

AWWA, Boise

# Managing Assets Before they Manage You – Lake Oswego Tigard Water Partnership Case Study

May, 2016





**“With a lot of our staff nearing retirement,  
we risked losing all the knowledge in our heads.  
We realized we needed to capture and organize  
information in a whole new way.”**

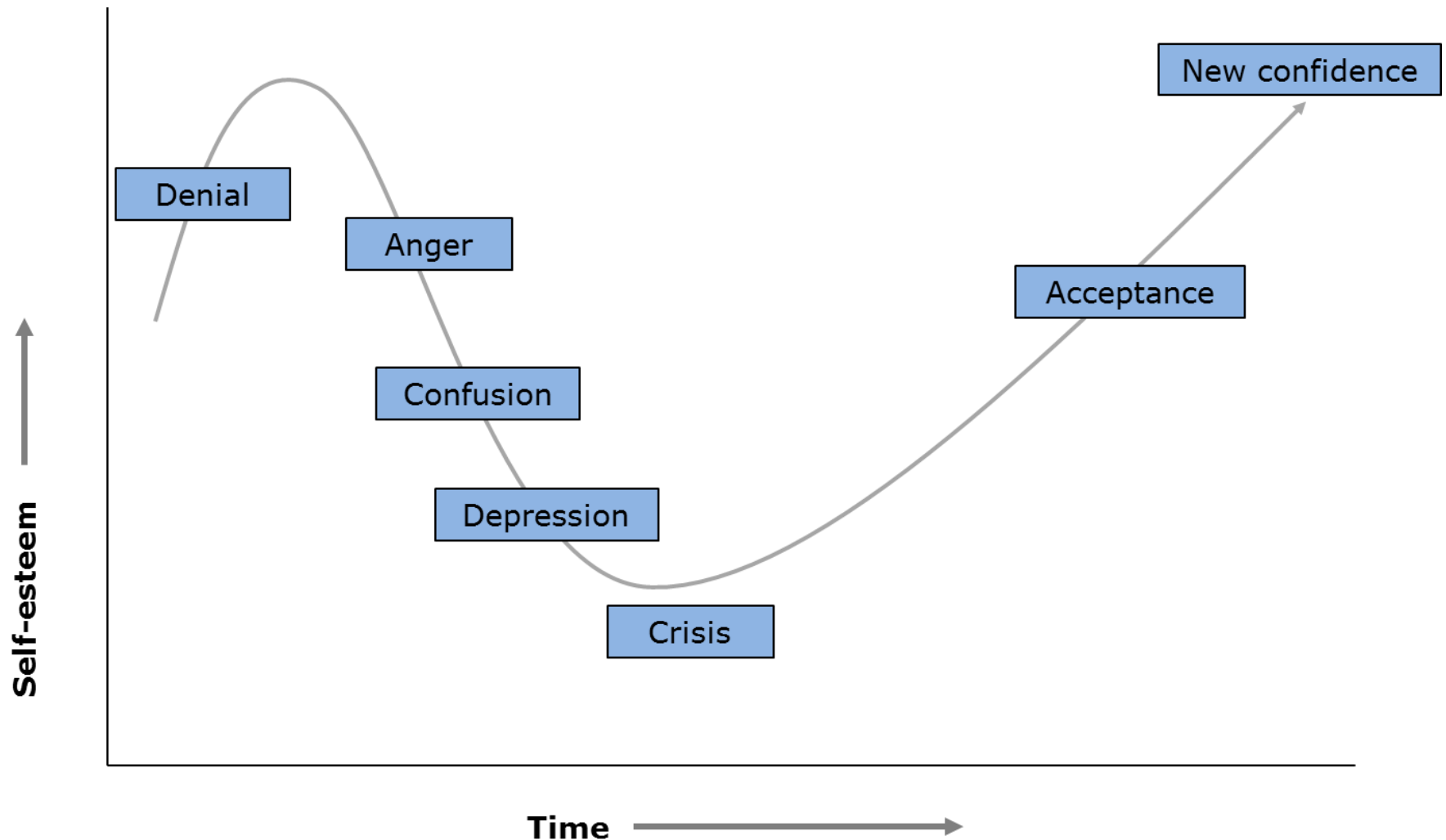
**Greg Farmer, Operations  
Littleton/Englewood WWTP, Colorado**

# Today we will discuss (high level)



1. The 7-year \$250M Lake Oswego/Tigard potable water system expansion
2. The goals and approach to handling the asset management and O&M for the program
3. The story of what is working, what isn't and share lessons learned

# Asset and O&M program implementation can certainly take you for a ride





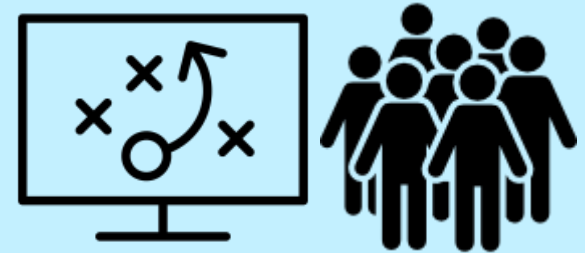
# LOTWP Asset Management and O&M – more detailed questions we will explore today



**1. What is the Project (or Program?)**



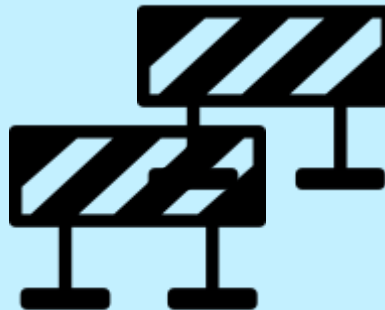
**2. What the goal or target?**



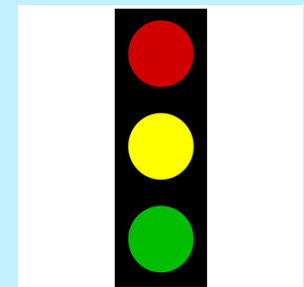
**3. Game plan and players?**



**5. Tools and process?**



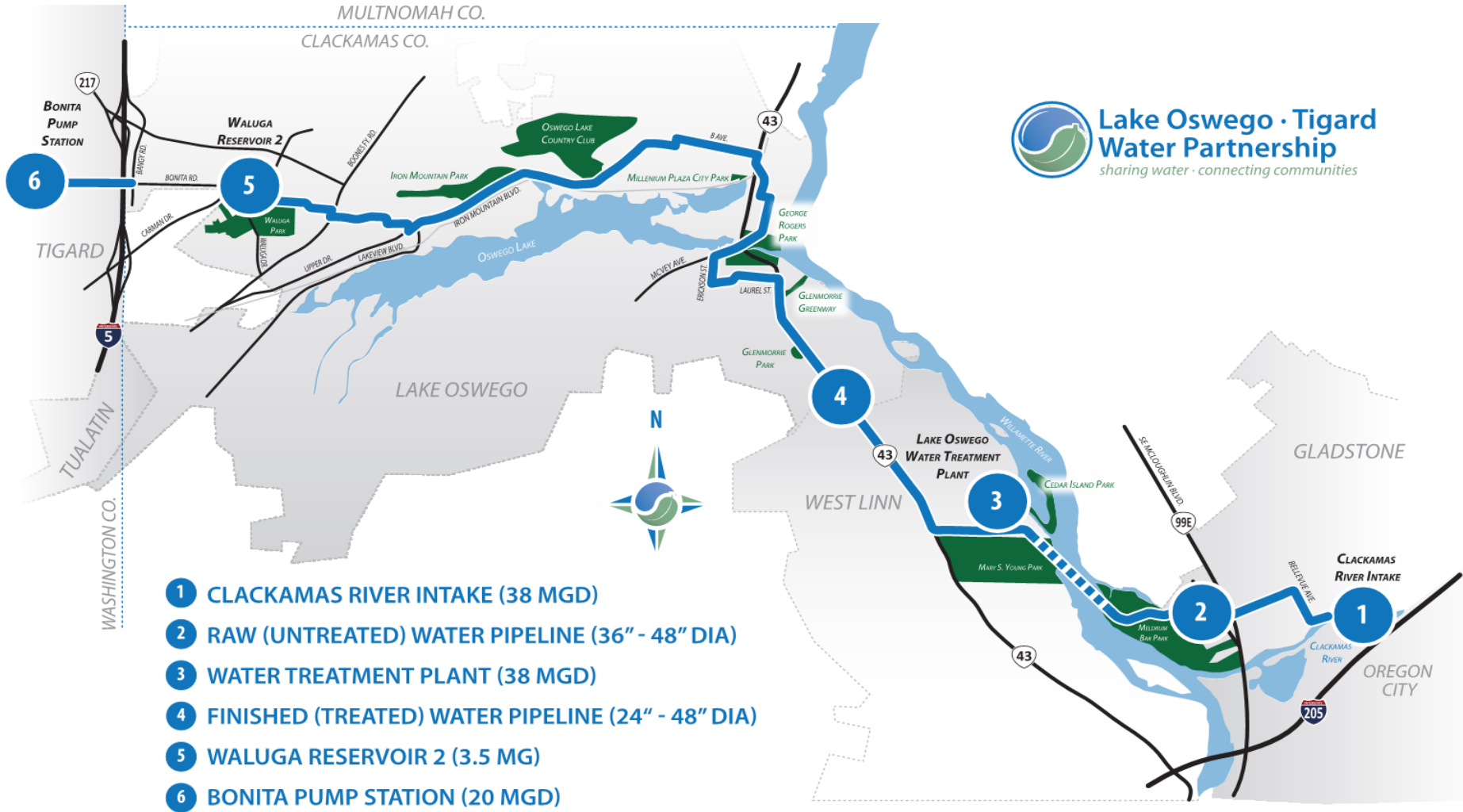
**6. Barriers to success?**



**7. Current Status and Benefits?**

# Lake Oswego-Tigard Water Program (LOTWP)

## 2 small towns spending \$250M together



# LOTWP water program by the numbers

- **7 year program**
- **\$250M total (\$180M Construction)**
- **10 miles of pipelines**
- **4,500 LF HDD river crossing**
- **38 MGD/\$70M WTP**
- **Numerous pump stations**







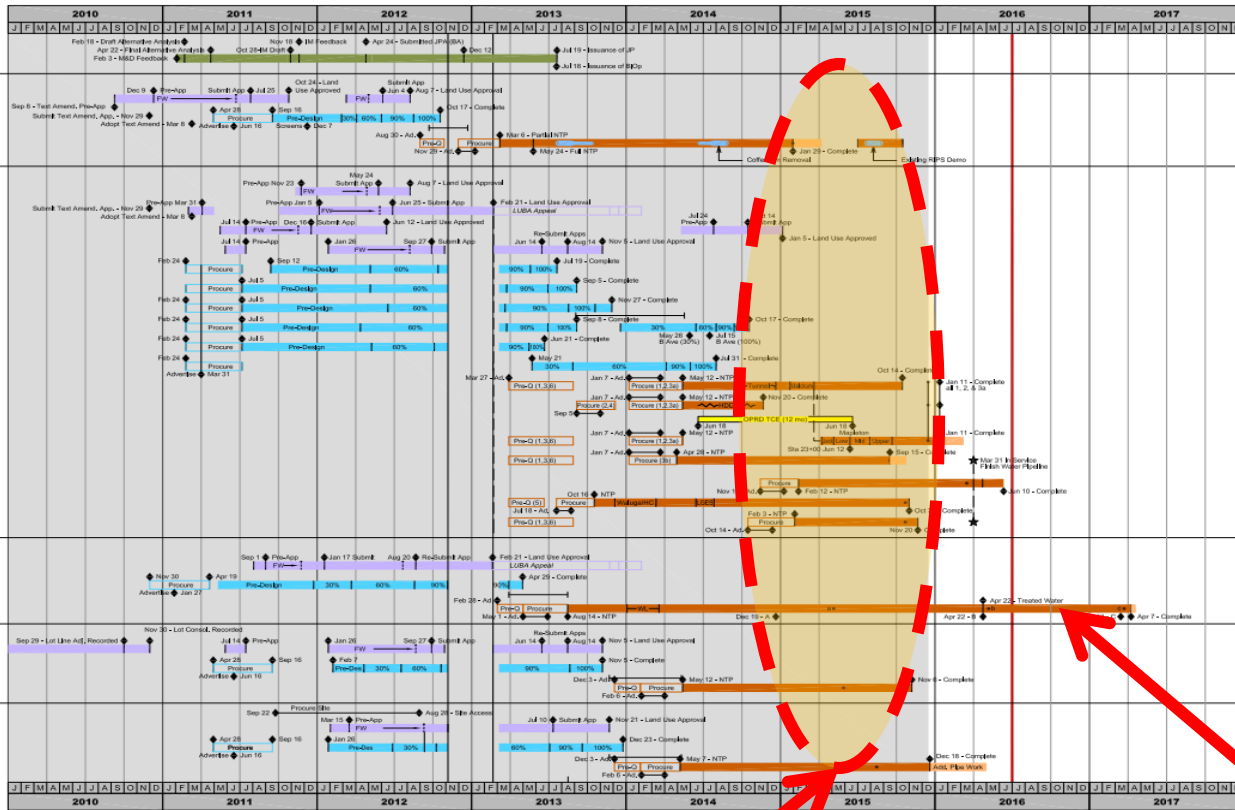
## Lake Oswego · Tigard Water Partnership

*sharing water · connecting communities*  
[lotigardwater.org](http://lotigardwater.org)





# All projects under construction at the same time



**11 major construction projects occurring simultaneously \$180+M**

**All construction complete about one year from now**

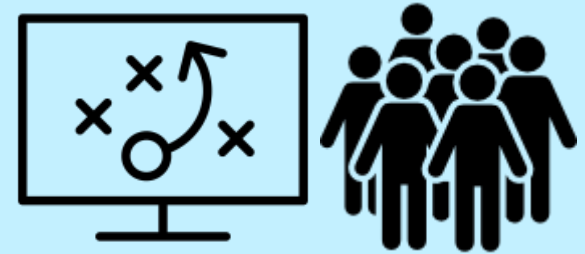
# LOTWP Asset Management and O&M – Questions we will answer today



**1. What is the Project (or Program?)**



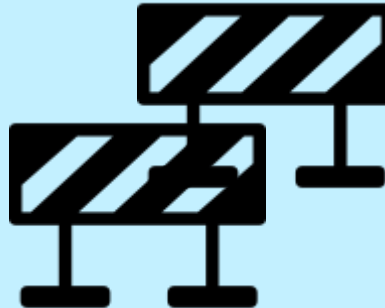
**2. What the goal or target?**



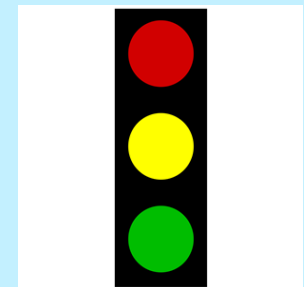
**3. Game plan and players?**



**5. Tools and process**



**6. Barriers to success?**



**7. Current Status and Benefits?**



# LOTWP – Asset Management and O&M objectives

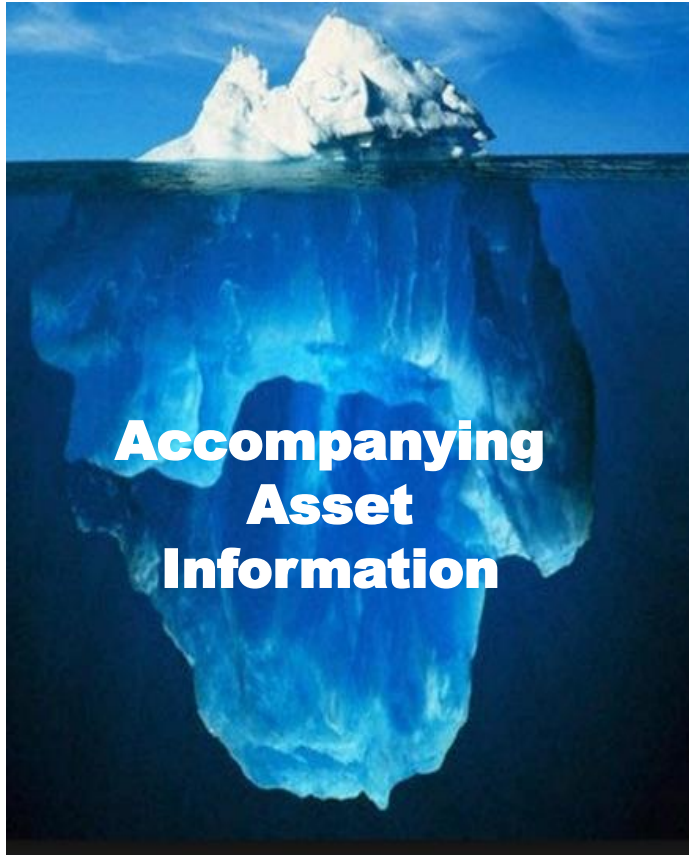
*“You can have data without information, but you cannot have information without data”*

-Daniel Keys Moran

- Implement best practices to **keep life cycle costs down**
- **Honor IGA** and provide transparency
- **Get out in front of large amounts of data** prior to a busy startup
- Leverage contractor and designer access to information
- Refine work prioritization practices

# Once complete, the LOTWP will own some new stuff!

**1,700+  
new  
assets**



- Individual asset data
- Accompanying paperwork (vendor OEM manuals)
- Warranty information
- Preventative Maintenance schedules
- Photos



# Information about the new assets could easily pile up

**Design, acquire,  
build/install 1,700+  
new assets**

Design

Closeout

Construction



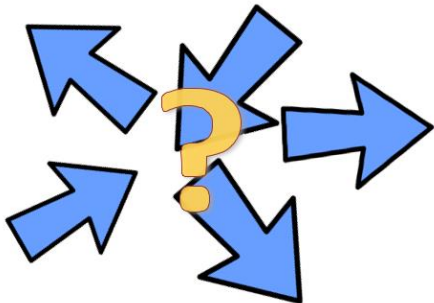
**Aftermath**

**Could take years to  
sort through**

**\*Mitigate the risk of trying to wrestle with the information later  
after startup – presuming data is well organized**

# Over 7 years, asset information comes from all directions and the volume can be unruly

- 1,700 assets
- 50,000+ data fields
- Many hundreds of
  - Warranties
  - Vendor manuals
  - Photos
  - PM Schedules



How do we wrangle this in?

