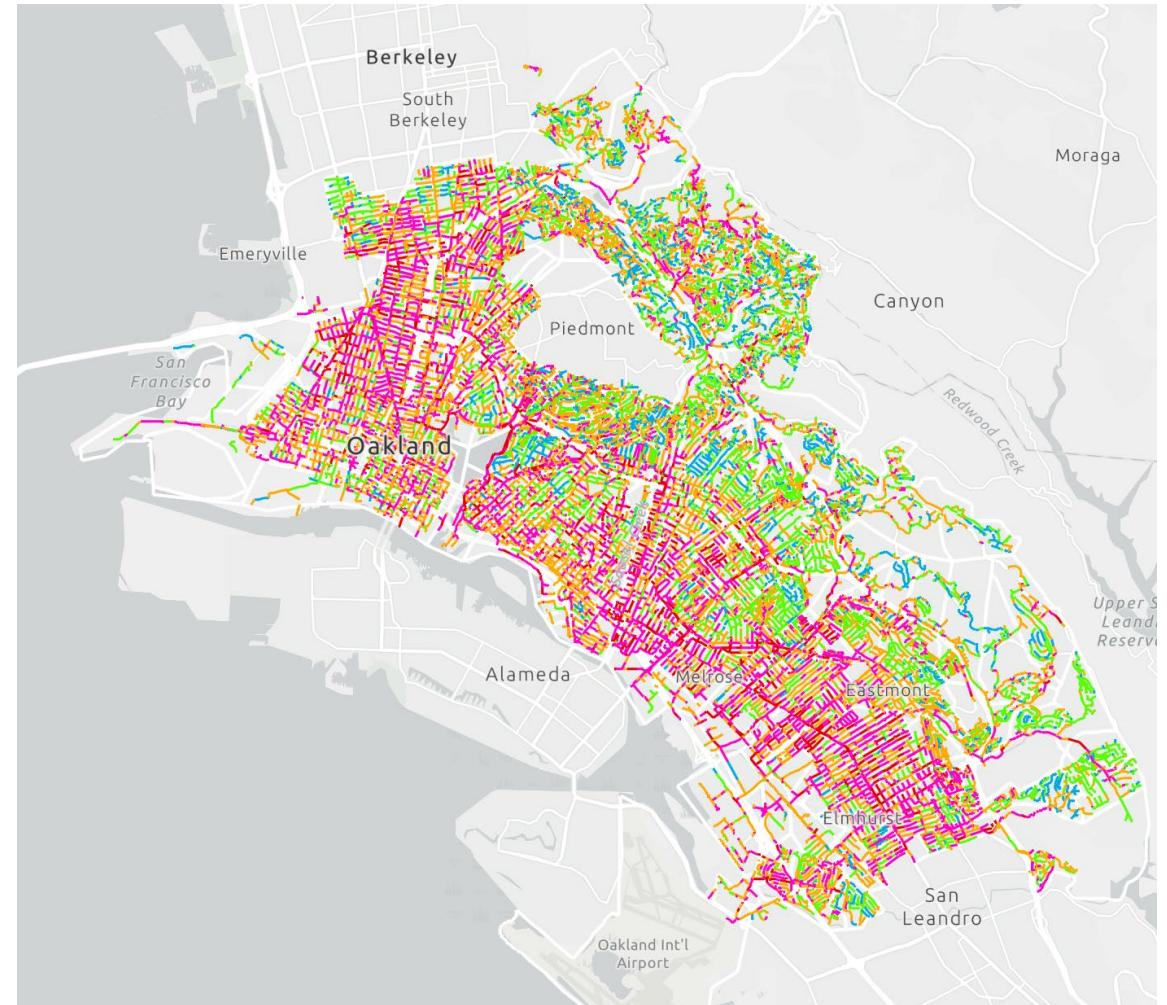
Overview



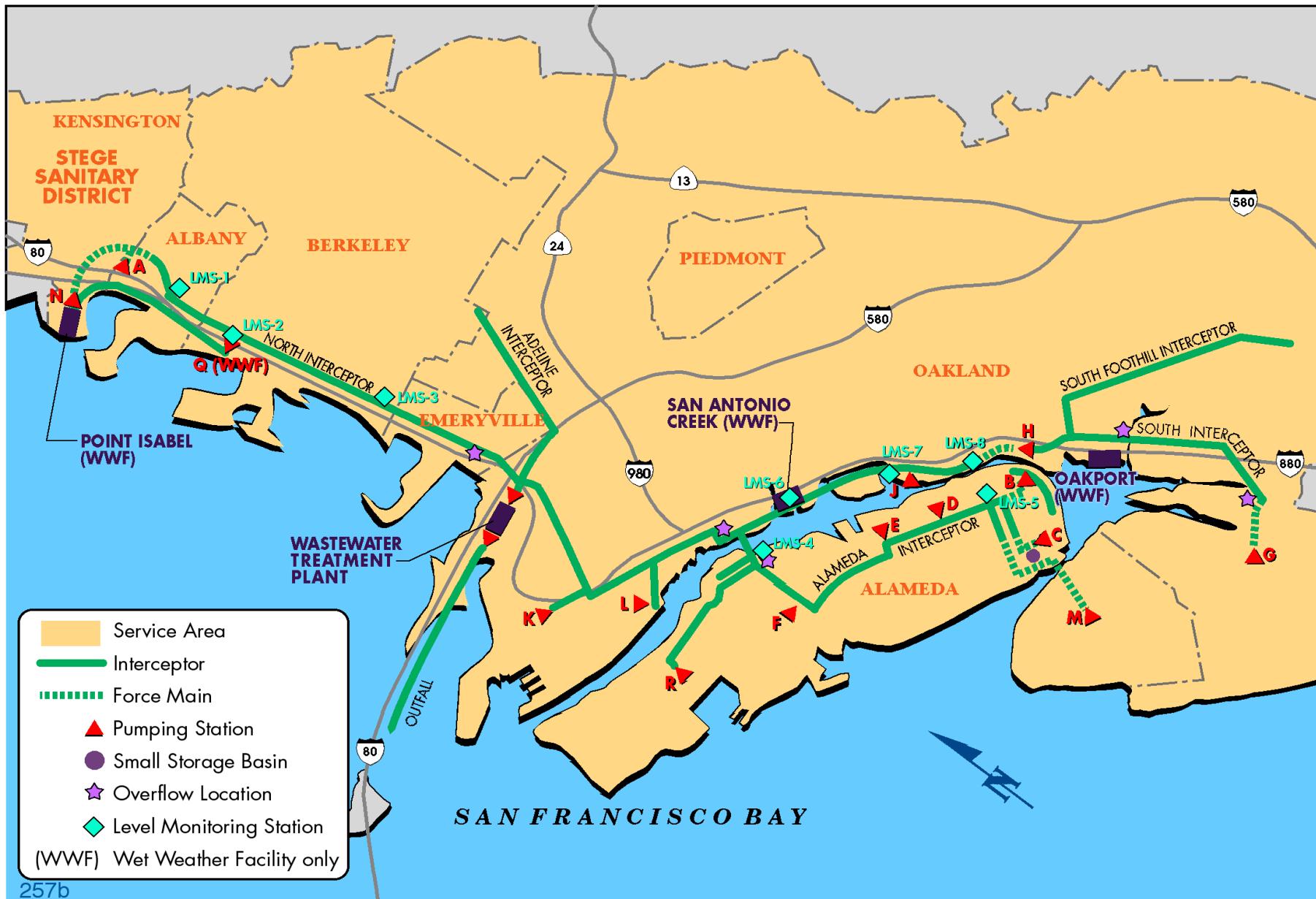
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Oakland Sewer Collection System

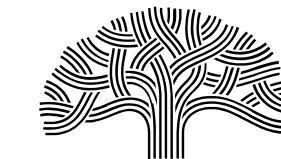
- Approximately 1,000 miles
- 11 pump stations
- Over 100,000 sewer connections
- Serves 430,000 residents
- First sanitary pipe installed in 1852
- Average service life over 50 years
- Discharges to East Bay Municipal Utility District (EBMUD) for treatment along with six other Cities/Districts



East Bay Sewer Collection System



City of Oakland's Challenges



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Issues and Challenges

- Aging infrastructures
- Sanitary Sewage Overflows (SSO)
- Inflows and Infiltrations
- Inadequate conveyance capacity due to developments
- Blocked/reduced capacity due to debris / root intrusion / illicit dumps
- Limited work forces & funding