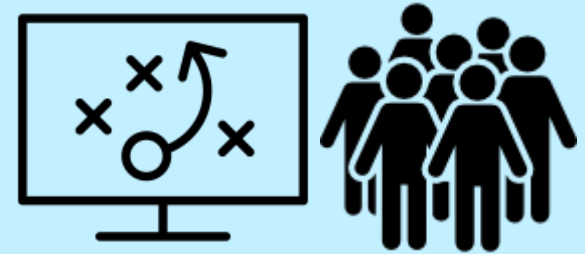
# LOTWP Asset Management and O&M – Questions we will answer today



**1. What is the Project (or Program?)**



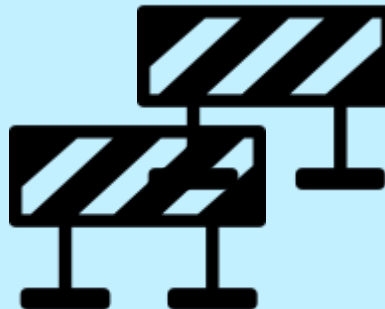
**2. What the goal or target?**



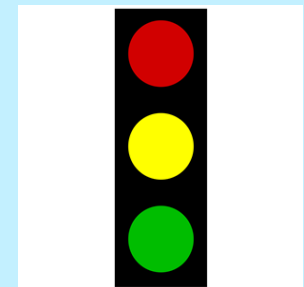
**3. Game plan and players?**



**5. Tools and Process**

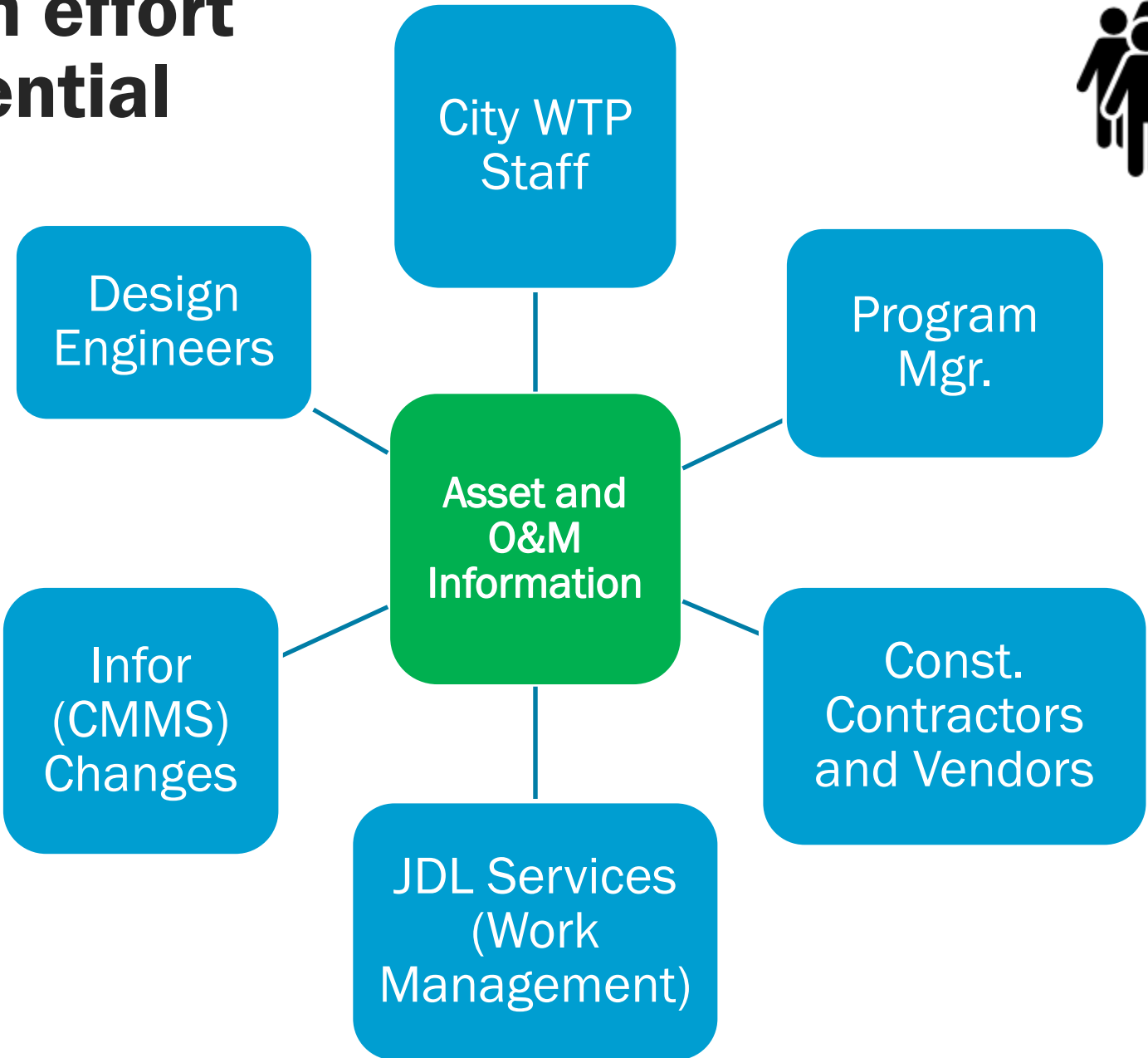


**6. Barriers to success?**



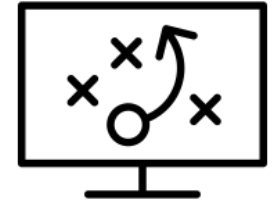
**7. Current Status and Benefits?**

# A team effort is essential





# The plan – a brief outline (1 of 2)



- Decide what we want to capture early



- Tag #
- Description
- Size
- Horsepower
- Year Installed
- Cost
- Warranty information
- And so on

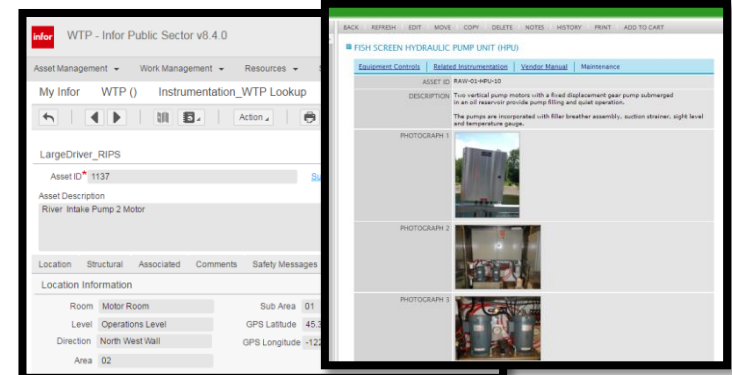
- Figure out where it will go

- Which programs?
- Are the right buckets and fields setup?



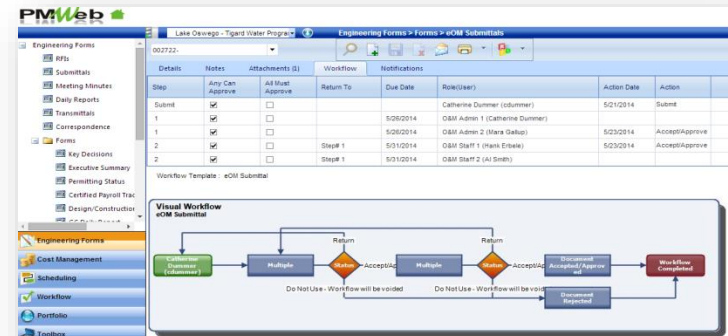
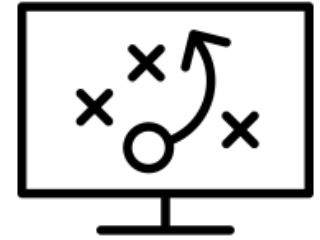
- Leverage existing program tools

- CMMS
- PMIS
- O&M Manual



# The plan – a brief outline (2 of 2)

- Leverage the team that is already on-board
  - Owner staff
  - Program Management Team
  - Construction Contractors and vendors
  - Designers
- Know what to report on early (reverse engineer approach)
- Provide structure so it's easy to play along (or you have to)
  - Construction contract documents/specifications



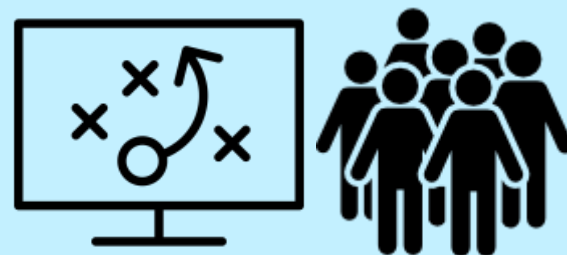
# LOTWP Asset Management and O&M – Questions we will answer today



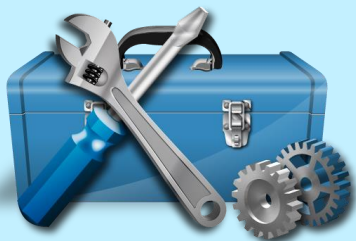
**1. What is the Project (or Program?)**



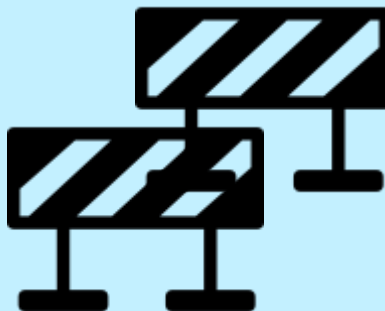
**2. What the goal or target?**



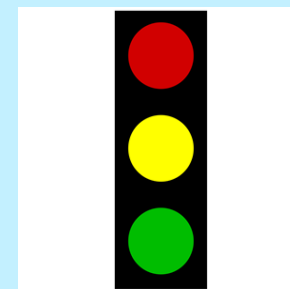
**3. Game plan and players?**



**5. Tools and Process**



**6. Barriers to success?**



**7. Current Status and Benefits?**

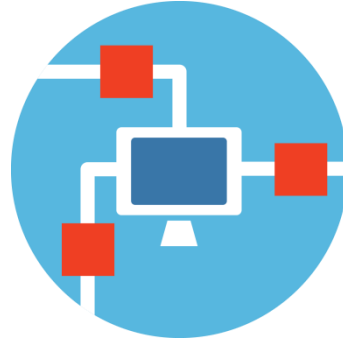


# In our toolbox



## CMMS

- What you have
- When to work on it
- Plan work
- Report on work history



## Electronic O&M Manual (EOM)

- Maintenance procedures
- Resource library
- The “How-to” guide



## PMIS

- Manage submittals
- Track approvals
- Temporary “support system”

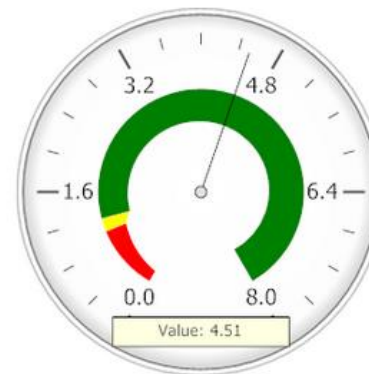


# Refresher – What is a Computerized Maintenance Management System (CMMS)

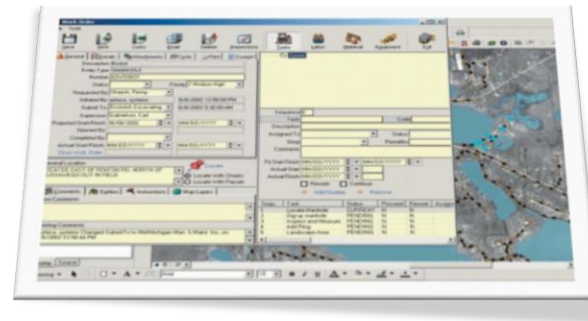
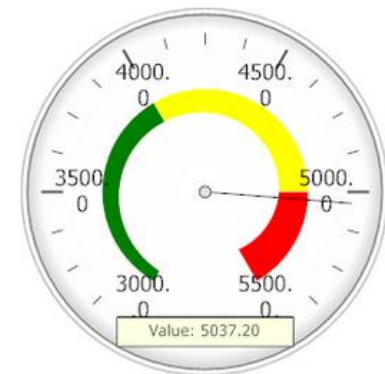
**Software Tool** – Manages the flow of **high volumes** of asset information (including \$\$)

- Data Driven Systems
- Asset inventory
- Detailed asset information
- Ongoing work history
- Reporting and planning

PM/Non-PM Ratio Last Month



Total Maintenance \$ Spend - this month



# CMMS Key Performance Indicators (KPI's) – begin with the end in mind

Measurement	Goals
Work Order Backlog	Planned 6 weeks (SMRP 5.4.8) Ready to schedule 2-3 weeks (SMRP 5.4.9)
Overtime	<5% (SMRP 5.5.8)
Preventive Maintenance Compliance	>90% (SMRP 5.4.14)
Schedule Compliance	>90% (SMRP 5.4.4) Report as to why the schedule was broken (equipment not ready, emergency breakdown, staffing etc..)
Planned Maintenance Ratio	85% (AWWA benchmark)
Reactive Work	<10% (SMRP 5.4.1)
Mean Time Between Failure (start on critical assets)	Higher the better. Don't want failures between PM's
Budgeted vs Actual	95%-100% of Budget



# To do the work, gather data, and generate reports, we need specific asset information first!

**Asset Attribute Data**  
(Model #, Year, Cost, Size etc.)



**Warranty Information**

**Preventative Maintenance Schedules**  
(Maintenance Tasks and frequency)

**Spare parts, special tools**

**Original Equipment (Vendor) O&M Manuals**



# Each individual asset has it's own unique set of detailed information



Asset ID
Asset Name
Type
Description/Function
Design type
Design Voltage
Phase
Rated AMPS
HP
Watt/KW
RPM
Service Factor
Efficiency
Power Factor
Thermal Protection
Y/N
Ambient Temperature (Max.)
Design Code
NEMA Insulation Class
Frame number
Drive End Bearing
Non Drive End Bearing
Serial number
Model number
Size
Frame number
Month, Year Manufactured
Failure Analysis
Included in Criticality Model?
Y/N
Drive End Bearing
Bearing manufacturer
Drive End Bearing
Bearing number
Opposite Drive End Bearing
Bearing manufacturer
Opposite Drive End Bearing
Bearing number
Owner
Installation Cost
Purchase Cost
Purchase date
Expected life (years)
Mean Time Between Failure - Hours
Average Monthly Use - Hours
Total Usage - Hours

HP, Voltage, RPM

Serial Number, Model Number, Year made

Purchase Cost, Date and Expected Life & Owner!

WARRANTY INFORMATION
Shipping date
WARRANTY INFORMATION
Startup date
WARRANTY INFORMATION
Effective date
WARRANTY INFORMATION
Duration (months) 100%
WARRANTY INFORMATION
Expiration date
WARRANTY INFORMATION
Duration for reduced coverage
WARRANTY INFORMATION
Duration for reduced coverage #2
WARRANTY INFORMATION
(Warranty PDF)
WARRANTY INFORMATION
Comments
LOCATION INFORMATION
Address
LOCATION INFORMATION
City, ST, Zip
LOCATION INFORMATION
Location
LOCATION INFORMATION
Area #
LOCATION INFORMATION
Sub - Area
LOCATION INFORMATION
Room
LOCATION INFORMATION
Level
LOCATION INFORMATION
Direction
LOCATION INFORMATION
GPS - Latitude
LOCATION INFORMATION
GPS - Longitude
MANUFACTURER
MANUFACTURER
Address
MANUFACTURER
City, ST, Zip
MANUFACTURER
Phone #
MANUFACTURER
Fax #
MANUFACTURER
email
MANUFACTURER
Web site
VENDOR
VENDOR
Address
VENDOR
City, ST, Zip
VENDOR
Phone #
VENDOR
Fax #
VENDOR
email
VENDOR
Web site
Pages

Warranty Information – Effective Date, Expiration Date Condition, risk....

Manufacturer & Vendor Information

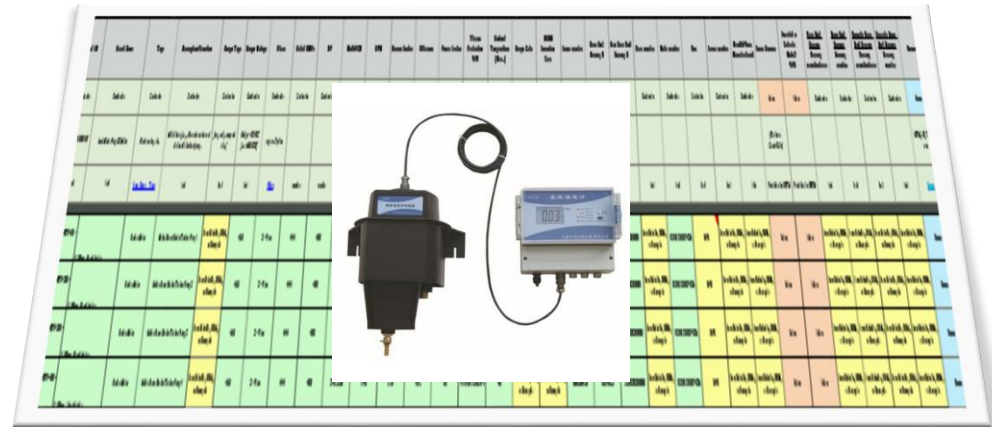






# Pre-work - existing IPS CMMS system – some additional assembly required

- Infor to assist with:
  - Configuring appropriate “buckets” for vertical assets
  - Auto-upload of contractor submitted asset data
  - Keeping data properly segregated



“Instrumentation” bucket



# JDL Services worked with owners staff to fine-tune work management practices

Work Order Priority	Time in which work order will be analyzed and work will be started to resolve issue
5	
4	
3	
2	
1	Low (30 days or less)

**Priority Codes**

Condition Assessment Ratings	
Condition Rating	Description
1	
2	
3	
4	Requires a rebuild
5	Unserviceable (Cannot rebuild or beyond economical repair)

**Condition Codes**

Code	Description	Code	Description
ARLK	Air Leak	OHET	Over Heating
OLLK	Oil Leak	NOPB	No Power
WTLK	Water Leak		No Air
BRNG	Bearing		Alarm
SEFL	Seal Failure		No Lubrication
ENOS	Excessive Noise	CALB	Calibration Problem
EVIB	Excessive Vibration	VSTO	Valve stuck closed
LFLW	Low Flow	VSCL	Valve stuck open

**Problem Codes**

WTP
W000 - INSTALL OR SETUP
W001 - REMOVE OR DEMOLISH
W002 - CONSTRUCT
W003 - SEASONAL STARTUP CHECK
W004 - SEASONAL SHUTDOWN CHECK
W005 - REMOVE/SHIP FOR SERVICE
W006 - REPAIR/REPLACE BY WTP
W007 - REPAIR/REPLACE UNIT BY OTHERS
W008 - REPAIR/REPLACE ON WARRANTY
W009 - PREVENTATIVE MAINT. DAILY

## Activity Codes

W012 - PREVENTATIVE MAINT. 4 WEEK
W012A - PREVENTATIVE MAINT. 3 MONTH
W012B - PREVENTATIVE MAINT. 4 MONTH
W013 - PREVENTATIVE MAINT. 6 MONTH
W014 - PREVENTATIVE MAINT. 12 MONTH
W015 - PREVENTATIVE MAINT. 2 YEAR
W016 - PREVENTATIVE MAINT. OTHER
W017 - EQUIPMENT REBUILD. NON-PM
W018 - REPROGRAM INSTRUMENT
W019 - VISUAL CHECK
W020 - TROUBLESHOOT PROBLEMS
W021 - SAFETY INSPECTION
W022 - CALIBRATION. NON-PM
W023 - STANDARDIZATION CHECK
W024 - TELEMETRY CHECK/REPAIR

# Tweaked CMMS to support future reporting and planning

## Valve-Slide Gates\_RIPS

Asset ID\* 1165

### Asset Description

Tee Screen 3 Isolation Slide Gate

Location Structural Associated Comments Safety Messages Attachments

### Valve-Slide Gate General

Owner LOTWP

Installation Cost 0.0000

LOTWP

Purchased Cost 17697.0000

Purchase Date //

Expected Life 0.0000

Average Monthly Usage 0.0000

Total Usage 0.0000

LO Finance ID

Criticality

Condition



Criticality and  
Condition (1  
through 5)