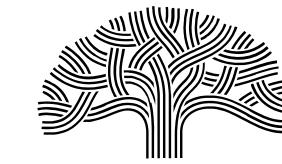
2014 EPA Consent Decree

Starting from 2014 to 2035, Mandates to Improve the Sewer Collection System Annually:

- Rehabilitate 13 miles pipelines & maintenance holes
- Inspect / Assess 92 miles via CCTV
- Root control 50 miles via chemical treatment
- Manage sewer lateral connections



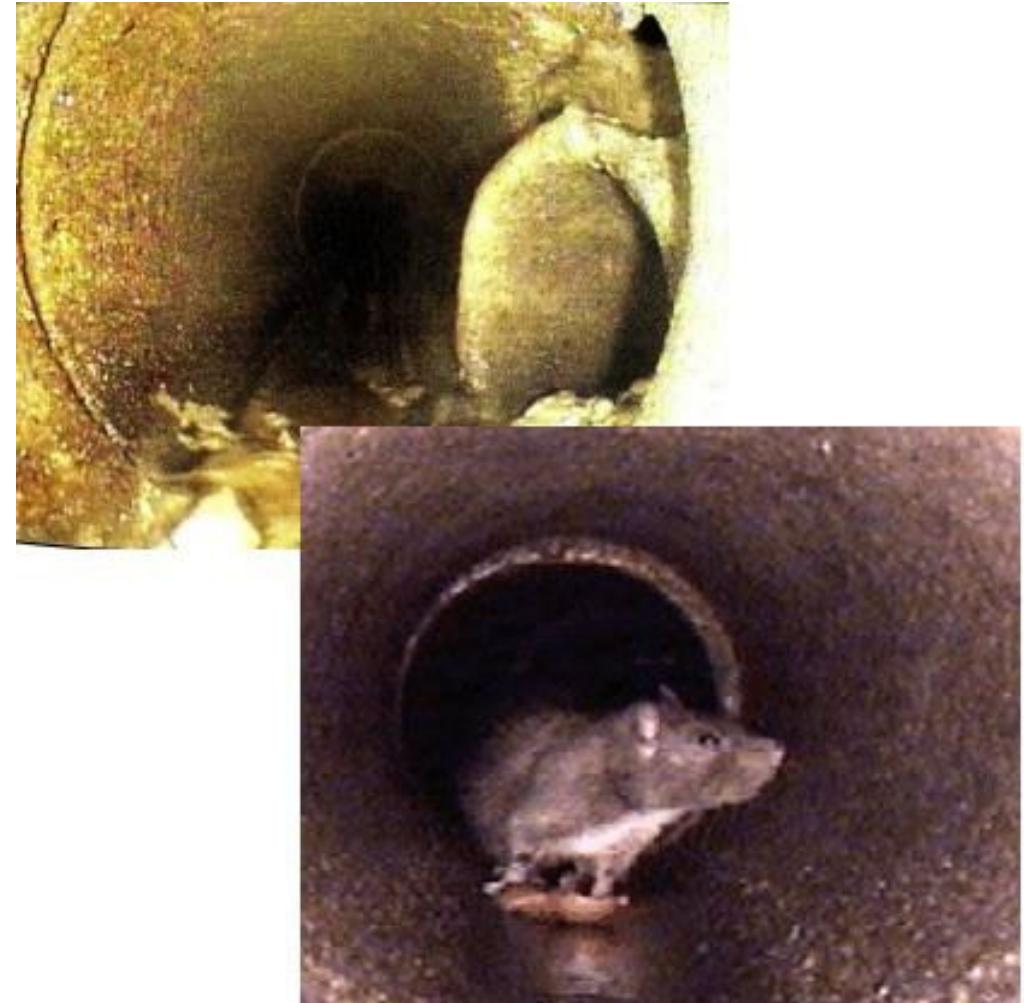
Management Practice Measures



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Management Practice Measures

- Build digital infrastructure: Arc-GIS Online & Apps
- Granite XP/IT Pipes CCTV
- CityWorks platform: service requests and work orders
- Info Asset Planner in transition to Info360 Asset
- Master Plans – risk based
 - Operation & Maintenance
 - Capital Improvement Program



Sewer System Risk Delineation - LOF

Likelihood of Failure (LOF) - SSO & I / Reduction Focus Only		Criteria	Scoring Criteria					Scoring Weight	Rating Logic
			1	2	3	4	5		
Structural Failure	Condition: PACP Structural Peak Score	Peak Structure Score = 1; No Defects Noted (Score = 0)	Peak Structure Score = 2	Peak Structure Score = 3	Peak Structure Score = 4	Peak Structure Score = 5		44.45%	Defect Rating is primary (if no CCTV use Age)
		Installation Year/Rehab Year	> 1990	1971 - 1990	1951-1970; unknown	<=1950	Not Used		
	Maintenance Failure	Condition: PACP O&M Peak Score	Peak O&M Score = 1; No Defects Noted (Score = 0)	Peak O&M Score = 2	Peak O&M Score = 3	Peak O&M Score = 4	Peak O&M Score = 5	33.33%	Maximum score used from all 4 factors
		Roots/Grease Observed During Cleaning	Clear; Not Observed (N/A, Blank)	Not Used	Light	Moderate	Heavy		
		Debris Observed During Cleaning	Clear; Not Observed (N/A, Blank)	Light	Moderate	Heavy	Not Used		
		SSO occurrences at pipe locations	No documented SSOs	Not Used	Not Used	1 SSO	> 1 SSO		
Hydraulic Capacity Failure	Condition (Based on Cleaning Frequency)	Pipes not identified for frequent cleaning	Pipes identified for 12 month cleaning frequency	Pipes identified for 6 month cleaning frequency	Pipes identified for 3 month cleaning frequency	Pipes identified for weekly cleaning frequency			
	Modeled Capacity - Identified Restrictions (d/D)	<= 0.5 (< 50% full)	0.5 - 0.75 (50% - 75% full)	0.75 - 1.0 (75% - 100% full)	Surcharge due to Backwater	Surcharge due to Capacity Exceedance		22.22%	Modeled capacity restrictions is primary factor; if no model data for individual pipe,