## LargeDriver\_RIPS

Asset ID\* 1137

[Subunit Of](#)

### Asset Description

River Intake Pump 2 Motor

Location Structural Associated Comments Safety Messages Attachments Subunits

### Large Driver Details

Large Driver Types

Description/Function This motor drives River Intake Pump 2

Serial # DHFT094U022

Model # 5KS513SAE7426

Phase THREE

Frame # L5013VP20

Owner LOTWP

Month/Year Manufactured 41699

Purchase Cost 66250.0000

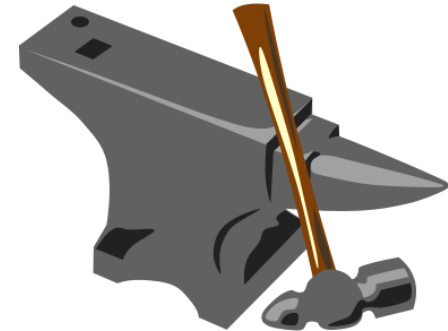
Purchase Date 8/7/2014



Purchase Cost  
and Date

# Each asset, once captured, will need regular maintenance work in the coming years

- Contractor provided maintenance schedules with Vendor input



EQUIP DESCRIP	Air Handling Unit	
ASSET ID	ENR-21-ERV-01	SHOP DWG NO.
MFGR	Alliance Air	
MFGR ADDRESS	2285 Michael Faraday Dr. Suite 15 San Diego CA 92154	
VENDOR	Fluid Systems Inc	VENDOR CONTACT
VENDOR ADDRESS	2021 Lloyd Center, Portland OR 97232	

EQUIP LOC	Ozone Building 21						
DATE INST	16-Mar-17	COST	\$149,053.00				
MFGR CONTACT	N/A						
		PHONE	619-428-9688				
		PHONE	503-233-8877				
	D	W	M	Q	S	A	Hours
				X			0.25
					X		0.25
						X	0.25
						X	0.25

2. MAINTENANCE REQUIREMENTS	
Check motor is clean and free of dirt, oil, grease, water, ect.	
Check that the integrity of the winding insulation has been maintained	
Check bearings periodically and if required clean and re-lubricate	
Check drive belts periodically for proper tension	
Regular inspection and cleaning of the fan housing and impeller	

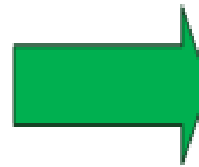
# CMMS – Helps organize the mountain of preventative maintenance data and to-do's



**CARMINE'S IMPORT SERVICE**  
FOREIGN AUTOMOTIVE SPECIALISTS

**BOSCH Service**  
Car Service

**RECOMMENDED SERVICE SCHEDULE**



- 1,700+ cars
- Different maintenance schedules
- Different start dates
- Reporting requirements

Service & Mileage	5k	10k	15k	20k	25k	30k	35k	40k	45k	50k	55k	60k	65k	70k	75k	80k	85k	90k	95k	100k	105k	110k	115k	120k
Synthetic Oil Service & Filter Replacement - Tire Rotation (Upon Request) - Multi-Point Inspection	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Engine Air Filter(s) Replacement					✓					✓								✓						✓
Cabin Air Filter(s) Replacement (HVAC)		✓			✓			✓			✓							✓				✓		
Fuel Filter Replacement (Most Vehicles)					✓					✓								✓						✓
Diesel Fuel Filter Replacement (Most Vehicles)		✓			✓			✓			✓			✓				✓				✓		
Fuel/Air Induction Cleaning		✓			✓			✓			✓			✓				✓				✓		
Rotate & Balance Tires & Check Air Pressure - Balance Optional Upon Request	✓		✓		✓		✓		✓		✓		✓		✓		✓		✓		✓		✓	
Check/Adjust DEF Fluid Level (Some Diesel Only)		✓			✓			✓			✓			✓				✓				✓		

- One car
- One maintenance schedule
- One start date



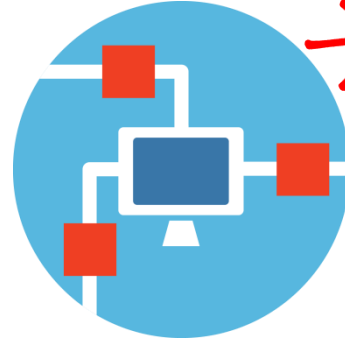


# In our toolbox



## CMMS

- What you have
- When to work on it
- Plan work
- Report on work history



## Electronic O&M Manual (EOM)

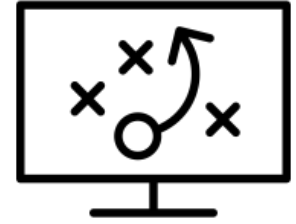
- Maintenance procedures
- Resource library
- The “How-to” guide



## PMIS

- Manage submittals
- Track approvals
- Temporary “support system)

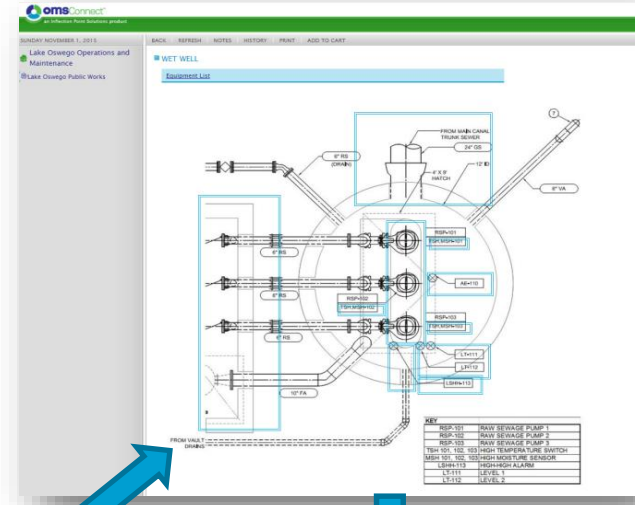
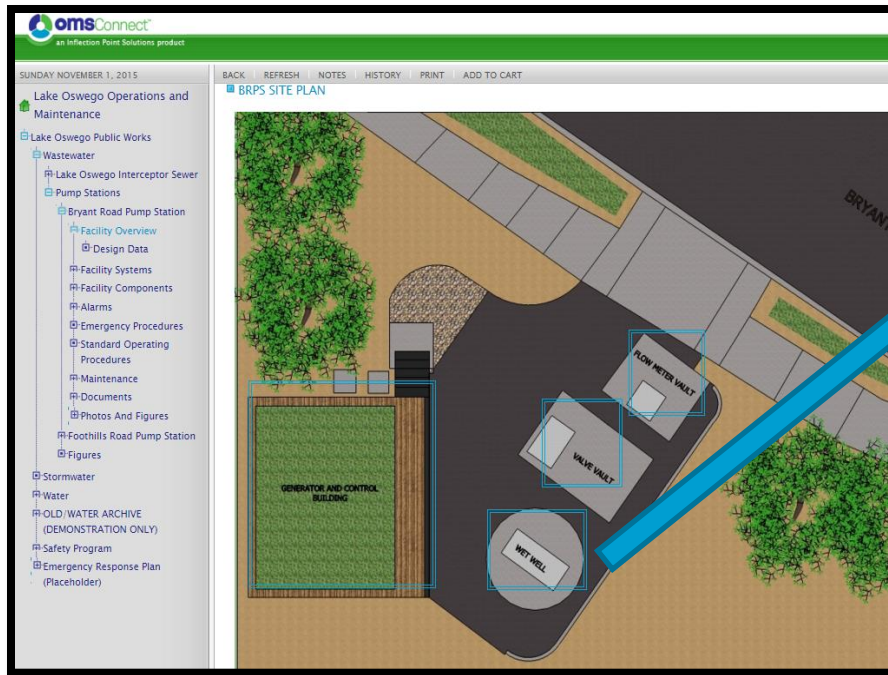
# O&M Manuals needed tell how to do something (specific procedure)



*O&M manuals do not tell you when or where (or keep history) the CMMS does that*

# Electronic O&M manual

- Similar to a paper manual
- Easier to access information and update
- A bit more dynamic



Control | Instruments | Troubleshooting | Vendor Manual | Maintenance

ID NUMBER: RSP 101, 102, 103

DESCRIPTION: The BRPS contains three ITT Flygt 6-inch NP3171.091 submersible pumps (RSP- 101, 102 and 103) specifically designed for sewage pumping applications. Each pump is equipped with a 30 HP explosion proof submersible motor that utilizes 480 volt, 3- phase, 60 Hz. service and has a 50 foot cord that incorporates a decontactor type of disconnecting system. The decontactors are located on the East side of the building. The cords are installed below grade in a cable trench and run from the Electrical/ Generator Building to the wet well.

PHOTOGRAPH:

LOCATION: Wet Well

MANUFACTURER: ITT Water & Wastewater  
Flygt Products  
2630 North Marine Drive  
Portland OR 97217  
Phone: (503) 240-1980  
Fax: (503) 240-3445  
Email: [flygt\\_or@itt.com](mailto:flygt_or@itt.com)  
[ITT Flygt](http://www.itt.com)

FUNCTION: The pumps are capable of passing solids up to 3-inches in diameter and the impeller design is resistant to ragging. Their function is to pump raw sewage that is collected in the wet well and transfer it to the Valve Vault. Power and control of the pumps are supplied by the Pump Control Panels.

PHYSICAL DESCRIPTION:

Flygt Pump Overview	
Pump type	Centrifugal Submersible Type P (mounted on stationary discharge connection)
Quantity	3
Model	3171.091
Impeller Code	696 52 47
Impeller Diameter	255 millimeters
Discharge size	6-inches
Suction	Submerged



# Asset Management

## Asset Management Information Database (AMID)

Asset ID	Asset Name	Location	Status
1000001	Water Pump	Plant A	Operational
1000002	Water Pump	Plant B	Operational
1000003	Water Pump	Plant C	Operational
1000004	Water Pump	Plant D	Operational
1000005	Water Pump	Plant E	Operational
1000006	Water Pump	Plant F	Operational
1000007	Water Pump	Plant G	Operational
1000008	Water Pump	Plant H	Operational
1000009	Water Pump	Plant I	Operational
1000010	Water Pump	Plant J	Operational

## Equipment Record Form (ERF)

GENERAL INFORMATION

1. EQUIPMENT IDENTIFICATION

2. MAINTENANCE REQUIREMENTS

3. RECOMMENDED SERVICE PLANS

4. SPECIAL TOOLS

5. ELECTRICAL PARAMETERS DATA



Construction contractor completes per specifications

Asset Attributes (similar to height, weight, eye color etc.) – **DATA DUMP**

Preventative Maintenance Schedule (when to grease, turn, calibrate, clean etc.)



Program team and Owner provide reviews

CMMS System (asset and work order inventory and history)



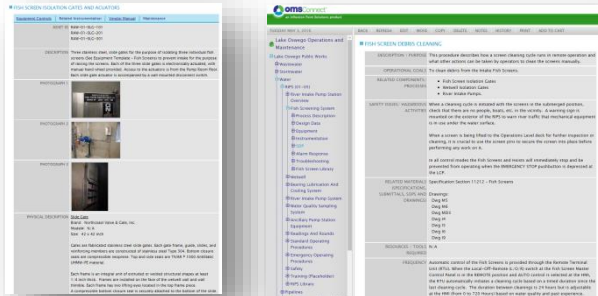
Schedule and generate Work Orders



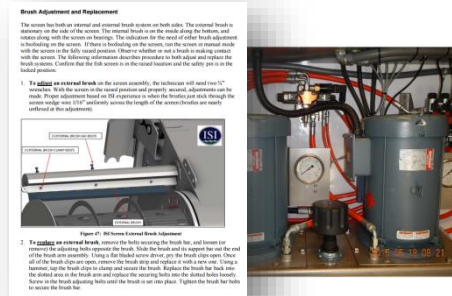
Owner creates PM Schedules in CMMS

# Electronic O&M Manual

## O&M Information Templates



## Vendor Manuals and Photos



Design Engineer and Construction Contractor completes

How to perform work  
Operational process  
descriptions

Linked in manual



Program team and Owner provide reviews



Electronic O&M manual – the “How-to” guide

Program management team builds manuals



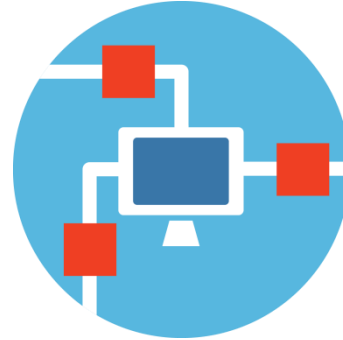


# In our toolbox



## CMMS

- What you have
- When to work on it
- Plan work
- Report on work history



## Electronic O&M Manual (EOM)

- Maintenance procedures
- Resource library
- The “How-to” guide

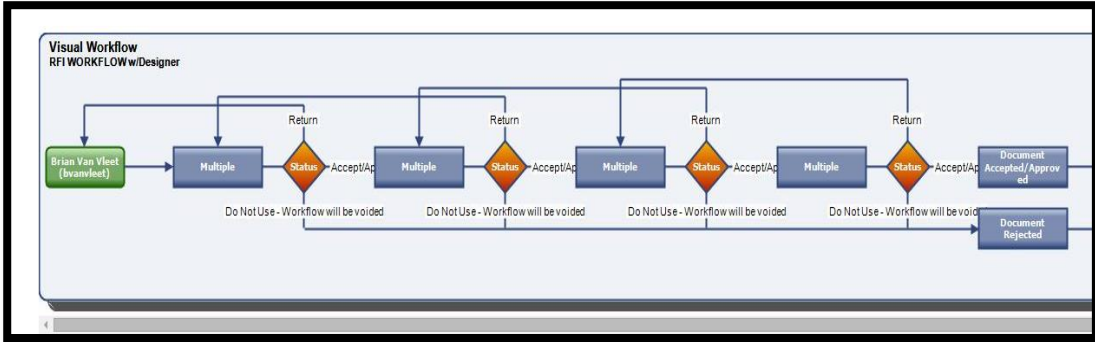
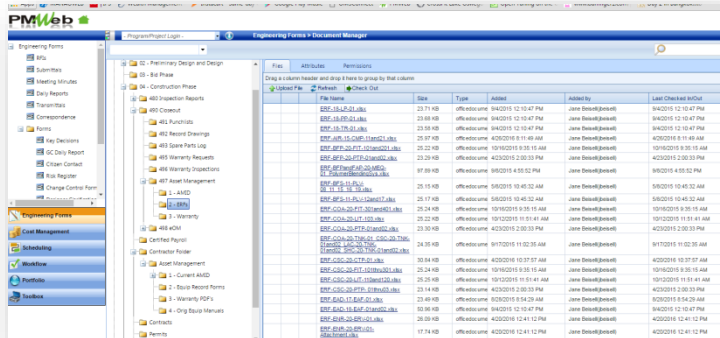
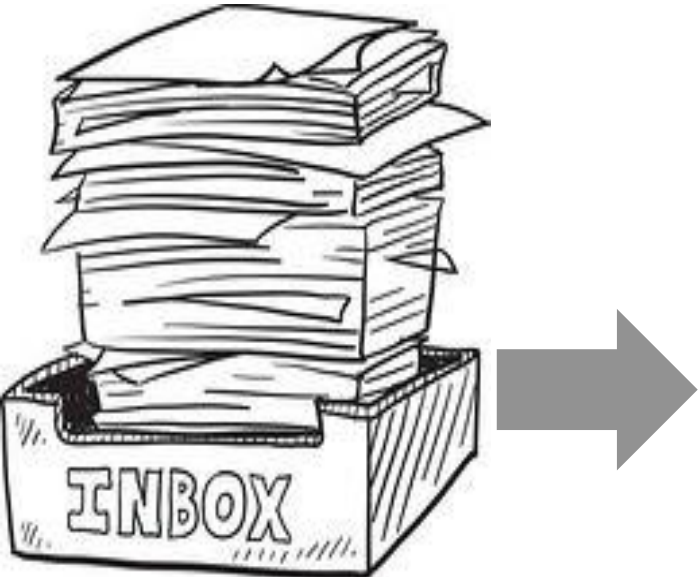


## PMIS

- Manage submittals
- Track approvals
- Temporary “support system)



# Hundreds of AM and O&M submittals and multiple reviewers...used a PMIS to help stay organized



Used to track and house all submittals of Asset and O&M information

# PMIS Submittal example

Engineering Forms > Submittals

204 - River Intake Pump Station (RIPS)

Project\* 204 - River Intake Pump Station (RIPS)

Sub # 171

CSI Code 01660

Description\* Operations Test - Commissioning Report Revis

Status Submitted

Revision 2 Date 12/8/2015

Details Notes Attachments (1) Workflow Notifications

Step	Any Can Approve	All Must Approve	Return To	Due Date	Role(User)	Action Date	Action
Submit					Kim Shelby (kshelby)	12/8/2015	Submit
1				12/29/2015	Construction Manager 1 (Jerome Duletzke)	12/10/2015	Accept/Approve
1				12/29/2015	Construction Manager 2 (Corianne Hart)		
2				12/31/2015	General Contractor 1 (Mark Hoover)		
2				12/31/2015	General Contr		

Workflow Template : Submittal - RIPS

**Visual Workflow Submittal - RIPS**

```
graph LR; Start([Kim Shelby (kshelby)]) --> M1[Multiple]; M1 --> S1{Status}; S1 -- Accept/Approve --> M2[Multiple]; S1 -- Do Not Use - Workflow will be voided --> Void1[Do Not Use - Workflow will be voided]; M2 --> S2{Status}; S2 -- Accept/Approve --> DocAcc[Document Accepted/Approved]; S2 -- Do Not Use - Workflow will be voided --> Void2[Do Not Use - Workflow will be voided]; DocAcc --> End([Workflow Completed]); DocRej[Document Rejected] --> End;
```

**Contractor inputs data and submits into PMIS**

**CM Pinged by Workflow Inbox "To-do"**

**Audit trail maintained**

**You are here**

**Visual workflow map (live updates)**

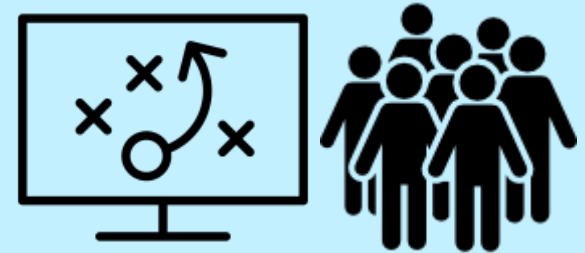
# LOTWP Asset Management and O&M – Questions we will answer today



**1. What is the Project (or Program?)**



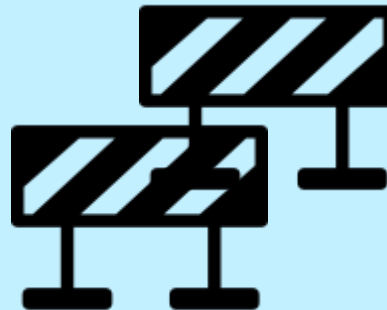
**2. What the goal or target?**



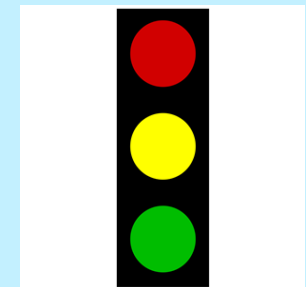
**3. Game plan and players?**



**5. Tools and Process**



**6. Barriers to success ?(and lessons learned)**



**7. Current Status and Benefits?**

# Easy to bite off more than one can chew

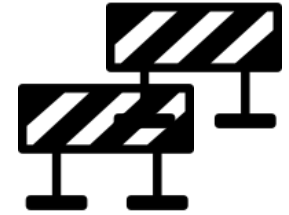


Can lead to:

1. Abandoned reports and procedures
2. Loss of team confidence
3. Why are we doing this (can't we just use spreadsheets?)



# Barriers and challenges (and what was learned) – where do I start? (1 of 2)




- Asked contractor for too many data fields
- We aren't going to get every last field – better prioritize
- Construction contractors – asset data not a priority for them (specs need more teeth)
- Naming convention (many forms/manuals cover numerous assets)

**INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTION MA**

THIS MANUAL APPLIES TO THE FOLLOWING VALVES:  
FNW-35-CKV-11;  
FNW-41-CKV-11, 21, 31  
FNW-42-CKV-41, 51

**Equipment Description**  
Duo-Chek II & Marlin Valves

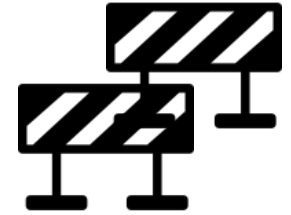


**Installation and Operation**

1. Remove the valve from carton or packing skid.
2. The protective rust proof coating on the internal parts of steel or cast iron valves should be removed by brushing out with any standard petroleum solvent (Varsol, Kerosene), and air dry. Insure internal parts operate freely.
3. Stainless Steel or Bronze valves need only to be wiped clean and installed.

*One O&M factory manual applies to many assets – which ones?*

# Barriers and challenges (and what was learned) – where do I start? (2 of 2)



- PMIS use was convenient for Program Team, but not for Owner's operations staff
- Interim access to information (multi-year effort, may need some stuff sooner)
- CMMS work-management efforts take a while (lots of codes/drop-downs to agree upon)
- Designers providing O&M information – sooner is better, have O&M professionals on-staff



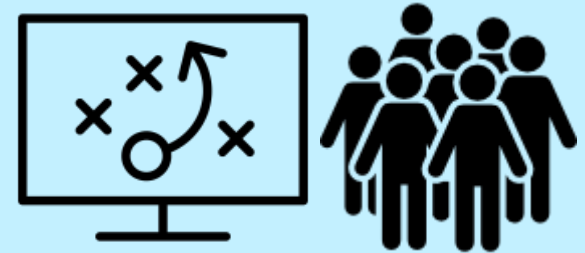
# LOTWP Asset Management and O&M – Questions we will answer today



**1. What is the Project (or Program?)**



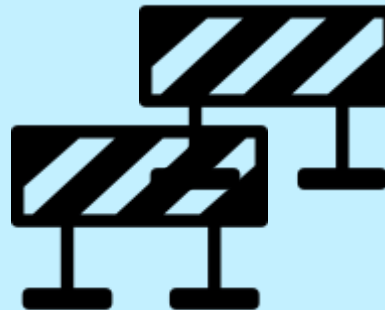
**2. What the goal or target?**



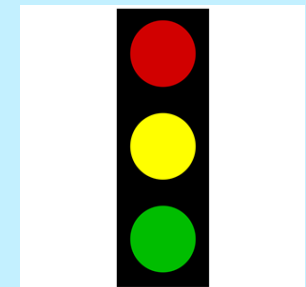
**3. Game plan and players?**



**5. Tools and Process**



**6. Barriers to success ?(and lessons learned)**



**7. Current Status and Benefits?**

# Where are we now?

- Most facilities (sans WTP) are currently operational – trying to keep up with construction
- Asset management/O&M efforts are ongoing – certain facilities are complete with
  - WO's being generated
  - Reports being run
- Owner has played a key role (and has been patient!)
- Effort completion should coincide with program closeout (vs. years later.....or never)



# Work orders and reports are starting to flow from the CMMS

**Work Order Backlog Report**

Work Order	Activity	Asset ID	Tag #	Assigned To	Scheduled Start	Started	Due Date	Closed Date	Maintenance Type	Priority
2150	PM - Ops	1364	TKS 17 SLT 01		4/30/2016		5/10/2016		Preventive	Medium
2031	PM - Mech	1169	RAW 02 BFV 101		4/12/2016		5/12/2016		Preventive	Medium
2032	PM - Mech	1170	RAW 02 BFV 201		4/12/2016		5/12/2016		Preventive	Medium
2033	PM - Mech	1171	RAW 02 BFV 301		4/12/2016		5/12/2016		Preventive	Medium
2034	PM - Mech	1172	RAW 02 BFV 401		4/12/2016		5/12/2016		Preventive	Medium
		1663	BFS 11 PLV 11		5/6/2016		5/13/2016		Preventive	Medium
		1665	HCS 11 PLV 14		5/6/2016		5/13/2016		Preventive	Medium
		1668	BFS 11 PLV 15		5/6/2016		5/13/2016		Preventive	Medium
		1670	BFS 11 PLV 08		5/6/2016		5/13/2016		Preventive	Medium
		1671	BFS 11 PLV 16		5/6/2016		5/13/2016		Preventive	Medium
		1672	BFS 11 PLV 19		5/6/2016		5/13/2016		Preventive	Medium
		1240	RAW 05 DFC 201		4/28/2016		5/18/2016		Preventive	Medium
		1245	RAW 05 AHU 301		4/28/2016		5/18/2016		Preventive	Medium
		1225	RAW 05 PF 102		5/4/2016		5/18/2016		Preventive	Medium
		1228	RAW 05 PF 101		5/4/2016		5/18/2016		Preventive	Medium
		1244	RAW 05 PF 301		5/4/2016		5/18/2016		Preventive	Medium
		<b>182</b>								
		<b>3</b>								<b>1.65%</b>
		<b>102</b>								<b>56.04%</b>
		<b>57</b>								<b>31.32%</b>
		<b>20</b>								<b>10.99%</b>

Asset Management | Work Management | Resources | System

My Infor | Lookup Work Orders (WLWO) | **Work Order InfoViewer**

Work Order # 1614

Activity Code \* PM - Mech | Preventative Maintenance for Mechanical Work

Asset Valve-Slide Gates\_RIFS | 1165

Tee Screen 3 Isolation Slide Gate

Summary | **Information** | Location | Comments

**Work Order Information**

Initiated 2/22/2016 00:00 | Source | Authorization

Schedule Start 2/22/2016 17:46 | Maint Type Preventive | Assigned To

Schedule Finish // | Problem | Responsibility Operations

Due 4/4/2016 17:46 | Priority Medium | Reference #

Initiated By | Service Request | Work Type

Project | Estimated Cost 4.00 | Group Project 1109

Budget Number | Incident

Out of Service |  Potential Service Request | RegType

Started // | Result

Closed // | Condition

Closed By | Actual Quantity 0.000

Hours 0.00

Down Time 0.00 | Asset Valuation Type

## Planned vs Reactive Maintenance

From: 3/1/2016 1:56:00 PM To: 5/5/2016 1:56:00 PM

Maintenance Type	Work Order #	Asset ID	Tag #	Activity	Closed Date
Corrective	11				
	2,96%				
	2165			Calibrate	5/5/2016
	2151	1137	RAW 02 VTP 201	Test	4/29/2016
	1237	1206	RAW 03 XFM 001	Coat/Paint	3/2/2016
	1238	1207	RAW 03 XFM 002	Coat/Paint	3/2/2016
	2104	1255	RAW 02 CTP 71	Instal/Setup	4/25/2016
	1755	1291	SND 11 CTP 22	Repack	3/9/2016
	2166	1305	SHC 20 PTP 01	Inspect	5/5/2016
	2039	1346	FDR 17 SUP 01	Clean	4/8/2016
	2097	1353	RAW 11 MIX 12	Replace	4/20/2016
	1588	1368	BFP 20 MEQ 01	Clean	3/25/2016
	1591	1900	RAW 04 LND 02	Coat/Paint	3/2/2016
Preventive	360				
	97.04%				
	1041	1131	RAW 02 VTP 101	PM	3/9/2016
	1051	1131	RAW 02 VTP 101	PM	3/9/2016
	1606	1131	RAW 02 VTP 101	PM - Ops	3/2/2016
	1730	1131	RAW 02 VTP 101	PM - Ops	3/6/2016
	1772	1131	RAW 02 VTP 101	PM - Ops	3/13/2016
	1829	1131	RAW 02 VTP 101	PM - Ops	3/23/2016
	1949	1131	RAW 02 VTP 101	PM - Ops	4/10/2016
	2057	1131	RAW 02 VTP 101	PM - Ops	4/22/2016
	1042	1132	RAW 02 VTP 201	PM	3/9/2016

## Work Order Backlog

## Work Order Form

## PM vs. CM report

# The LOTWP can now start to generate KPI reports to assist in planning and budgeting



Measurement	Goals**
Work Order Backlog	Planned 6 weeks (SMRP 5.4.8) Ready to schedule 2-3 weeks (SMRP 5.4.9)
Overtime	<5% (SMRP 5.5.8)
Preventive Maintenance Compliance	>90% (SMRP 5.4.14)
Schedule Compliance	>90% (SMRP 5.4.4) Report as to why the schedule was broken (equipment not ready, emergency breakdown, staffing etc..)
Planned Maintenance Ratio	85% (AWWA benchmark)
Reactive Work	<10% (SMRP 5.4.1)
Mean Time Between Failure (start on critical assets)	Higher the better. Don't want failures between PM's
Budgeted vs Actual	95%-100% of Budget



# Working towards long term benefits and data driven decisions



- Collect reliable data to measure performance
- Workload backlog – justify more resources
- Productivity
- Effectiveness of preventative maintenance
- Improves focus on critical assets
- True O&M costs



# CMMS provides the ability to analyze PM and CM performance

Station Number	PM Count	CM Count	Total	% CM	Total Cost	Unit Cost
20	124	28	152	18%	\$ 58,000	\$ 381.58
21	169	129	298	43%	\$ 179,000	\$ 600.67
22	110	18	128	14%	\$ 55,000	\$ 429.69
23	102	5	107	5%	\$ 41,000	\$ 383.18
24	100	8	108	7%	\$ 27,000	\$ 250.00
25	104	6	110	5%	\$ 41,000	\$ 372.73
26	115	18	133	14%	\$ 42,000	\$ 315.79
27	108	10	118	8%	\$ 120,000	\$ 1,016.95
28	119	47	166	28%	\$ 185,000	\$ 1,114.46
29	144	32	176	18%	\$ 102,000	\$ 579.55

- Where are my highest failure rates and why?
- Where are my most expensive maintenance costs?
- Which assets are the most expensive to maintain?
- What changes can I make to reduce failure rates?

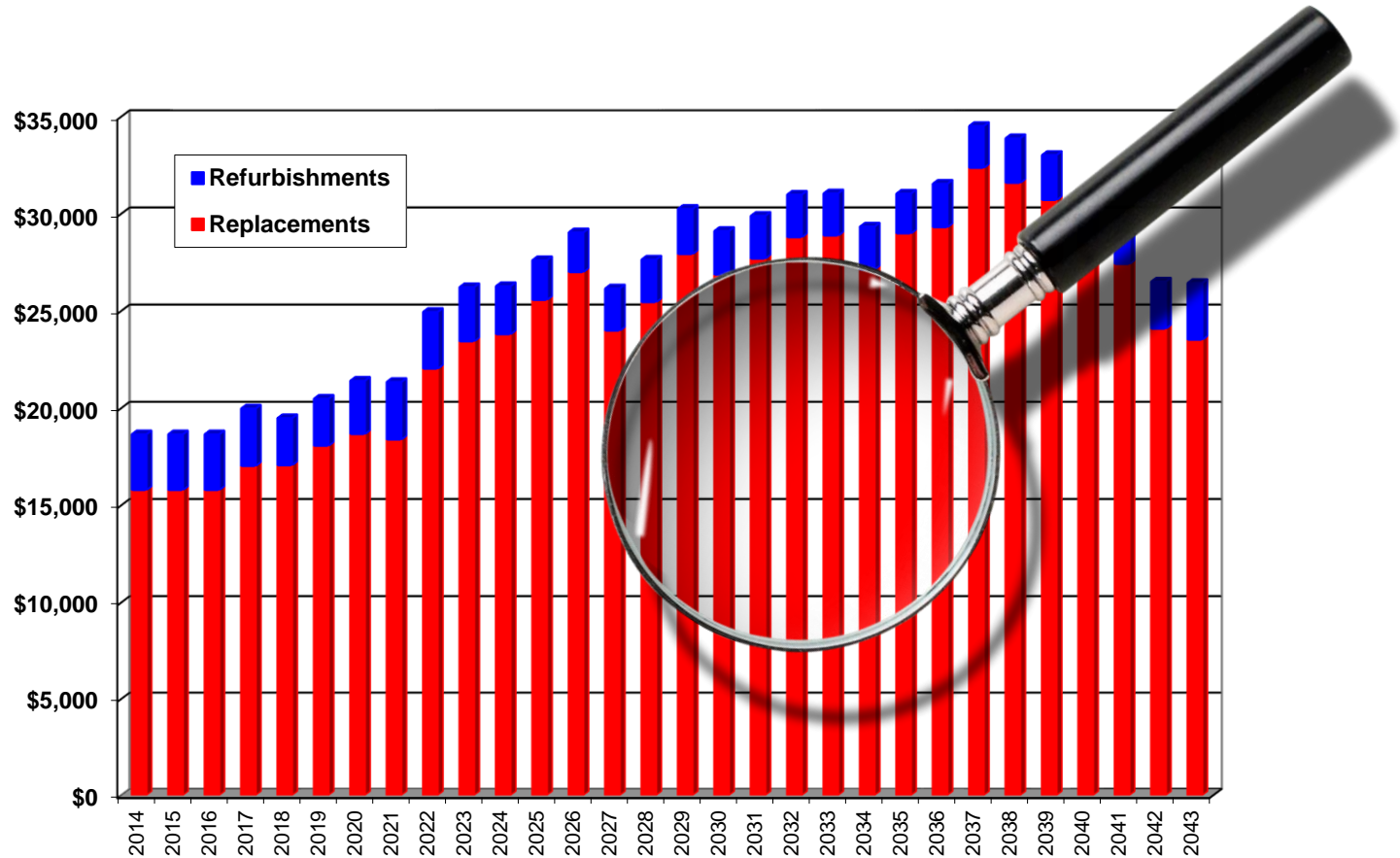
# Preventative Maintenance metrics help find “Bad Actors”

Facility	User Requested Reporting Date Range (i.e. 1/12 to 12/12)						PMs Total Hours	CMs Total Hours	% CMs vs. PMs	CM/PM vs. PMs Completed
	PMs Planned	PMs Completed	%PMs Completed	Hours Estimated	Hours Actual	Hours Actual vs. Estimated				
Bothin Pump Station	89	67	75%	40	67	168%	40	67	168%	167 : 75
Escondido Pump Station	88	67	76%	88	67	76%	88	67	76%	76 : 76
Rocky Nook Pump Station	78	67	86%	99	67	68%	99	67	68%	67 : 85
Alameda Well	140	130	93%	170	130	76%	170	130	76%	76 : 92
San Roque Well	150	130	87%	120	130	108%	120	130	108%	108 : 86

168%

- **% CMs vs. PMs:** Helps identify high areas of unplanned maintenance.

# Will provide the ability to more easily understand R&R funding needs



# Can help move towards more standard O&M practices and avoid “brain drain” when folks retire



- Facilitates continual O&M improvement
- Captures system O&M knowledge
- Streamline work practices
- Accessible information (web based)