Sewer System Risk Delineation - COF

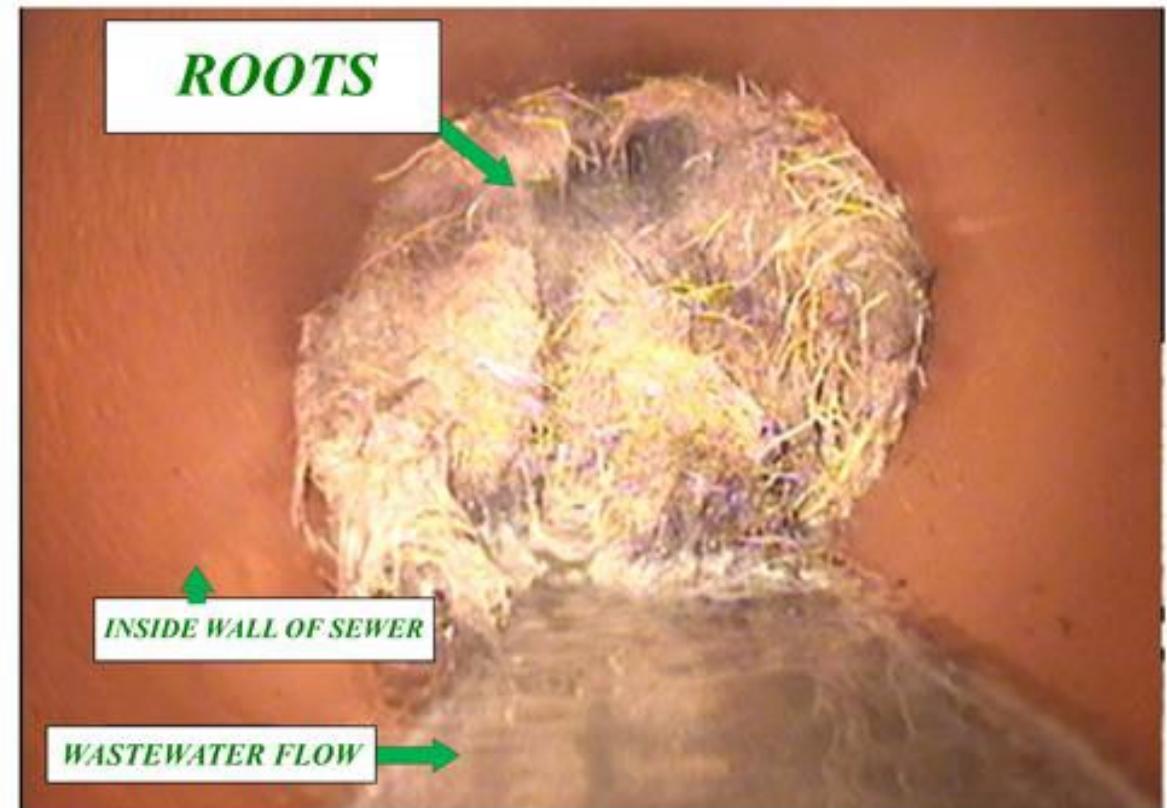
Consequence of Failure (COF)	Criteria	Definition	Scoring Criteria					Scoring Weight	Rating Logic
			1	2	3	4	5		
Potential Spill Volume	Potential Spill Volume (Based on Modeled Peak Wet Weather Flow)	State Water Resources Control Board requires that reported discharges be categorized by spill type as Category 1 (Any volume and reaches waterway), Category 2 (1000 gallons or greater and does not reach water way), Category 3 (Less than 1000 gallons and does not reach water way).	<0.25 mgd	0.25 mgd - 0.50mgd	0.51 - 1.0 mgd	1.01 mgd - 3.0mgd	> 3.0 mgd	20%	Modeled peak flow is primary factor (if not modeled diameter is used)
	Estimated Spill Volume Based on Pipe Diameter	Spill volume estimated based on pipe diameter (when modeled data not available)	<= 6 in	7in - 8 in; Unknown	9 in - 10 in	12 in	> 12 in		
Environmental Impact	Proximity to Water Ways	Locations where gravity main crosses or is within 25 ft to 250 ft of a water body (streams, lakes)	Greater than 250ft of water body or outside FEMA 100-yr Flood Zone	Within FEMA 100-year Flood Zone	Within 100 - 250 ft of water body	Within 50 - 100 ft of water body	Crosses or within 50 ft of water body	22%	Single factor
Public Exposure	Based on Pedestrian Traffic	Walkable streets downtown/urban areas; Bicycle lanes/trails; Neighborhoods - Chinatown, Downtown, East 14th Street Business, Fruitvale Station; BART Stations; High Use Areas (Zoo, Lion Creek, Dimond Park, City Slicker Farms)	Not within proximity	Not Used	Within 75 - 150 ft of high pedestrian traffic area	Within 25 - 75 ft of high pedestrian traffic area	Intersecting or within 25ft high pedestrian traffic area	23%	Maximum score used between both factors
	Based on Facility	Types of customers/facilities near a sewer main	Not within proximity	Not Used	Within 150 ft of Commercial Area	Within 150 ft of Schools	Within 150 ft of Hospitals, Medical Facilities, Nursing Homes		
Social Equity	Equity/Investment in Underserved Oakland Communities	Equity/Investment in underserved Oakland Communities - Based on location within Priority Neighborhood or Within 1/4 mile of 100% affordable housing development (adjustment only for Highest, High, Medium priority neighborhoods)	Lowest Priority Neighborhood; Area not included in priority neighborhood	Low Priority Neighborhood	Medium Priority Neighborhood	High Priority Neighborhood or Medium Priority Neighborhood and within 1/4 mile proximity to affordable housing	Highest Priority Neighborhood or High Priority Neighborhood and within 1/4 mile proximity to affordable housing	23%	Maximum score used between Equity/Investment in Underserved Communities and Preservation of existing facilities
		Preservation/Enhancement of Existing Cultural, Historical, or Natural Resources Within the Park Based on Areas Identified as Primary and Secondary Importance	Not within identified areas of primary/secondary importance		Within identified areas of primary/secondary importance				
Emergency Response and Construction Impact	Proximity to Road/Railroad and Easement Access	Locations where sewer gravity main crosses/within street. Assumed if sewer gravity main is not within designated road width, access is more difficult and may be in customer property.	Within 30 ft of Local Street road centerline	Within 40 ft of Minor/Major Collector road centerline	Within 50 ft to 100 ft of railroad centerline	Within 75 ft of Other Principal Arterial, Minor Arterial road centerline; Within steep hills designated area and within 10 ft of road centerline; Sewer gravity main outside designated road width for local/collector/arterial.	Within 75 ft of Interstate, Other Freeways or Expressways road centerline; Within steep hills designated area and outside of 10 ft road centerline; Within 50ft of railroad centerline	12%	Maximum score used from all 3 factors
	Difficulty of Repair/ Potential Contaminated Soils (Brownfield Sites)		Greater than 300 ft from contaminated site	Not Used	Not Used	Within 300 ft of contaminated site	Not Used		
	Difficulty of Repair/Depth of Pipe	Pipe depth based on manhole depth with populated City/Model data selected the deepest depth between selected data. City data was used when available, model data was used where data was not available. Shallower manholes have higher chance for SSO.	< 10 ft; Unknown	Not Used	10 ft - 12 ft	12 ft - 18 ft	> 18 ft		
Total COF Score								100%	

Sewer System Risk Dashboard



Root Intrusion Control

- InfoAsset Planner to select candidates up to 50 miles each year
- Contractor to verify root conditions
- Apply chemical foams to whither roots in pipelines
- Monitor root condition in 2 years for re-applying treatments as needed



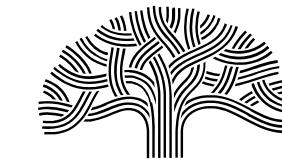
Move to the cloud solution

- Information sharing with clients and various stakeholders.
- Data security – Lessons learned from recent ransomware attack.
- Trend towards automation.
 - Real time updates between different databases.



Info360 Asset

Product Overview and Project Implementation



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What is Info360 Asset?



ASSET CONDITION



GIS



ASSET INVENTORY



CCTV INSPECTION



CMMS

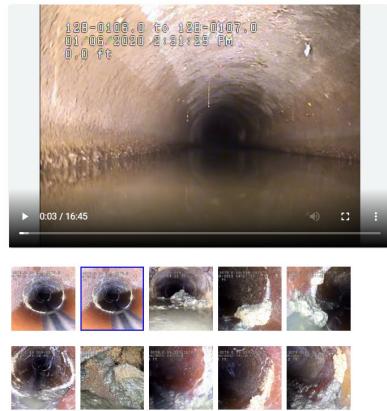


HYDRAULIC MODELS

asset.info360.com

What is Info360 Asset?

Assess pipeline condition & Risk

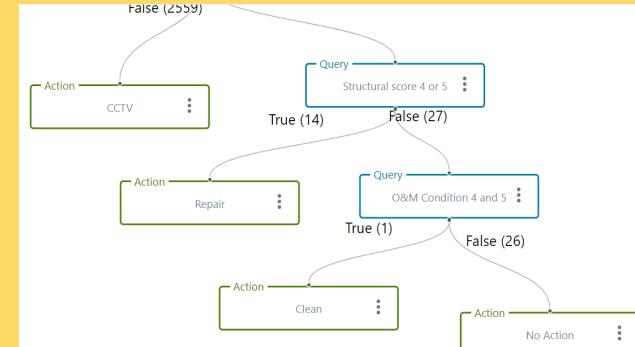


CCTV Management.

Risk Grade
Negligible
Low
Medium
High
Extreme

Risk Analysis

Develop a response plan



Rehab Analysis

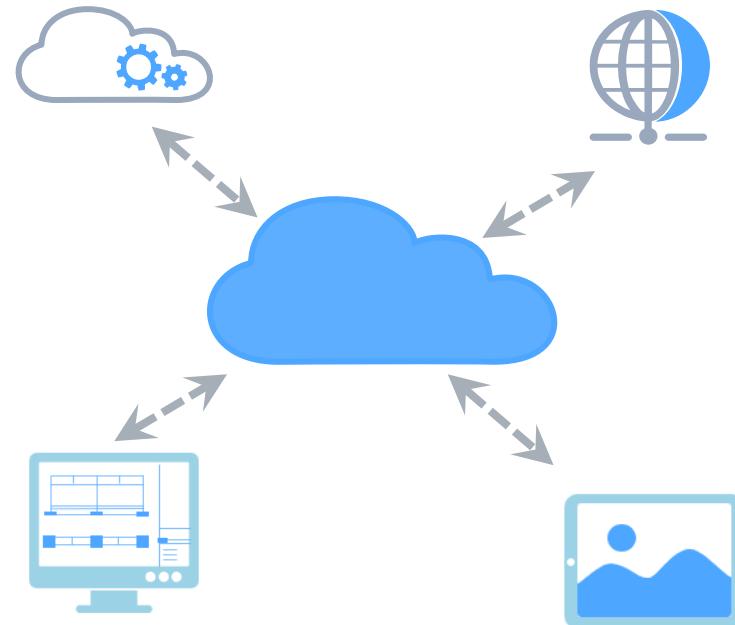
Share with your team!