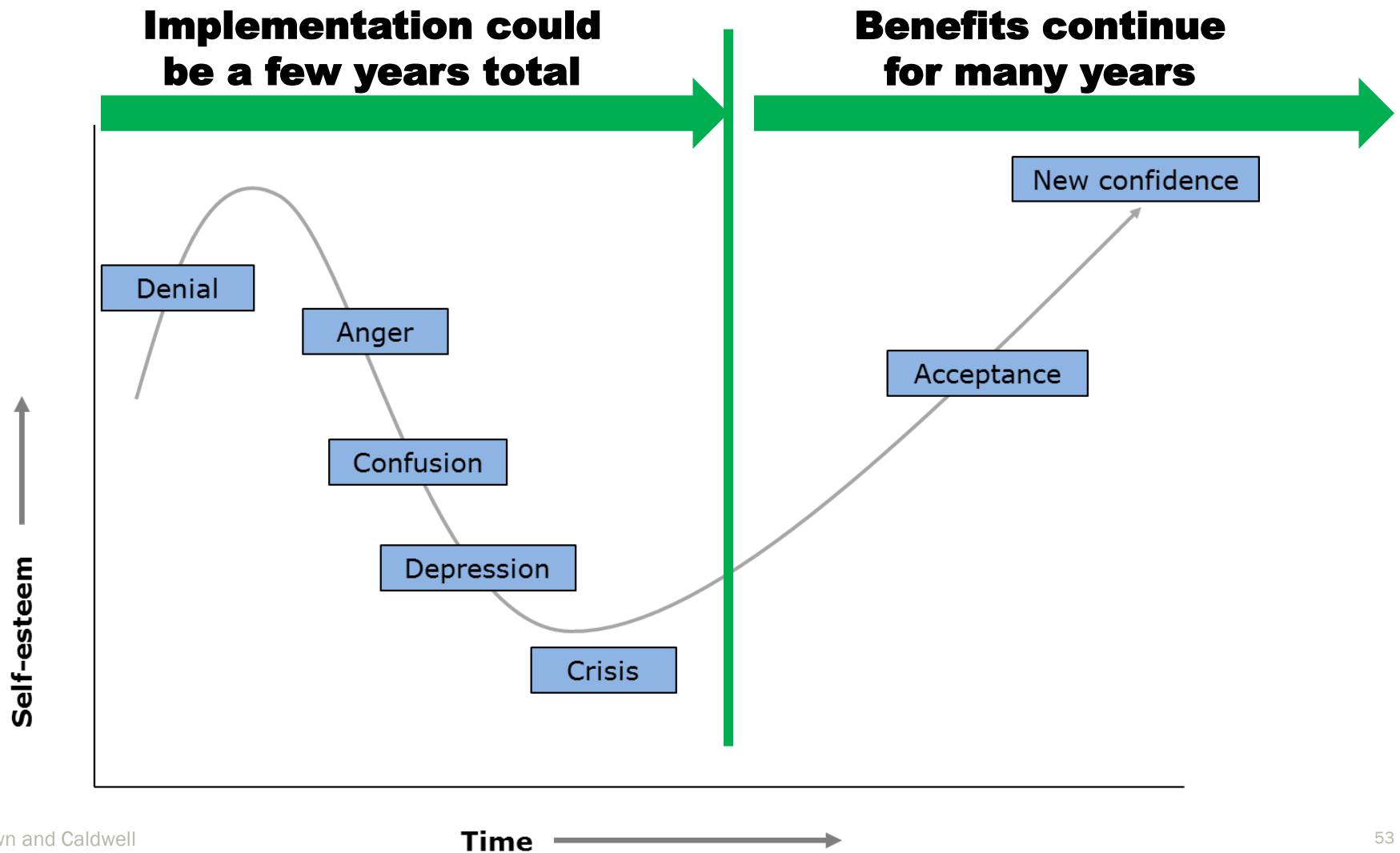


# Overall approach can help paint a clearer picture for decision makers (and ourselves)





# It's safe to say a ride has been taken



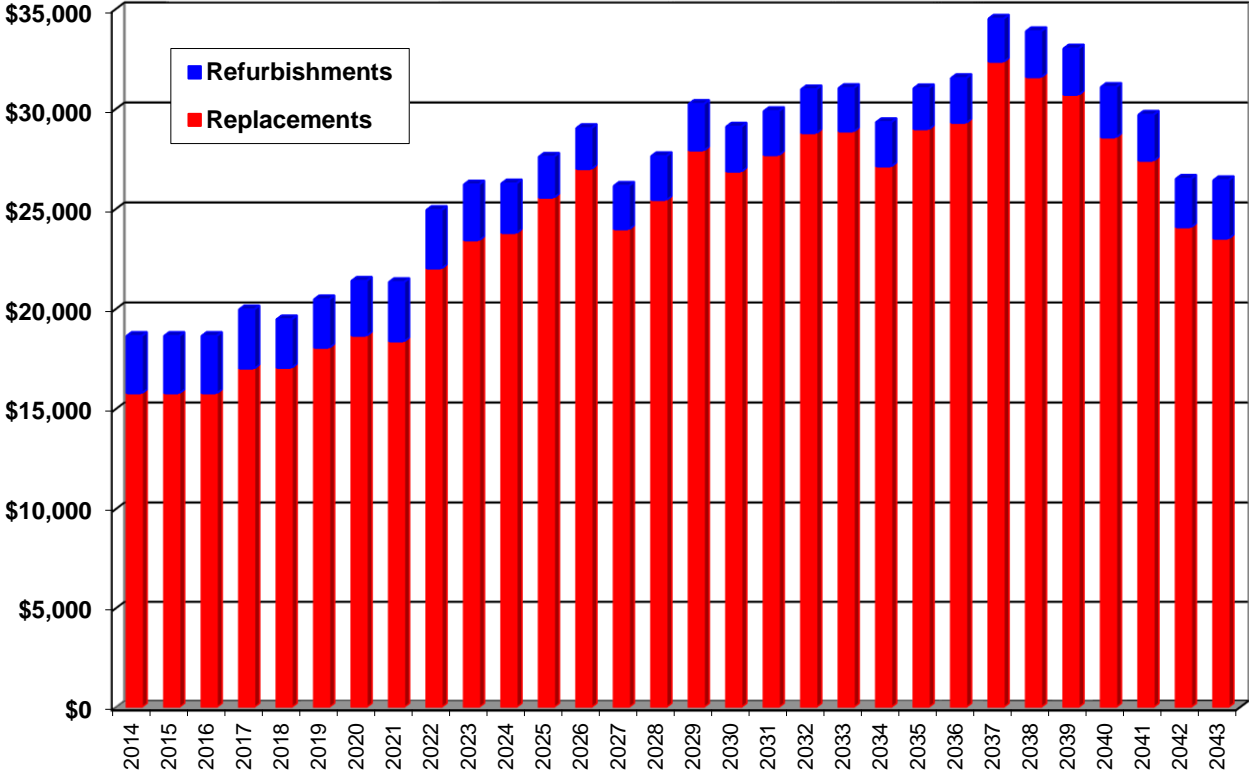


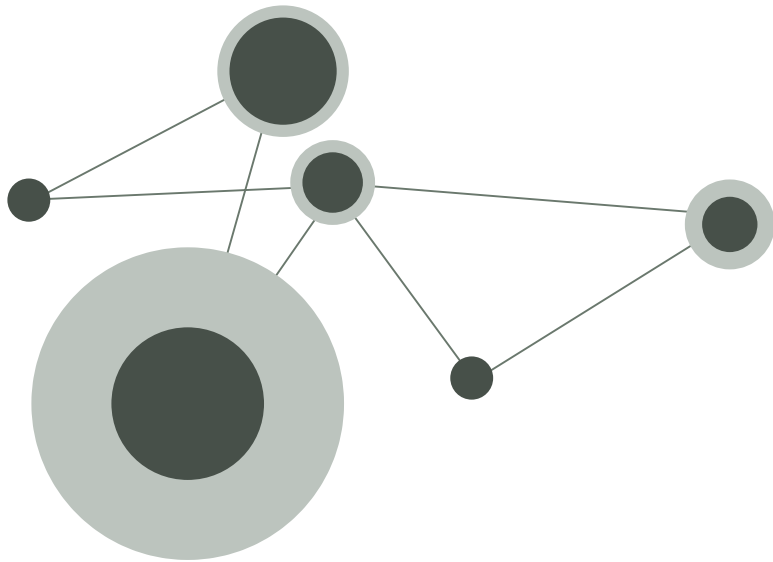
# Questions???

# Why is it important to be as effective as we can with our utility management?

- **Duty and Responsibility Today:** Provide the least cost/most safe/reliable service to rate payers today
- **Owe it to future generations:** To be properly planning and paying for improvements (technically and financially)

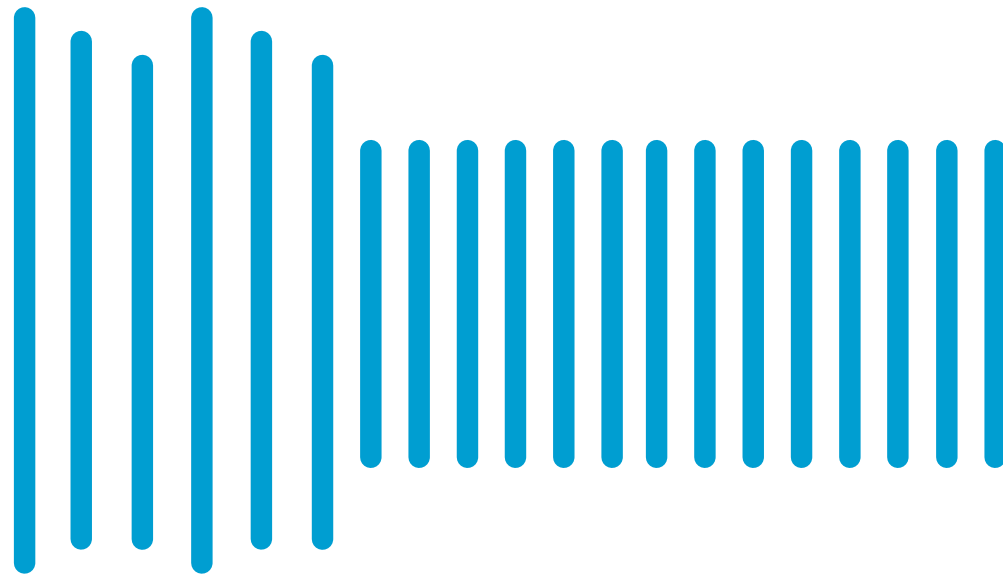
# WTP staff





# Disparate

Data base



# Organized

Data base

# CMMS systems provide a “pre-fab” platform for organizing the information

The screenshot shows a web browser window displaying the Infor CMMS interface. The main content is a 'Water Meter Lookup' table with the following data:

Meter ID	Description	Address	Area	Sub Area	District	Location	Meter Type	Service Status	Installed Date
94428602		21 WALKING WOODS DR LAKE OSWEGO OR 97035-					NEP	I	8/19/2014
67079916		2485 GREENTREE RD LAKE OSWEGO OR 97034-					NEP	I	8/8/2014
67079917		1817 CEDAR CT LAKE OSWEGO OR 97034-					NEP	I	8/8/2014
67079966		4242 COBB WAY LAKE OSWEGO OR 97035-					NEP	I	8/7/2014
67079970		18163 DEERBRUSH AVE LAKE OSWEGO OR 97035-					NEP	I	8/7/2014
52471274		290 IRON MOUNTAIN BLVD LAKE OSWEGO OR 97034-					NEP	I	8/7/2014
52699404		5680 LA MESA CT LAKE OSWEGO OR 97035-					NEP	I	8/7/2014
67079971		18030 MEADOWLARK LN LAKE OSWEGO OR 97034-					NEP	I	8/7/2014
93490738		17645 OAK MEADOW LN LAKE OSWEGO OR 97034-					NEP	I	8/7/2014
67079968		13638 TWIN CREEK LN LAKE OSWEGO OR 97035-					NEP	I	8/7/2014
67079967		4100 CHAPMAN WAY LAKE OSWEGO OR 97035-					NEP	I	8/7/2014
94788615		4123 HARVEY WAY LAKE OSWEGO OR 97035-					NEP	I	8/6/2014
67079920		5043 ROSEWOOD ST LAKE OSWEGO OR 97035-					NEP	I	8/6/2014
52471294		17620 WOODHURST PL LAKE OSWEGO OR 97034-					NEP	I	8/5/2014
94788811		18436 PIONEER CT LAKE OSWEGO OR 97034-					NEP	I	8/5/2014
67079918		17918 KELOK RD LAKE OSWEGO 97034					NEP	I	8/1/2014
93883152		505 MAPLE ST LAKE OSWEGO OR 97034-					NEP	I	7/30/2014
93883158		5878 SUNBROOK DR LAKE OSWEGO OR 97035-					NEP	I	7/29/2014
94788810		14335 CAMDEN LN LAKE OSWEGO OR 97035-					NEP	I	7/28/2014
52471288		0 WESTLAKE DR LAKE OSWEGO OR 97035-					NEP	I	7/28/2014
93883157		17108 KELOK RD LAKE OSWEGO OR 97034-					NEP	I	7/25/2014
67079909		12780 FIELDING RD LAKE OSWEGO OR 97034-					NEP	I	7/24/2014

Data is not just stored, it's ready to be used!





## ***Agenda Section 1***

**Discuss briefly: Where does the data at my utility currently reside for items like:**

**1. The asset registry?**

**2. Work history?**

**.....one location?.....many locations?**



# Bullpen



# Planning, tracking and executing PM's (warranty and beyond)

- “Equipment Record Forms” (one per asset)

- PM Schedules
- Spare Parts
- Special Tools

01/30-B. EQUIPMENT RECORD FORM: TAG# AHU-420

EQUIP DESCRIP AIR HANDLING UNIT EQUIP LOC ELECTRICAL ROOM  
EQUIP NO. AHU-420 SHOP DWG NO. DATE INST COST  
MFR ENERGY LABS INC MFR CONTACT  
MFR ADDRESS 9651 AIRWAY RD SAN DIEGO CA 92154 PHONE 619-671-0100  
VENDOR DMG NORTH, INC VENDOR CONTACT ANDREW HATFIELD  
VENDOR ADDRESS 8930 OSAGE AV SACRAMENTO, CA 95828 PHONE 916-381-2458

MAINTENANCE REQUIREMENTS	D	W	M	T	F	S	A	Hours
CLEAN CABINET AND RELATED COMPONENTS					X			1.0
CHECK FILTERS- CLEAN OR REPLACE AS NEEDED				X				1.0
CHECK SHAFT BEARINGS, LUBRICATE AS NEEDED						X		1.5
CHECK BELTS FOR ALIGN, TENSION, WEAR- ADJUST OR REPLACE							X	1.5
TIGHTEN ALL SET SCREWS/BOLTS, ETC.						X		1.0

LUBRICANTS: RECOMMENDED: CHEVRON SRI #2  
ALTERNATIVE: EXXON UNIREX #2

MISC NOTES: REFER TO MFG'S MANUAL FOR MAINTENANCE PROCEDURES

RECOMMENDED SPARE PARTS			
PART NO	QUAN	PART NAME	COST
24X24X2	2	FILTER	10.50
24X12X2	2	FILTER	10.50
24X24X12	2	V-BANK FILTER	
24X12X12	2	V-BANK FILTER	
B-52	1	V-BELT	32.50

ELECTRICAL NAMEPLATE DATA			
EQUIP AIR HANDLER			
MAKE TWIN CITIES/ENERGY LABS INC			
SERIAL NO. SEE * BELOW		ID NO.	
MODEL NO. C4052-F-L FRAME NO.			
HP 3	V 460	AMP	HZ 60z
PH 3	RPM	SF	DUTY
CODE	INSL CL	DES	TYPE
NEMA DES	C AMB	TEMP RISE	RATING
MISC. CFM 3500			

MECHANICAL NAMEPLATE DATA			
EQUIP MOTOR			
MAKE RELIANCE/BALDOR			
SERIAL NO.		ID NO.	
MODEL NO. BALDOR		FRAME NO. 182T	
HP 3	RPM 1800	CAP	SIZE
TDH	IMP SZ	BELT NO.	CFM
PSI	ASSY NO.	CASE NO.	
MISC ENCLOSURE--TEFC			

SERIAL #1210-6592-420

- Tells what task needs to be done when on a specific asset or a group of assets



# WTP Staff and JDL Services worked with owners staff to fine-tune work management practices

## Priority Codes

Work Order Priority	Time in which work order will be analyzed and work will be started to resolve issue
5	Emergency (30 minutes or less)
4	Urgent (48 hours or less)
3	High (14 days or less)
2	Medium (28 days or less)
1	Low (56 days or less)

## Condition Codes

Condition Assessment Ratings	
Condition Rating	Description
1	New or Excellent Condition
2	Minor Defects Only
3	Major Defects Noted
4	Requires a rebuild
5	Unserviceable (Cannot rebuild or beyond economical repair)

WTP

- W000 - INSTALL OR SETUP
- W001 - REMOVE OR DEMOLISH
- W002 - CONSTRUCT
- W003 - SEASONAL STARTUP CHECK
- W004 - SEASONAL SHUTDOWN CHECK
- W005 - REMOVE/SHIP FOR SERVICE
- W006 - REPAIR/REPLACE BY WTP
- W007 - REPAIR/REPLACE UNIT BY OTHERS
- W008 - REPAIR/REPLACE ON WARRANTY
- W009 - PREVENTATIVE MAINT. DAILY
- W010 - PREVENTATIVE MAINT. 1 WEEK
- W011 - PREVENTATIVE MAINT. 2 WEEK
- W012 - PREVENTATIVE MAINT. 4 WEEK
- W012A - PREVENTATIVE MAINT. 3 MONTH
- W012B - PREVENTATIVE MAINT. 4 MONTH
- W013 - PREVENTATIVE MAINT. 6 MONTH
- W014 - PREVENTATIVE MAINT. 12 MONTH
- W015 - PREVENTATIVE MAINT. 2 YEAR
- W016 - PREVENTATIVE MAINT. OTHER
- W017 - EQUIPMENT REBUILD. NON-PM
- W018 - REPROGRAM INSTRUMENT
- W019 - VISUAL CHECK
- W020 - TROUBLESHOOT PROBLEMS
- W021 - SAFETY INSPECTION
- W022 - CALIBRATION. NON-PM
- W023 - STANDARDIZATION CHECK
- W024 - TELEMETRY CHECK/REPAIR

## Activity Codes

Code	Description	Code	Description
ARLK	Air Leak	OHET	Over Heating
OLLK	Oil Leak	R	No Power
WTLK	Water Leak	R	No Air
BRNG	Beep	M	Alarm
SEFL	Seal	B	No Lubrication
ENOS	Excessive Noise	B	Calibration Problem
EVIB	Excessive Vibration	VCL	Valve stuck closed
FLW	Low Flow	VSC	Valve stuck open

## Problem Codes

# Areas where CMMS systems can help

Manage Lots of Data



Manage Work



Use the Data  
(report)



Accurately  
Forecast



# Prioritizing, managing and reporting on work can be tough to track

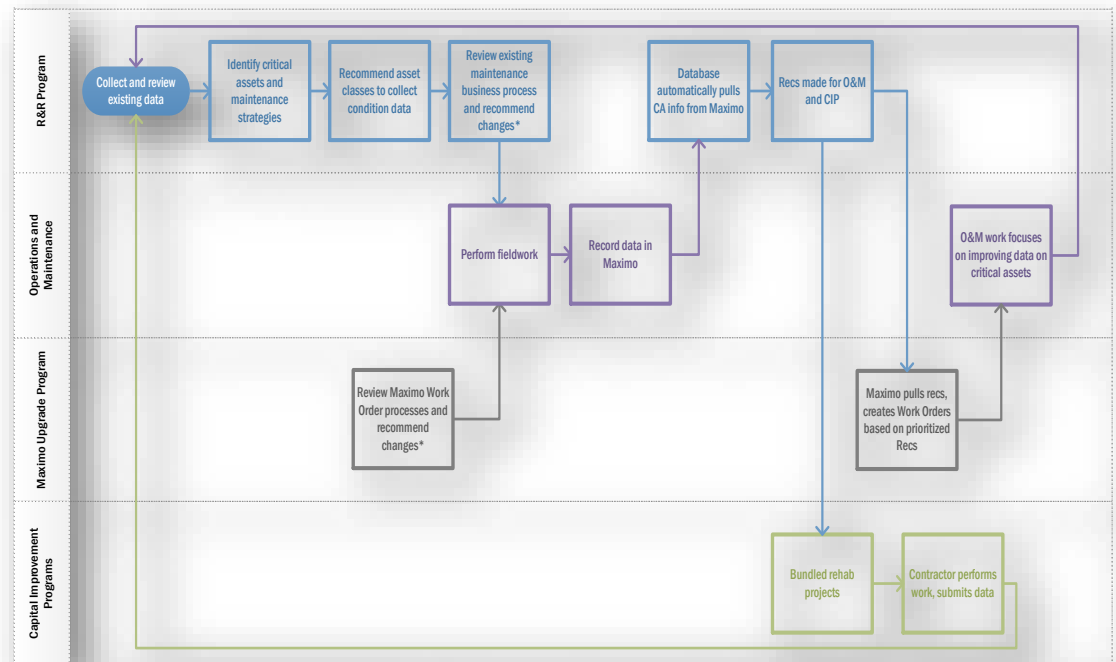




# CMMS systems can provide a vehicle for organizing work practices

- **Shepherd workflows**
- **Task lists**
- **Reminders (pings you)**
- **Alerts**

## Work Order Business Process



\* This is an ongoing process that will take several iterations before the process changes are made

# CMMS - Planning, tracking and executing PM's (warranty and beyond)



Service & Mileage	15k	20k	25k	30k	35k	40k	45k	50k	55k	60k	65k	70k	75k	80k	85k	90k	95k	100k	105k	110k	115k	120k	
Synthetic Oil Service & Filter Replacement - Tire Rotation (Synthetic - Multi-Point Inspection)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Engine Air Filter(s) Replacement				✓					✓							✓							✓
Cabin Air Filter(s) Replacement (HVAC)	✓			✓					✓							✓							✓
Fuel Filter Replacement (Most Vehicles)				✓					✓							✓							✓
Diesel Fuel Filter Replacement (Most Vehicles)	✓			✓					✓							✓							✓
Fuel/Air Induction Cleaning	✓			✓					✓							✓							✓
Rotate & Balance Tires & Check Pressure - Balance Optional (Request)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Check/Adjust Oil Level (Some Diesel Only)	✓			✓					✓							✓							✓

- One asset
- One maintenance schedule
- One start date

- Thousands of assets
- Different maintenance schedules
- Different start dates
- Reporting & regulatory requirements



# CMMS systems help organize work management (and show trends)

- Preventative Maintenance (PM's)
- Corrective Maintenance (CM's)
- Predictive Maintenance (PDM's)
- Emergencies (out of service/shut-downs etc.)
- Workflow inboxes
- Mobile solutions/tablets
- Perform the **RIGHT** amount of maintenance over the asset life-cycle