ArcGIS Online

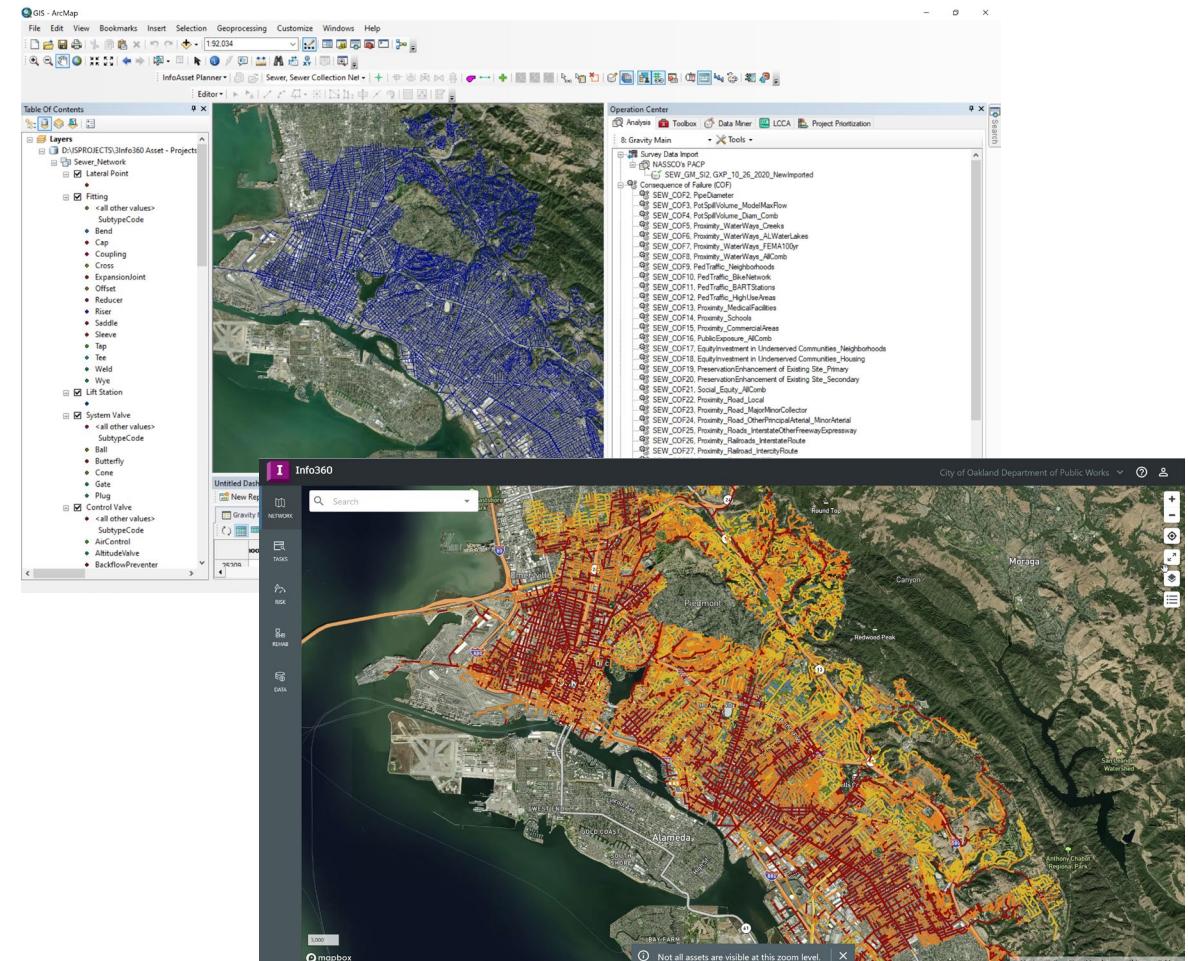
Why the cloud?

- Limited accessibility
 - Desktop solutions can get “stuck” with only a few team members.
- Lack of resources
 - (skilled workforce, storage, slow CPU).
- Industry trends.
 - Enable integrations with other cloud systems. Enabling automation.



InfoAsset Planner to Info360 Asset

- 1. GIS and table data import.
- 2. CCTV data import.
- 3. Risk Analysis migration.
- 4. Rehab Analysis migration.