# Areas where CMMS systems can help

Manage Lots of Data



Manage Work



Use the Data  
(report)



Accurately Forecast

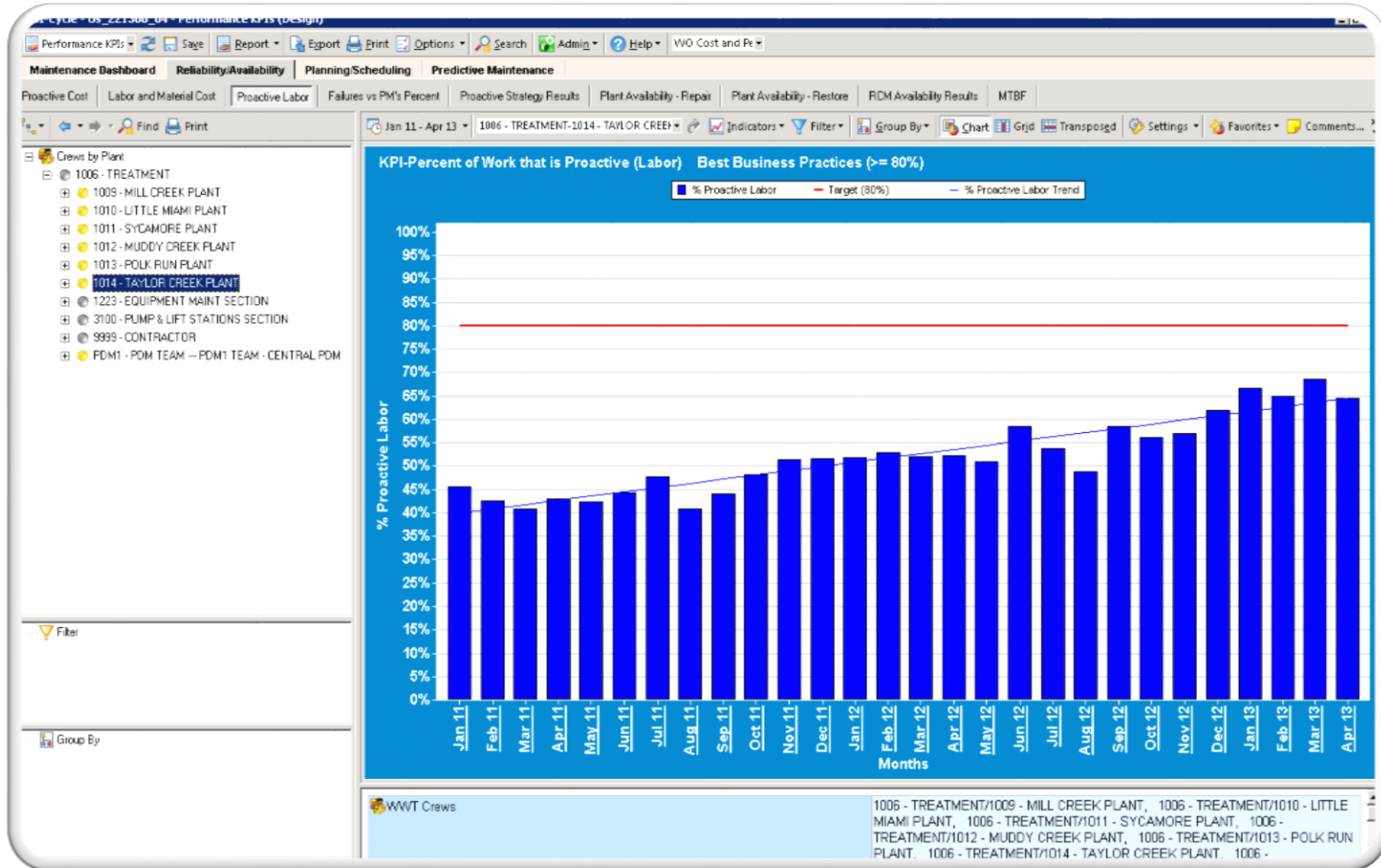


# CMMS systems can help paint a clearer picture for decision makers (and ourselves)





# CMMS reports can show performance against industry benchmarks.....and show trends







# LOTWP – Draft KPI's

Measurement	Goal
Work Order Backlog	Planned 6 weeks (SMRP 5.4.8) Ready to schedule 2-3 weeks (SMRP 5.4.9)
Overtime	<5% (SMRP 5.5.8)
Preventive Maintenance Compliance	>90% (SMRP 5.4.14)
Schedule Compliance	>90% (SMRP 5.4.4) Report as to why the schedule was broken (equipment not ready, emergency breakdown, staffing etc..)
Planned Maintenance Ratio	85% (AWWA benchmark)
Reactive Work	<10% (SMRP 5.4.1)
Mean Time Between Failure (start on critical assets)	Higher the better. Don't want failures between PM's
Budgeted vs Actual	95%-100% of Budget



## **Discussion Topic:**

**How are we currently communicating our needs at our utility to decision makers (including department heads, managers etc.)?**

**Was there a time you had trouble making your case? (for staff, new equipment etc.)**



**Why are we here?  
Why is this important?**

# Why are we here?....To do more with less

## Unique time in History

- Expected to keep the same or better Level of Service (LOS)
- Declining budgets
- Aging and failing infrastructure
- Increasing risk of failures
- Community and regulatory restrictions – getting tougher
- Climate Change



# Utilities are under increased scrutiny

## Portland Public Water District: Ballot Measure 26-156 trounced by nearly 3-to-1 margin (election results)

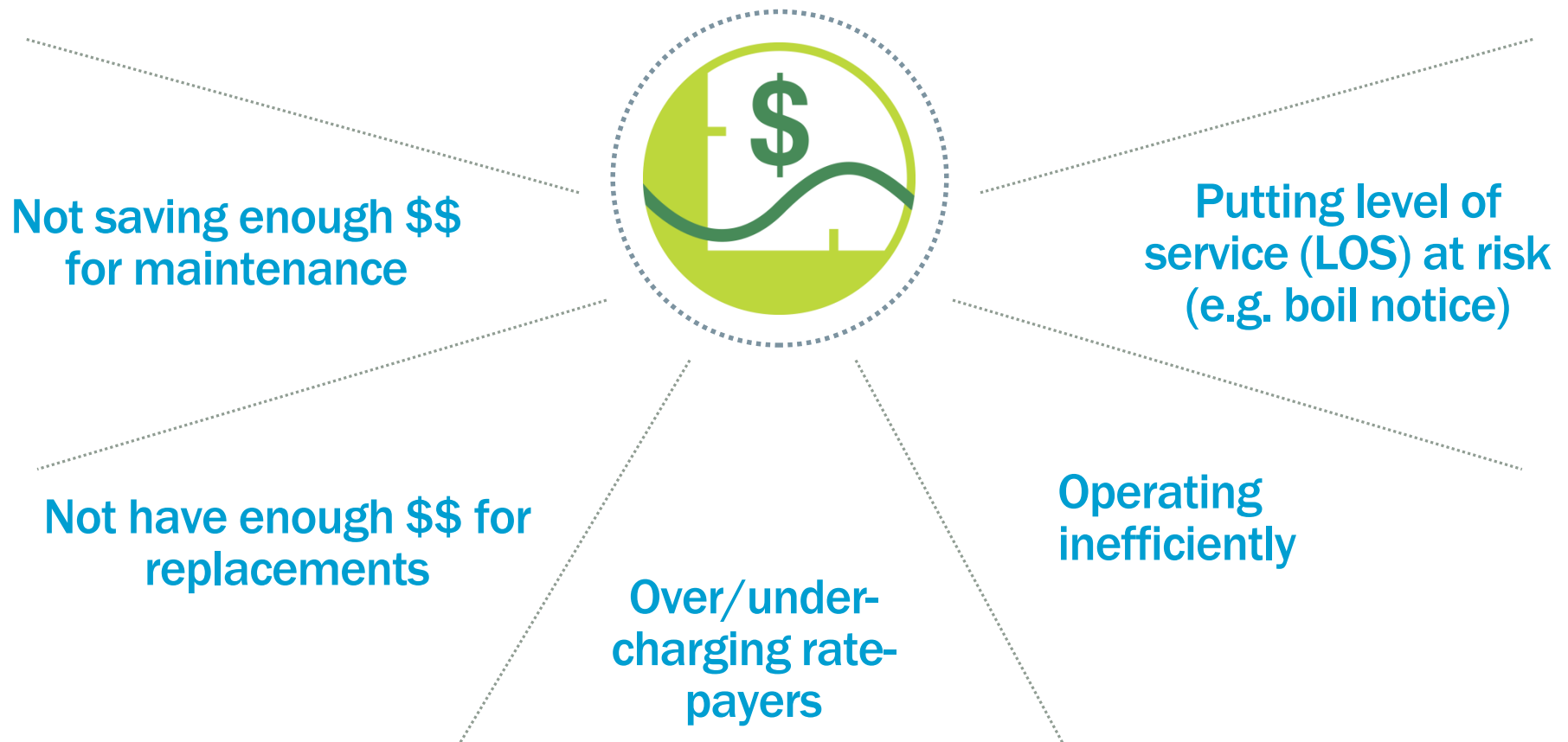
Would have created the [Portland Public Water District](#) and handed oversight and ratemaking to a new board of seven elected representatives



# Why is it important to be as effective as we can with our utility management?

- **Duty and Responsibility Today:** Provide the least cost/most safe/reliable service to rate payers today
- **Owe it to future generations:** To be properly planning and paying for improvements (technically and financially)

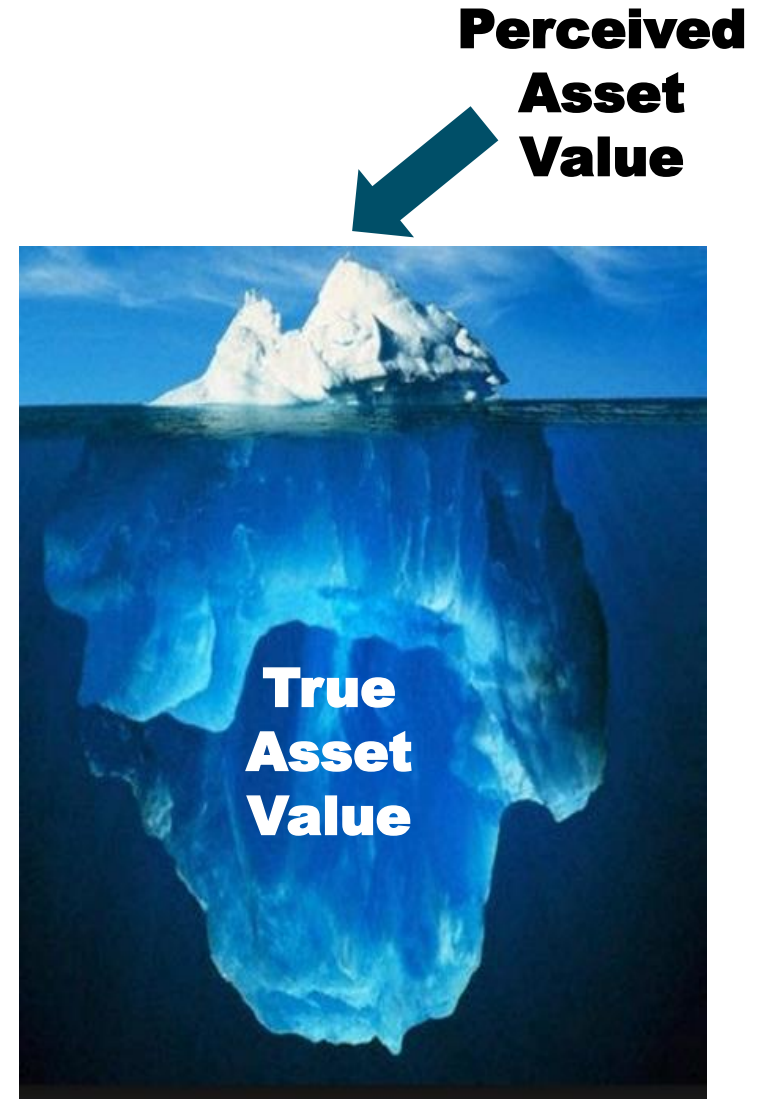
# Why is asset management important?.....without it a utility could be:





# The value of a small agencies assets can equal big dollars

- Relatively small agencies (100,000 or less) can own \$1B or more in assets
- Thousands of assets
- Long, complicated work histories
- Lots of data



# Key messages for today on CMMS systems

- CMMS systems can be an effective tool in **running a more efficient utility of any size**
- CMMS systems can be a vehicle to **advance an organizations maintenance culture**

# Who am I? – Mike Prett P.E.

- 19 Years of experience in civil/water related infrastructure
- Licensed in CA and OR
- Professional career started in Irvine in 1996
- Design background but specialize in delivery of larger projects and CIP's
- Currently working on a 6-year \$250M potable water CIP in Oregon
- Asset management/CMMS systems
- PMIS systems





## Where CMMS systems fit in to management of any sized utility



# Over-arching asset management goals: Common to agencies big and small

- **Operational optimization**  
Reliable/efficient
- **Infrastructure stability**  
High LOS, low cost, low risk
- **Measurement and continuous improvement**

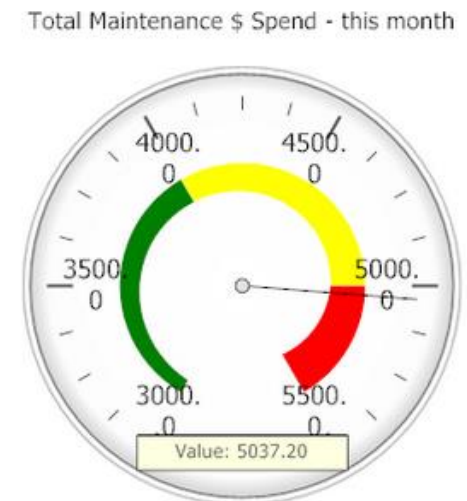


*\*\*From “Effective Utility Management, a Primer for Water and Wastewater Utilities”*

# Where does a CMMS system fit in?

**Software Tool** – Manages the flow of **high volumes** of asset information (including \$\$)

- Data Driven Systems
- Detailed asset information
- Ongoing work history
- Reporting





# Five fundamental areas to a well run utility

1. Agency policies and procedures
2. Equipment data
3. Work order control
4. Preventative maintenance practices
5. Materials control

**CMMS systems can strongly support and guide these**





## How can a CMMS help a small to mid-sized utility?

# Areas where CMMS systems can help

Manage Lots of Data



Work Management



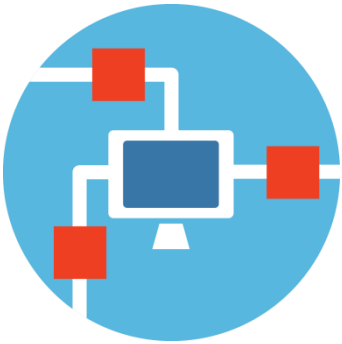
Use the Data (report)



Accurately Forecast



# Data Sources and your assets



**SCADA**



**GIS**



**CMMS**



**FINANCIAL  
SYSTEMS**

**Know what you have, how much  
it's worth, where it is, and it's  
condition**

# Data – put it somewhere other than our brains



**“With a lot of our staff nearing retirement, we risked losing all the knowledge in our heads. We realized we needed to capture and organize information in a whole new way.”**

**Greg Farmer, Operations  
Littleton/Englewood WWTP, Colorado**



# Each individual asset has it's own set of detailed information

Asset ID
Asset Name
Type
Description/Function
Design type
Design Voltage
Phase
Rated AMPs
HP
Watt/KW
RPM
Service Factor
Efficiency
Power Factor
Thermal Protection
Y/N
Ambient Temperature (Max.)
Design Code
NEMA Insulation Class
Frame number
Drive End Bearing
Non Drive End Bearing
Serial number
Model number
Size
Frame number
Month, Year Manufactured
Failure Analysis
Included in Criticality Model?
Y/N
Drive End Bearing
Bearing manufacturer
Drive End Bearing
Bearing number
Opposite Drive End Bearing
Bearing manufacturer
Opposite Drive End Bearing
Bearing number
Owner
Installation Cost
Purchase Cost
Purchase date
Expected life (years)
Mean Time Between Failure - Hours
Average Monthly Use - Hours
Total Usage - Hours

HP, Voltage, RPM

Serial Number, Model Number, Year made

Purchase Cost, Date and Expected Life & Owner!

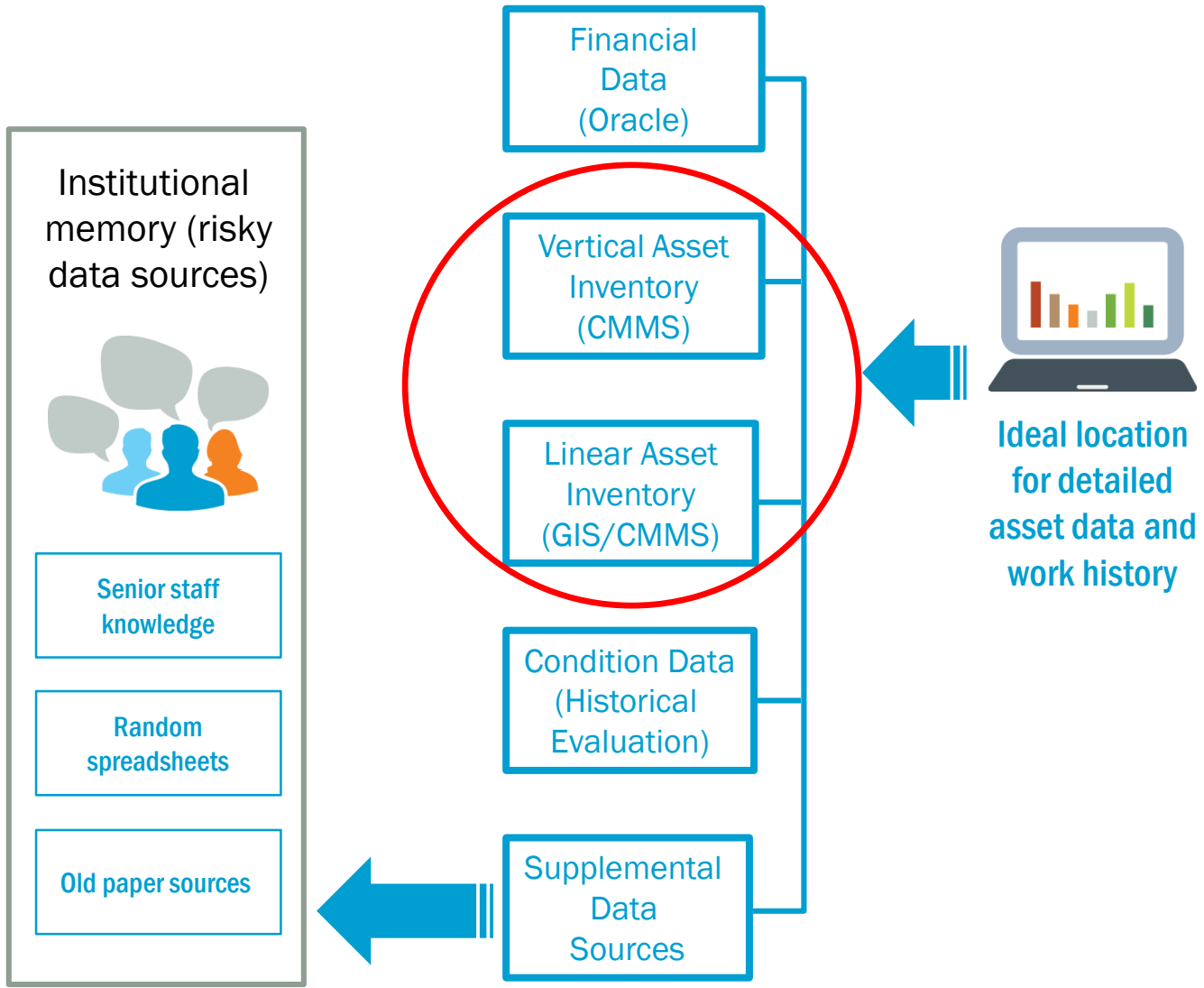
WARRANTY INFORMATION
Shipping date
WARRANTY INFORMATION
Startup date
WARRANTY INFORMATION
Effective date
WARRANTY INFORMATION
Duration (months) 100%
WARRANTY INFORMATION
Expiration date
WARRANTY INFORMATION
Duration for reduced coverage
WARRANTY INFORMATION
Duration for reduced coverage #2
WARRANTY INFORMATION
(Warranty PDF)
WARRANTY INFORMATION
Comments
LOCATION INFORMATION
Address
LOCATION INFORMATION
City, ST, Zip
LOCATION INFORMATION
Location
LOCATION INFORMATION
Area #
LOCATION INFORMATION
Sub - Area
LOCATION INFORMATION
Room
LOCATION INFORMATION
Level
LOCATION INFORMATION
Direction
LOCATION INFORMATION
GPS - Latitude
LOCATION INFORMATION
GPS - Longitude
MANUFACTURER
MANUFACTURER
Address
MANUFACTURER
City, ST, Zip
MANUFACTURER
Phone #
MANUFACTURER
Fax #
MANUFACTURER
email
MANUFACTURER
Web site
VENDOR
VENDOR
Address
VENDOR
City, ST, Zip
VENDOR
Phone #
VENDOR
Fax #
VENDOR
email
VENDOR
Web site
VENDOR
Notes

Warranty Information – Effective Date, Expiration Date Condition, risk....