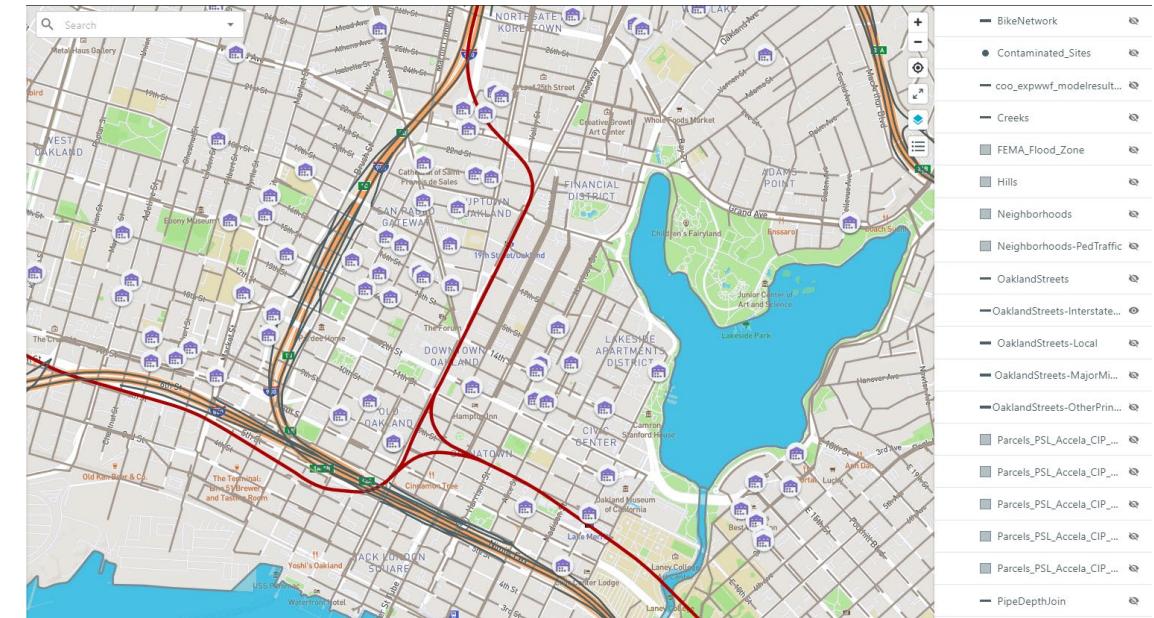


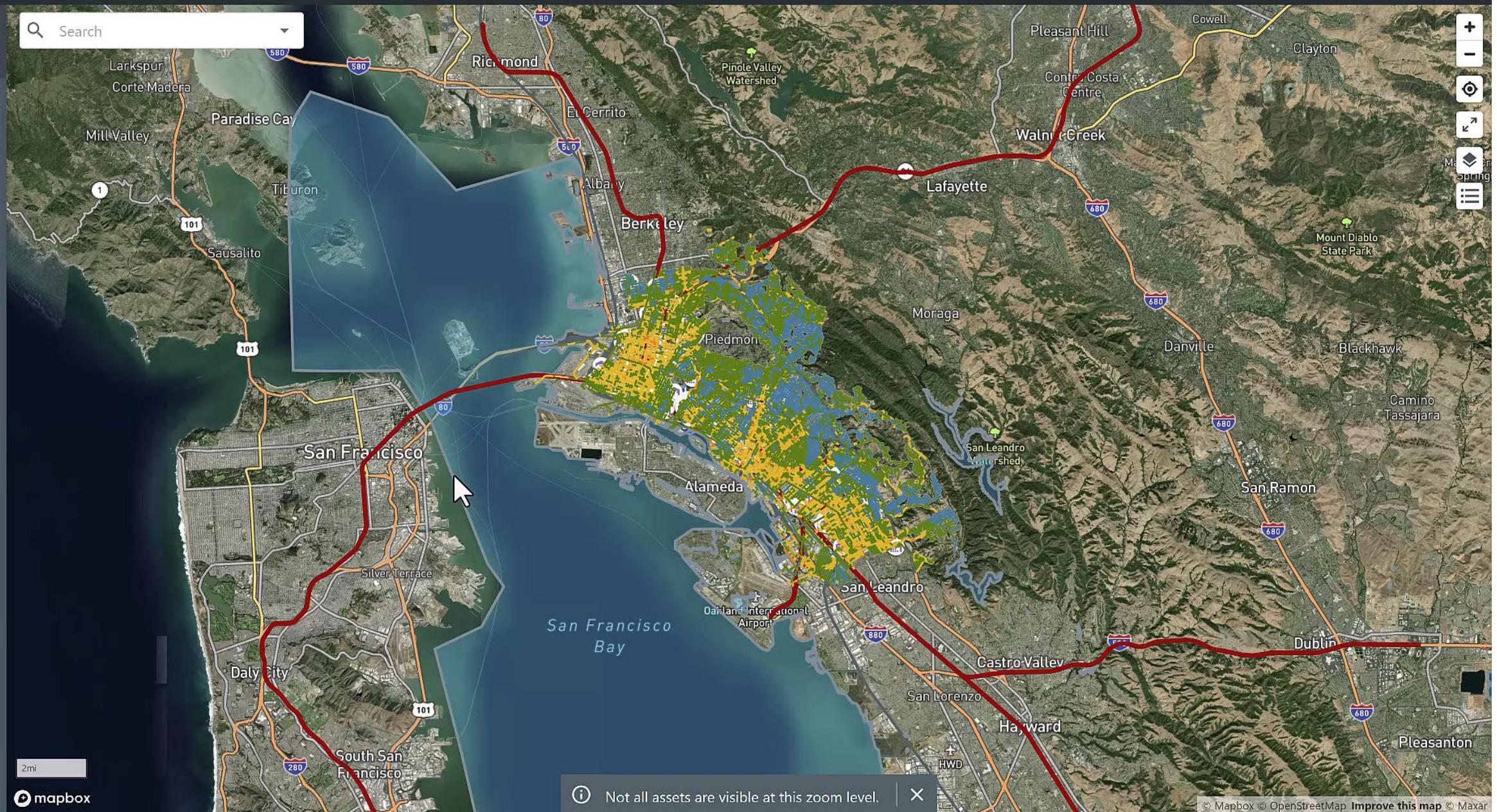
GIS and table data import



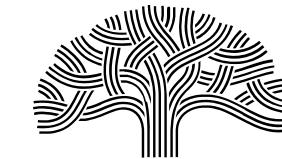
GIS and table data import

- GIS Data Import
 - Network Assets
 - Sewer Pipes and Manholes
 - Spatial layers
 - Roads, parcels, bodies of water
 - GeoJSON format WGS84 projection
- External tables
 - Root foaming type.
 - Hydraulic model results.
 - Maintenance observations.
 - Infiltration and Inflow.



Search

CCTV Inspection Import



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CCTV Inspection Management

- CCTV inspection defect coding and scoring is standardized.
- NASSCO: Pipeline Condition Assessment Program. PACP.
- Scores defects from 1 to 5
- Breaks, Collapses, Deformations, etc.



< Back

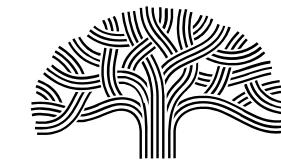
PACP Inspections

New PACP Upload

Inspection List Condition Summary Charts

<input type="text"/> Search																Action					
<input type="checkbox"/>	Inspection ID	Project	Survey Date	Uploaded By	Pipeline Ref. (...	Linked Asset	Upload D... ▾	Upstream MH	Downstream ...	Dir.	Media	Status Set By	Status								
<input type="checkbox"/>	SES12185.Downstream.201...	PACP Regular Ins	07/14/2014 -...	Martha Nunez	SEPi13478		09/15/2023 -...	SES12185	SES12164	D		Martha Nunez	READY								
<input type="checkbox"/>	SES23580.Upstream.20140...	TV4- Regular Ins	07/27/2014 -...	Martha Nunez	SEPi27280		09/15/2023 -...	SES23580	SES23576	U		Martha Nunez	READY								
<input type="checkbox"/>	SES10476.Downstream.201...	PACP Regular Ins	07/27/2014 -...	Martha Nunez	SEPi11515		09/15/2023 -...	SES10476	SES10513	D		Martha Nunez	READY								
<input type="checkbox"/>	SES10476.Downstream.201...	PACP Regular Ins	07/27/2014 -...	Martha Nunez	SEPi11515		09/15/2023 -...	SES10476	SES10513	D		Martha Nunez	READY								
<input type="checkbox"/>	SES26307.Downstream.201...	SPECIAL 2014	07/27/2014 -...	Martha Nunez	SEPi30323		09/15/2023 -...	SES26307	SES26269	D		Martha Nunez	READY								
<input type="checkbox"/>	SES22502.Downstream.201...	TV4- Regular Ins	07/27/2014 -...	Martha Nunez	SEPi26265		09/15/2023 -...	SES22502	SES22485	D		Martha Nunez	READY								
<input type="checkbox"/>	SES26269.Downstream.201...	SPECIAL 2014	07/27/2014 -...	Martha Nunez	SEPi30309		09/15/2023 -...	SES26269	SES25347	D		Martha Nunez	READY								
<input type="checkbox"/>	SES22485.Downstream.201...	TV4- Regular Ins	07/27/2014 -...	Martha Nunez	SEPi26264		09/15/2023 -...	SES22485	SES22484	D		Martha Nunez	READY								
<input type="checkbox"/>	SES19323.Downstream.201...	TV-4 PACP SUBB	07/14/2014 -...	Martha Nunez	SEPi22461		09/15/2023 -...	SES19323	SES19324	D		Martha Nunez	READY								
<input type="checkbox"/>	SES2638.Downstream.2014...	PACP REGULAR I	07/14/2014 -...	Martha Nunez	SEPi2980		09/15/2023 -...	SES2638	SES2634	D		Martha Nunez	READY								
Rows per page:													<	1	2	3	4	5	...	1698	>

Risk Analysis



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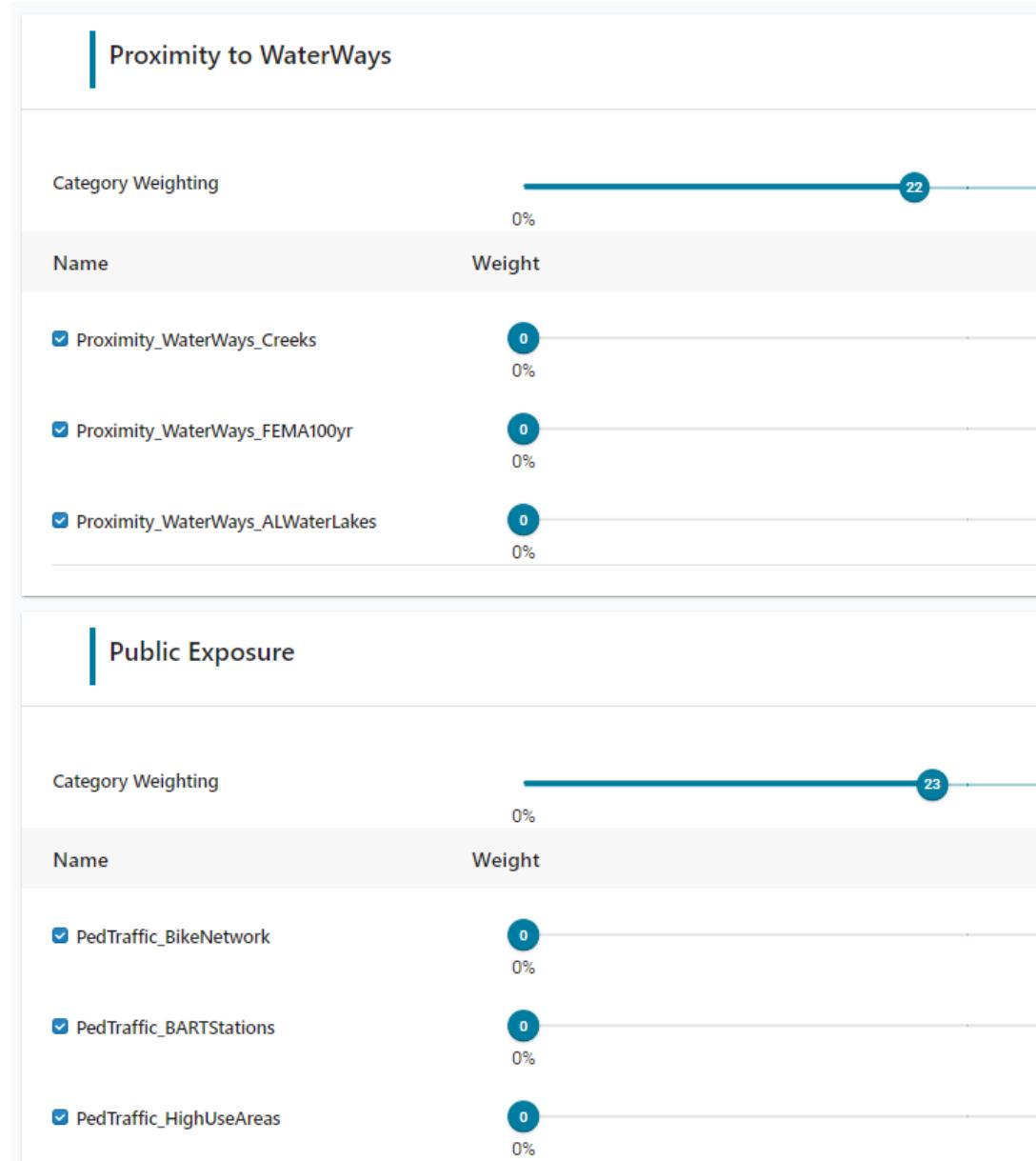
Risk Analysis

Components:

- Used to score individual CoFs and LoFs.
- Scores from 0-10.
- E.g. Proximity to creeks.

Categories:

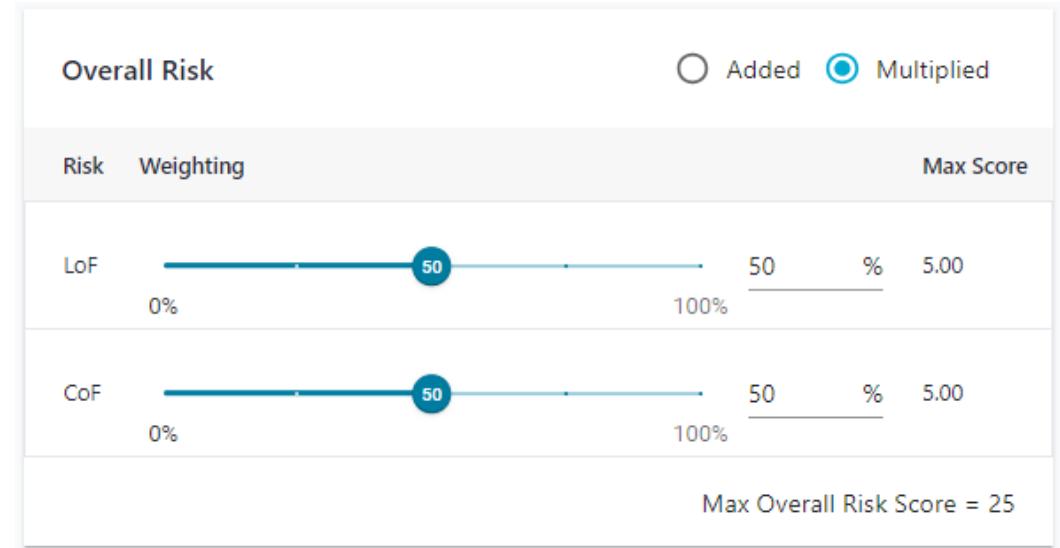
- Combines multiple CoF and LoFs.
- Has a weight % of total CoF or LoF score.
- E.g. Proximity to Waterways
 - Creeks, streams, and lakes.



Risk Analysis

Total Risk Calculation:

- Added or Multiplied.
- Can apply a CoF and LoF weight.



Risk Grade Calculation:

- Linear (based on total risk).
- 5x5 matrix.





NETWORK



TASKS



RISK



REHAB



DATA

[Back to Risk Models](#)

City of Oakland Risk Analysis



Risk Service: Ready



Results

Likelihood of Failure Setup

Consequence of Failure Setup

Risk Setup

Log

Condition Category

 If condition data is present, use it exclusively for LoF[Add Component](#)

Category Weighting

Uncheck box above to adjust category weighting

0

0%

0

%

100%

Name

Weight

Use highest score from components as overall category score **You do not have any components added**

Add components to set up weighting.

[Add Component](#)[Add Category](#)

HydraulicCapacityFailure_CapIIBasin

[Discard](#)[Add Component](#)

Category Weighting

When there is no condition data

22

0%

22

%

100%

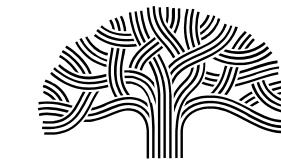
Name

Weight

Use highest score from components as overall category score

Risk Mitigation

Rehab analysis tool



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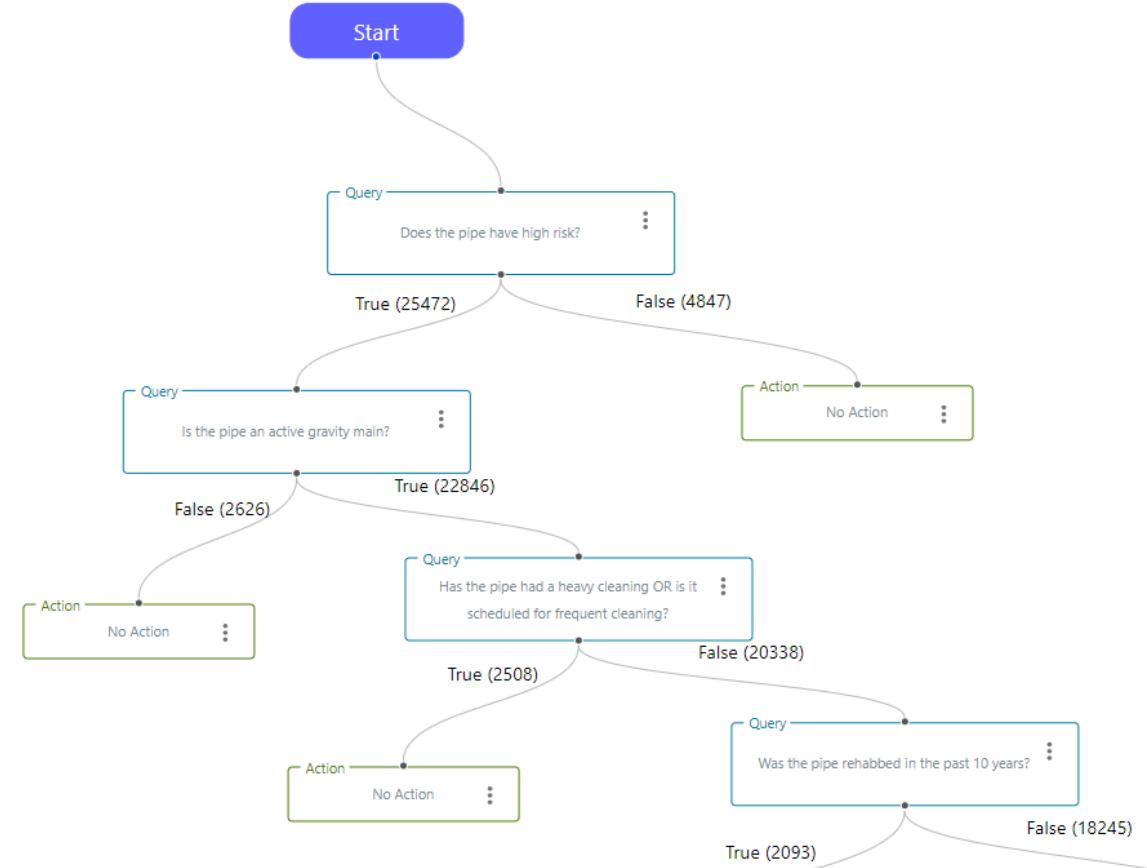
Decision Tree: Root Foaming