Manufacturer & Vendor Information



# All of that asset information can live in many different places.....(or not be captured at all)





# Areas where CMMS systems can help

Manage Lots of Data



Manage Work



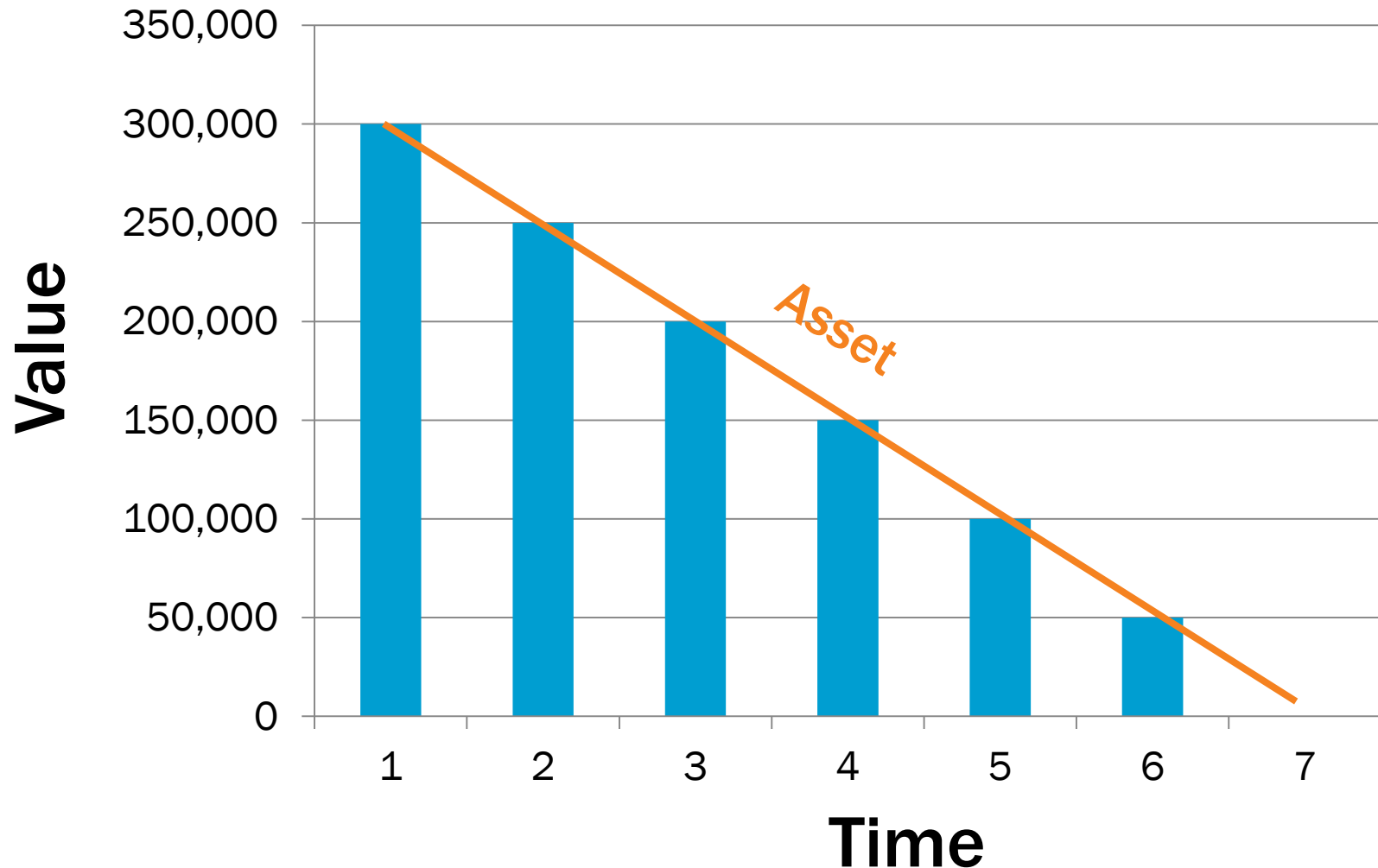
Use the Data  
(report)



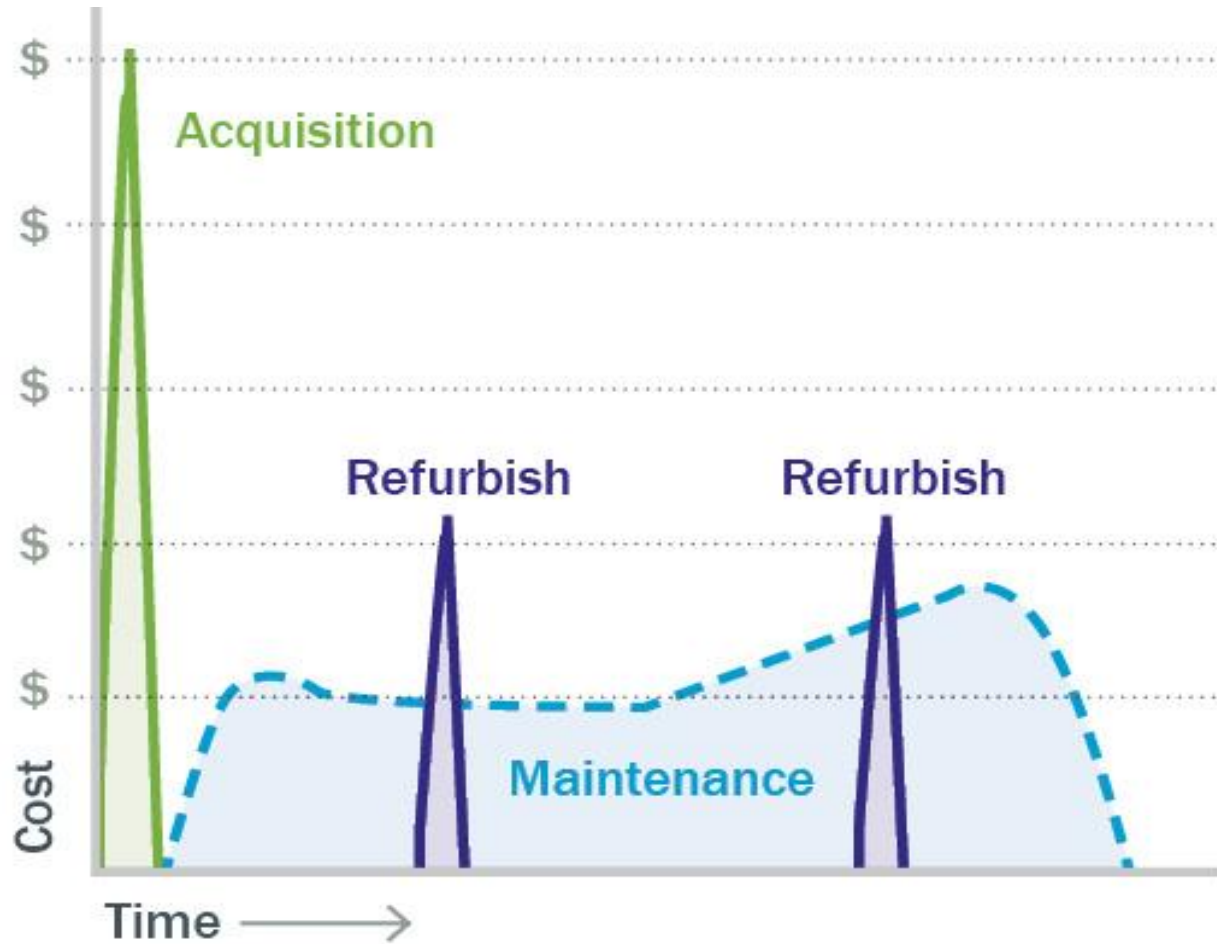
Accurately  
Forecast



# In our brains, failure is simple – but assets don't live like this!



# Point assets like pumps live and die more like this...



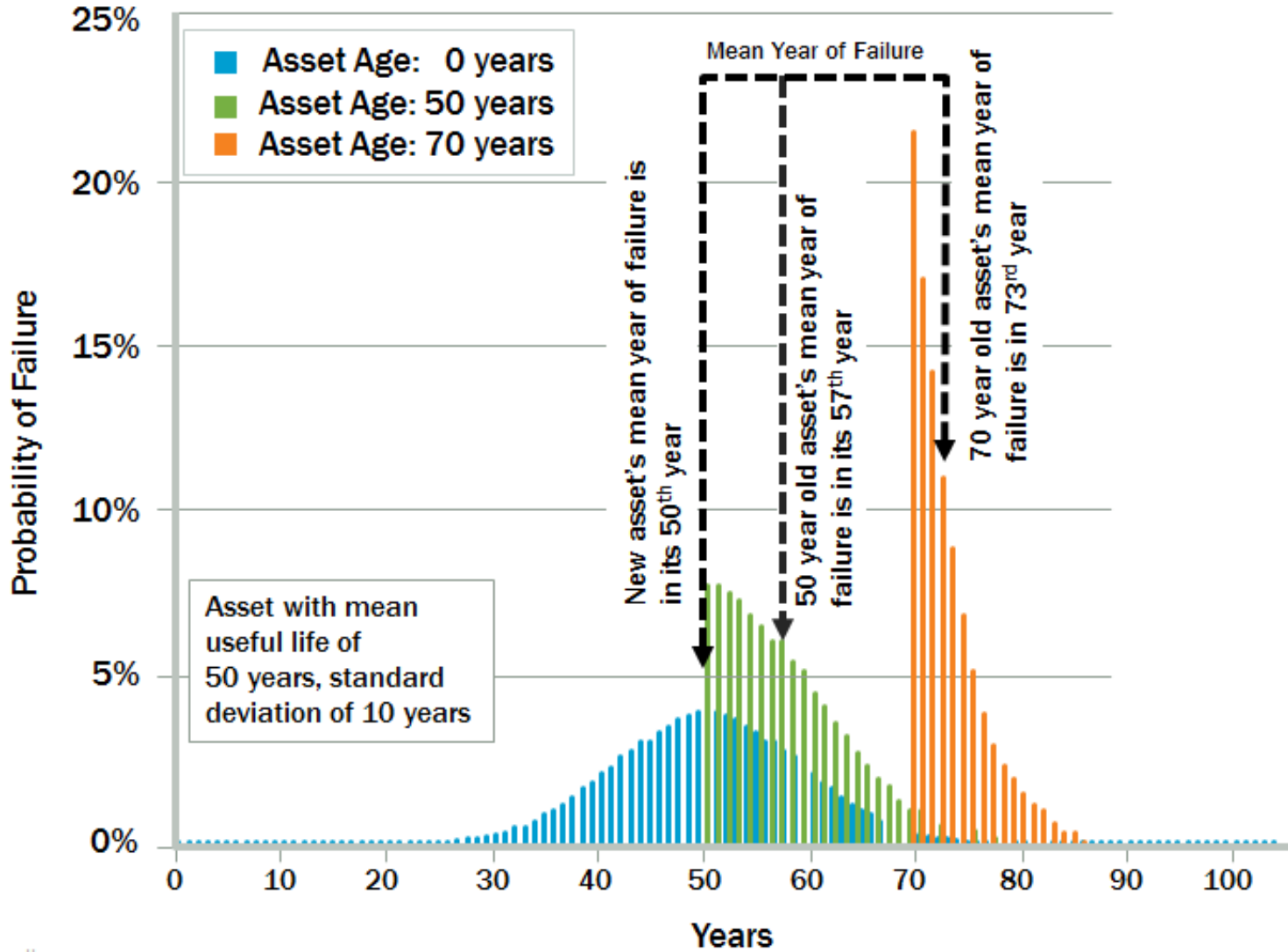


# Objectives (Specific Targets) for LOTWP AM/EOM Program

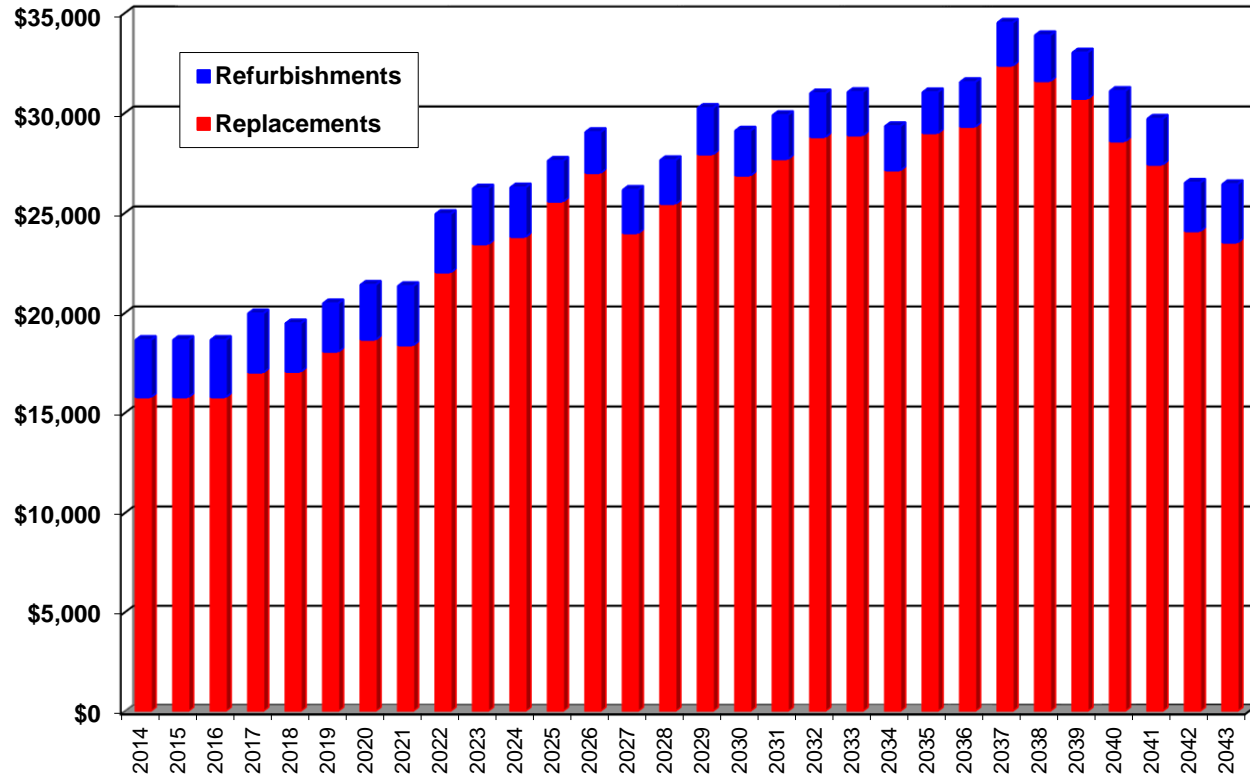
- IGA Compliance
  - Operations Manual (operations, management, capital improvements)
- Asset Management Program
  - “Thorough Inventory”
  - “Current condition”
  - Identification, budgeting and schedule for renewal, repair and replacement (R&R) costs

**KEEP IT  
SIMPLE!**

# And Linear Assets fail more like this...



# CMMS systems can provide data to support defensible rate adjustments and CIP funding





# Case Study Santa Barbara



# Santa Barbara Case Study

- Implemented Cartegraph CMMS for Sewer Collection System Group and for Water Distribution
- About
  - 95,000 customers
  - 260 miles of gravity sewers
  - 298 miles of water distribution pipe