Queries:

Risk results
CCTV findings
Historical Pipe Cleans
Historical Rehabilitations
Historical SSOs

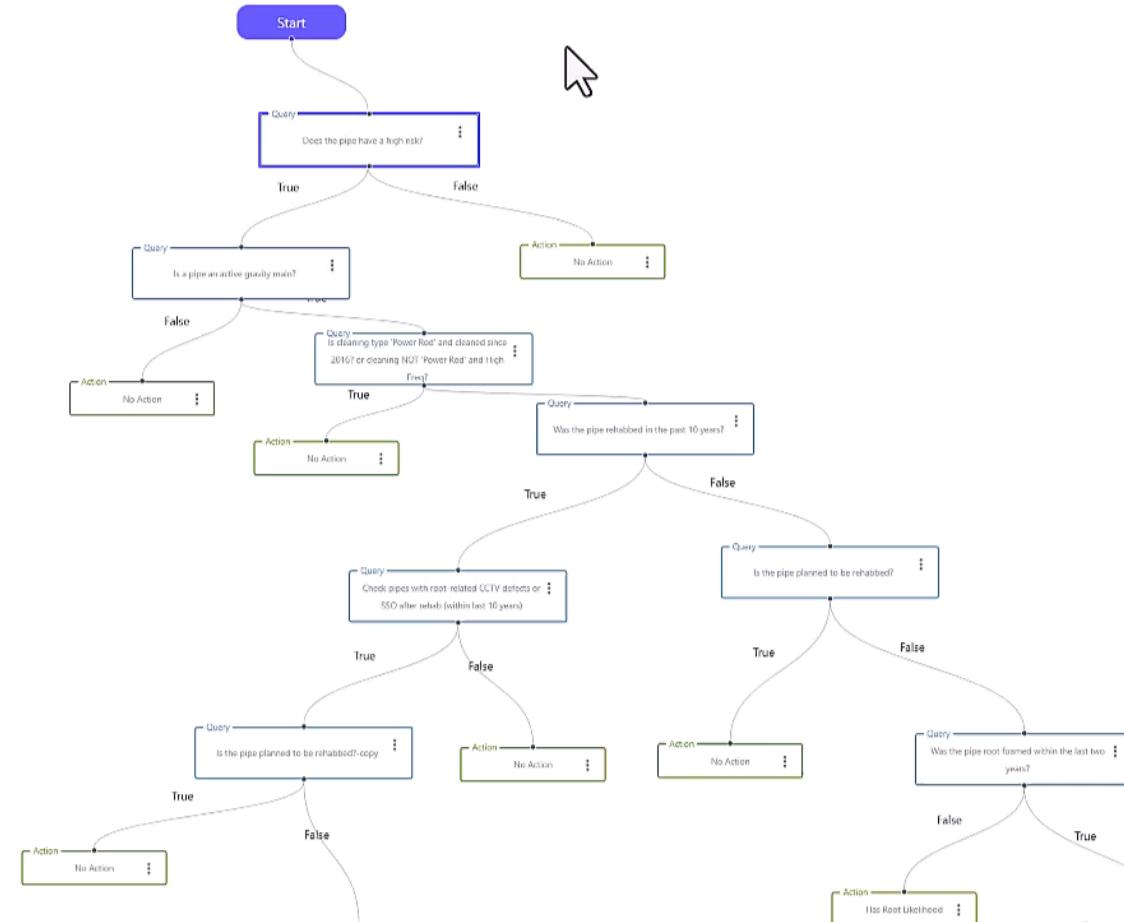
Actions:

Has likelihood of roots
Conduct root foaming

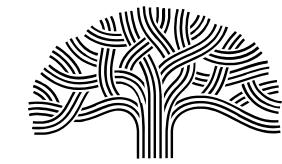


[Back to Rehab Decision Tree](#)

Root Foaming Rehab

[Configuration](#) [Results](#) [Actions](#)[+ Query](#)[+ Action](#)[Run](#)[Save](#)

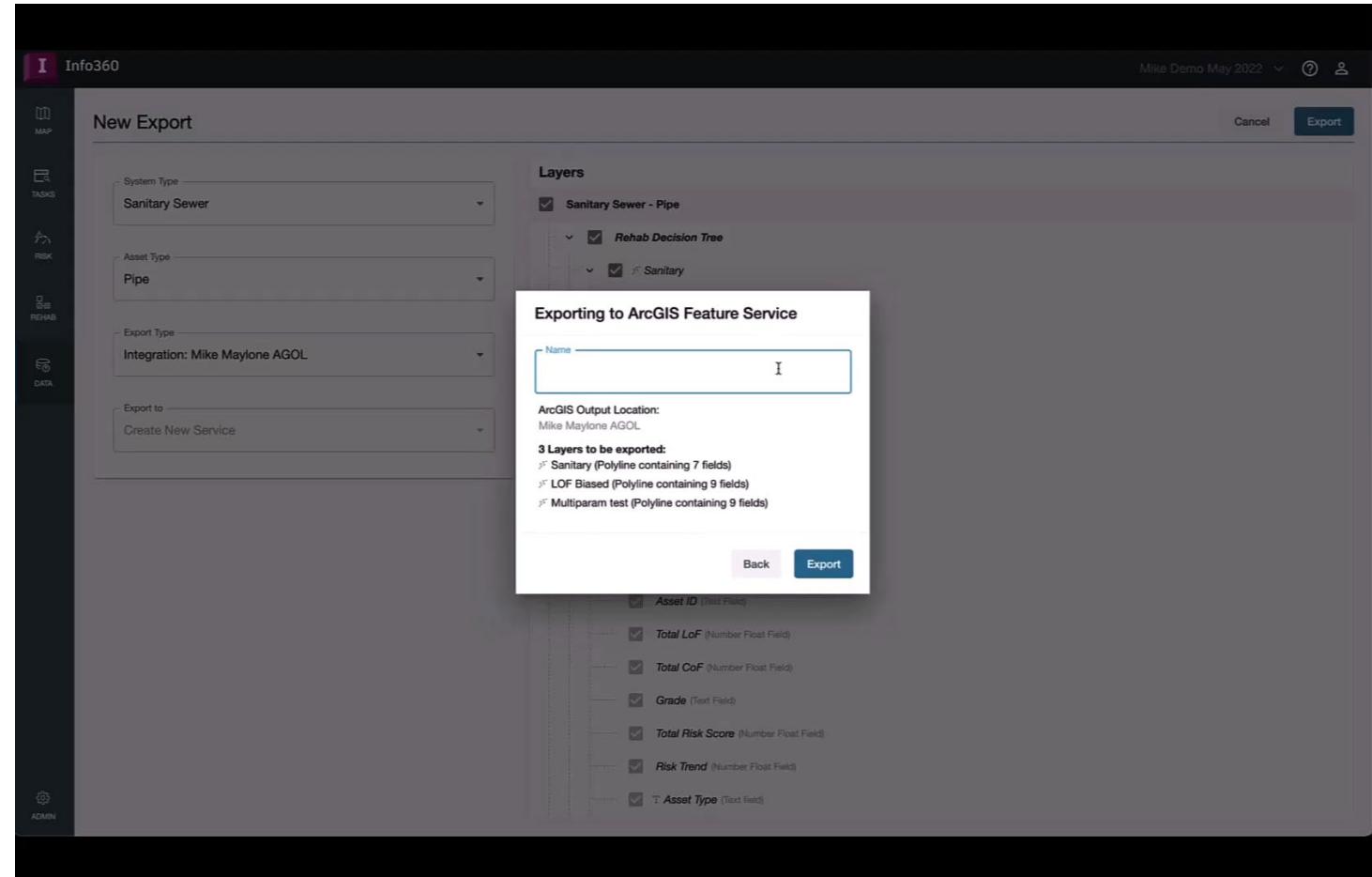
Next Steps



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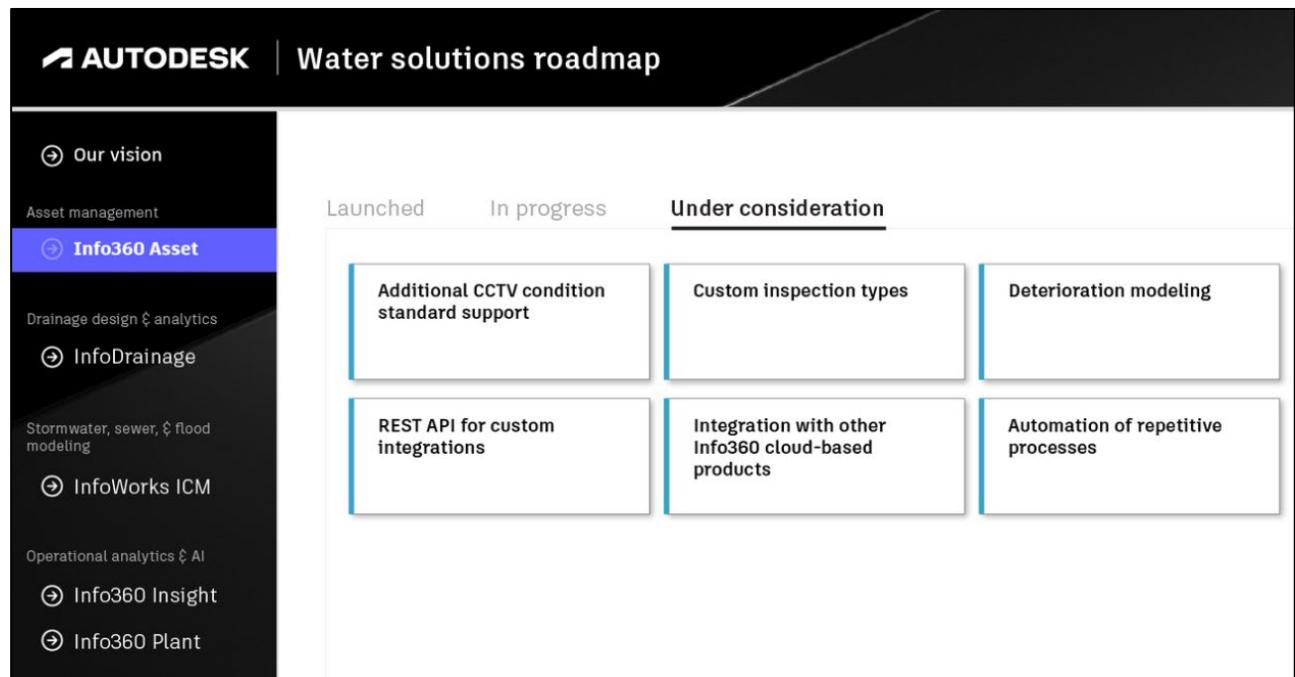
Next Steps

- ArcGIS Online integration.

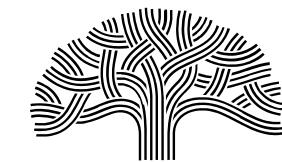


Future Roadmap

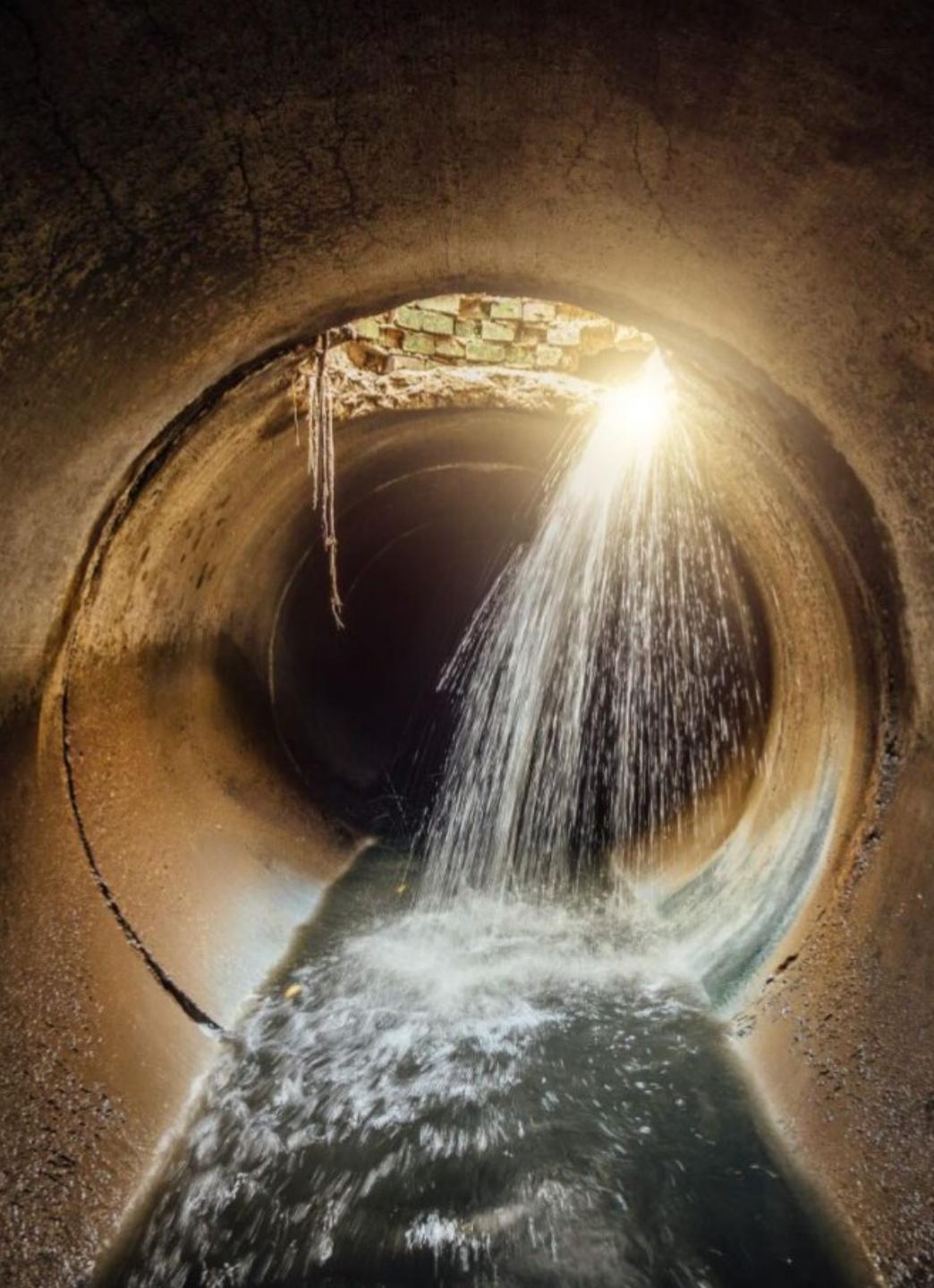
- AI based workflows
- Deterioration modeling
- API integrations with external systems
- ...and much more!
- <https://s.tiled.co/0OQtjB5/innovyze-info360-roadmap>



Conclusions



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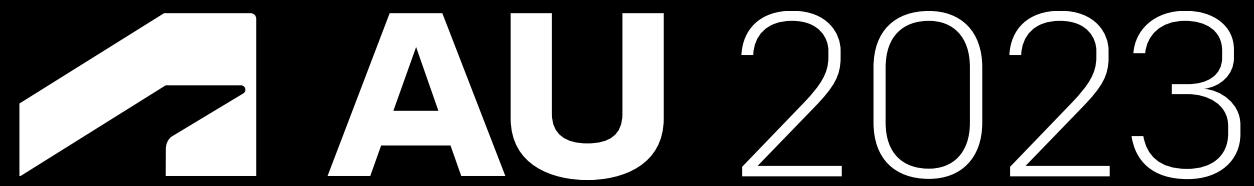
Moving Forward...

- The City is implementing master plan at sewershed level
- Automating data inputs from various sources
- Automation of system risk
- ArcGIS Online Migration



Info360 Asset will help City of Oakland

- ✓ Prioritize aging infrastructure.
- ✓ Plan for the future.
- ✓ Protect their data.
- ✓ Share information with their team.



AU 2023
THE DESIGN & MAKE CONFERENCE

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