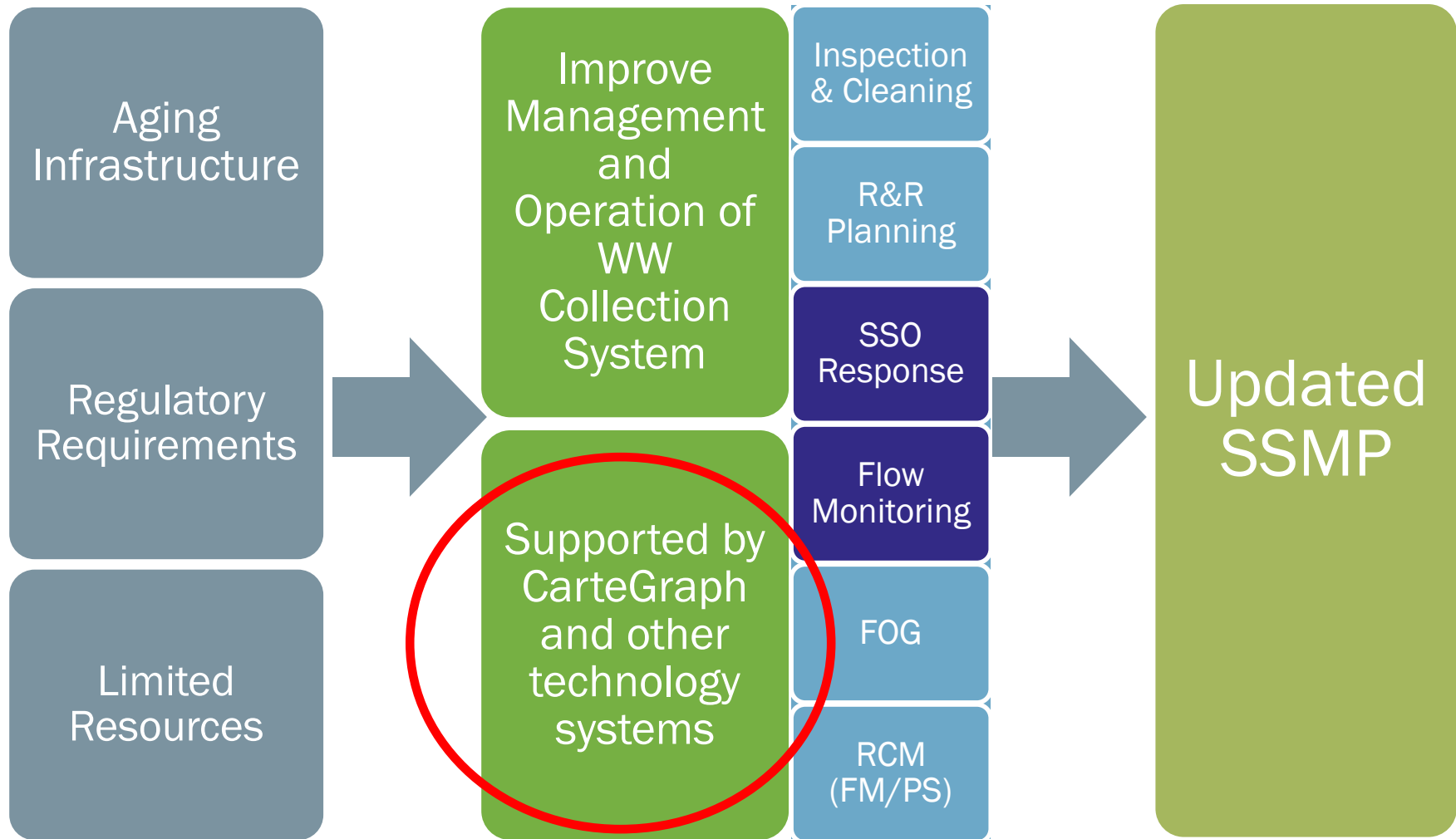


# Key Challenges

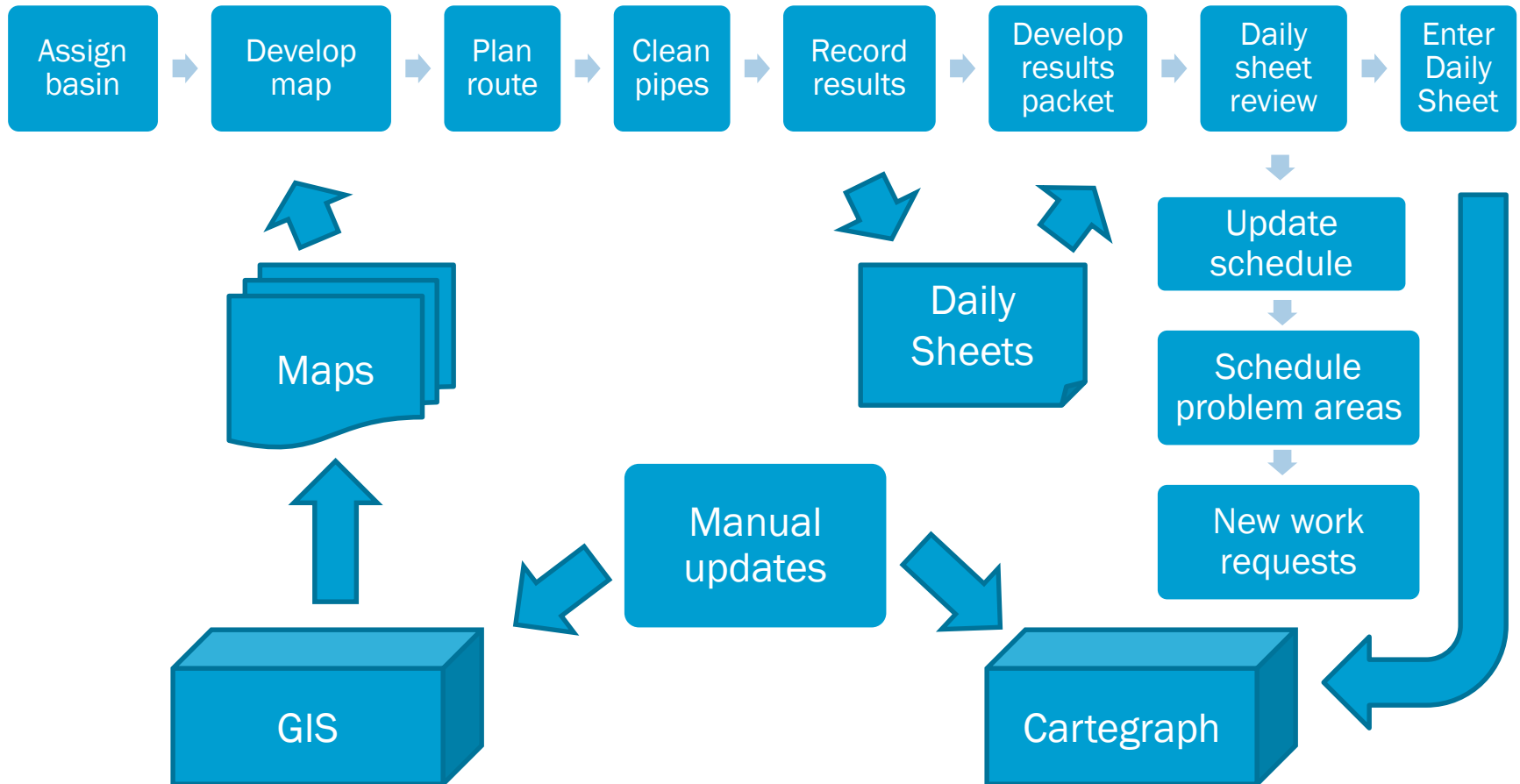
- Waste water **SSO consent decree** requiring increased performance for sewer pipe cleaning and inspection
- Aging water infrastructure and **O&M resource limitations** raised concerns over effectiveness of O&M program and identification of future needs.



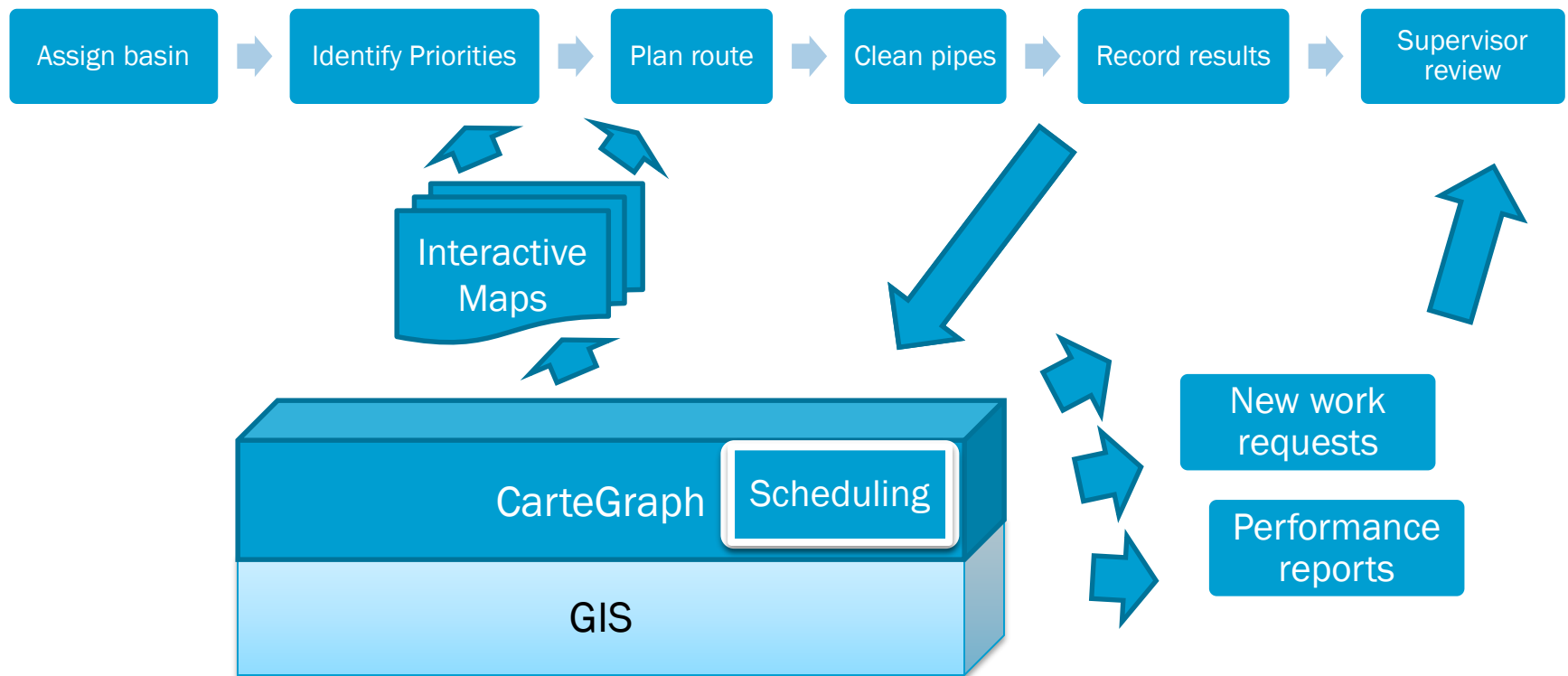
# Standard Workflows Supported by Technology Helped Santa Barbara Achieve its Goals



# Streamlining Work Practices By Aligning Technology and Data With Efficient Work Processes



# Streamlining Work Practices By Aligning Technology and Data With Efficient Work Processes



# CMMS allowed the ability to analyze PM and CM performance

Station Number	PM Count	CM Count	Total	% CM	Total Cost	Unit Cost
20	124	28	152	18%	\$ 58,000	\$ 381.58
21	169	129	298	43%	\$ 179,000	\$ 600.67
22	110	18	128	14%	\$ 55,000	\$ 429.69
23	102	5	107	5%	\$ 41,000	\$ 383.18
24	100	8	108	7%	\$ 27,000	\$ 250.00
25	104	6	110	5%	\$ 41,000	\$ 372.73
26	115	18	133	14%	\$ 42,000	\$ 315.79
27	108	10	118	8%	\$ 120,000	\$ 1,016.95
28	119	47	166	28%	\$ 185,000	\$ 1,114.46
29	144	32	176	18%	\$ 102,000	\$ 579.55

- Where are my highest failure rates and why?
- Where are my most expensive maintenance costs?
- Which assets are the most expensive to maintain?
- What changes can I make to reduce failure rates?
- What do I need to do to reduce costs of my problem assets?

# Preventative Maintenance Metrics shined a light on “Bad Actors”

Facility	User Requested Reporting Date Range (i.e. 1/12 to 12/12)						PMs Total Hours	CMs Total Hours	% CMs vs. PMs	CM/PM vs. PMs Completed
	PMs Planned	PMs Completed	%PMs Completed	Hours Estimated	Hours Actual	Hours Actual vs. Estimated				
Bothin Pump Station	89	67	75%	40	67	168%	40	67	168%	167 : 75
Escondido Pump Station	88	67	76%	88	67	76%	88	67	76%	76 : 76
Rocky Nook Pump Station	78	67	86%	99	67	68%	99	67	68%	67 : 85
Alameda Well	140	130	93%	170	130	76%	170	130	76%	76 : 92
San Roque Well	150	130	87%	120	130	108%	120	130	108%	108 : 86

168%

- **% CMs vs. PMs:** Helps identify high areas of unplanned maintenance.



# Accomplishments for Collections

- **Improved business processes**
  - (pipe cleaning, CCTV inspection, FOG Management, SSO Response, R&R planning)
- **Improved use of GIS and CMMS**
  - Risk-based CCTV inspections
  - Streamlined SSO documentation
  - Implemented Sewer Lateral Inspection Program
  - Implementing R&R Program

# Collections Results (a few highlights of many)

- New processes and systems in use for 2+ years
- **Decreased annual SSOs over 40% (on average)**
- Successfully meeting Consent Decree requirements
- On track to clean entire system over 5 years





# Case Study Clark Regional WW District

# Vision

- Financial Viability
- Infrastructure Stability
- Customer Focused (approx. 27,000 customers)
- Environmental Stewardship
- Responsible Management
  - Practicality of managing 9,500 main line pipes segments
- Be able to support economic development
  - Reliable sewer system
  - Targeted investments



# Goal: Develop a ground level record system capable of:

Work order and asset management

AND

- Critical Sewers Analysis
- Condition Assessment
- Asset Risk
- Project Prioritization Process
- Program Level Project Scoping
- Documentation





# Concern: Gaining Staff Buy In



# Concern: Non Tech Savvy





# Existing data evaluation

- Identify Existing Data

- Assets
  - GIS
  - Hand written WO



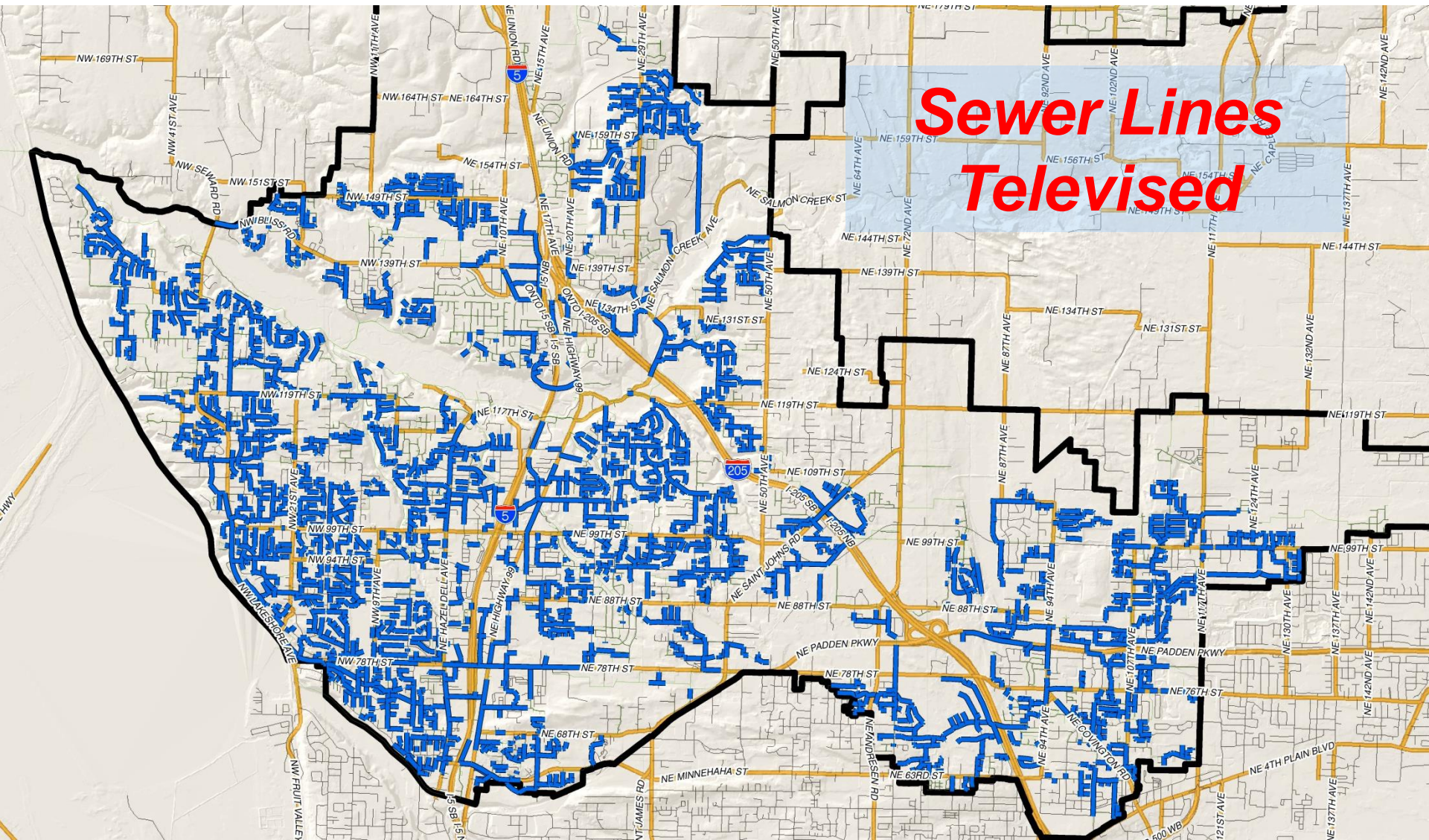
- Asset Condition

- CCTV Data
  - **475 miles of CCTV in Maintenance Management System (Lucity)**
- Internal Knowledge of known defects

# Program Outline

- Asset Risk
  - Combining Condition and Criticality (GIS Analysis)
- Develop Prioritization Concept
- Define R&R Projects
- Prioritize R&R Projects
- Project Priority Array

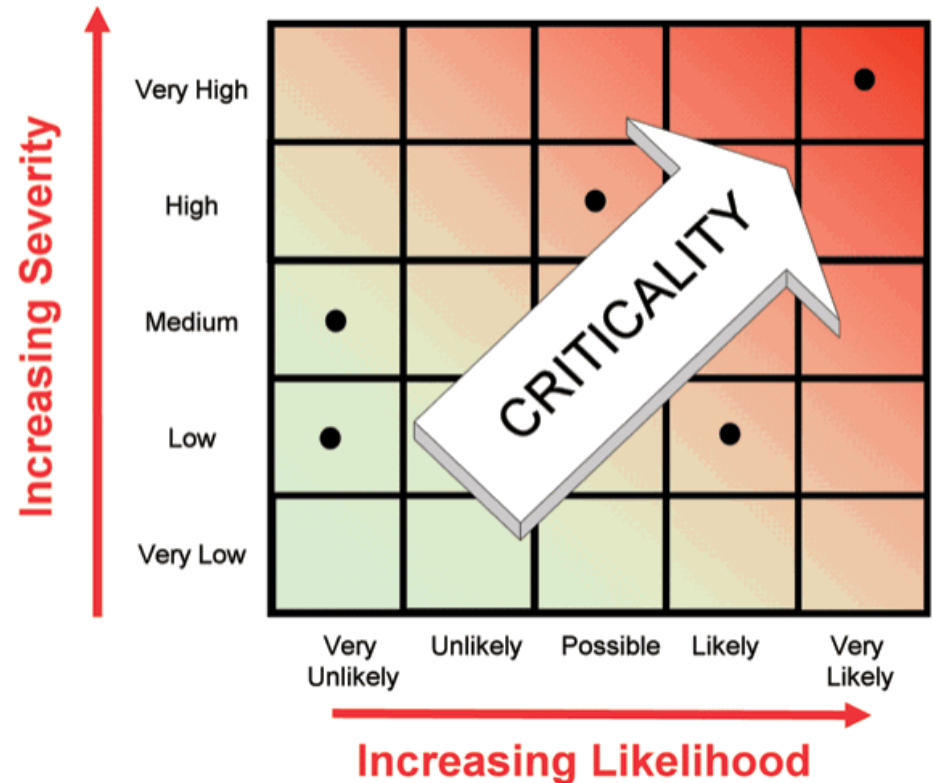
# Existing Data - 475 miles of CCTV in CMMS System - Now what?



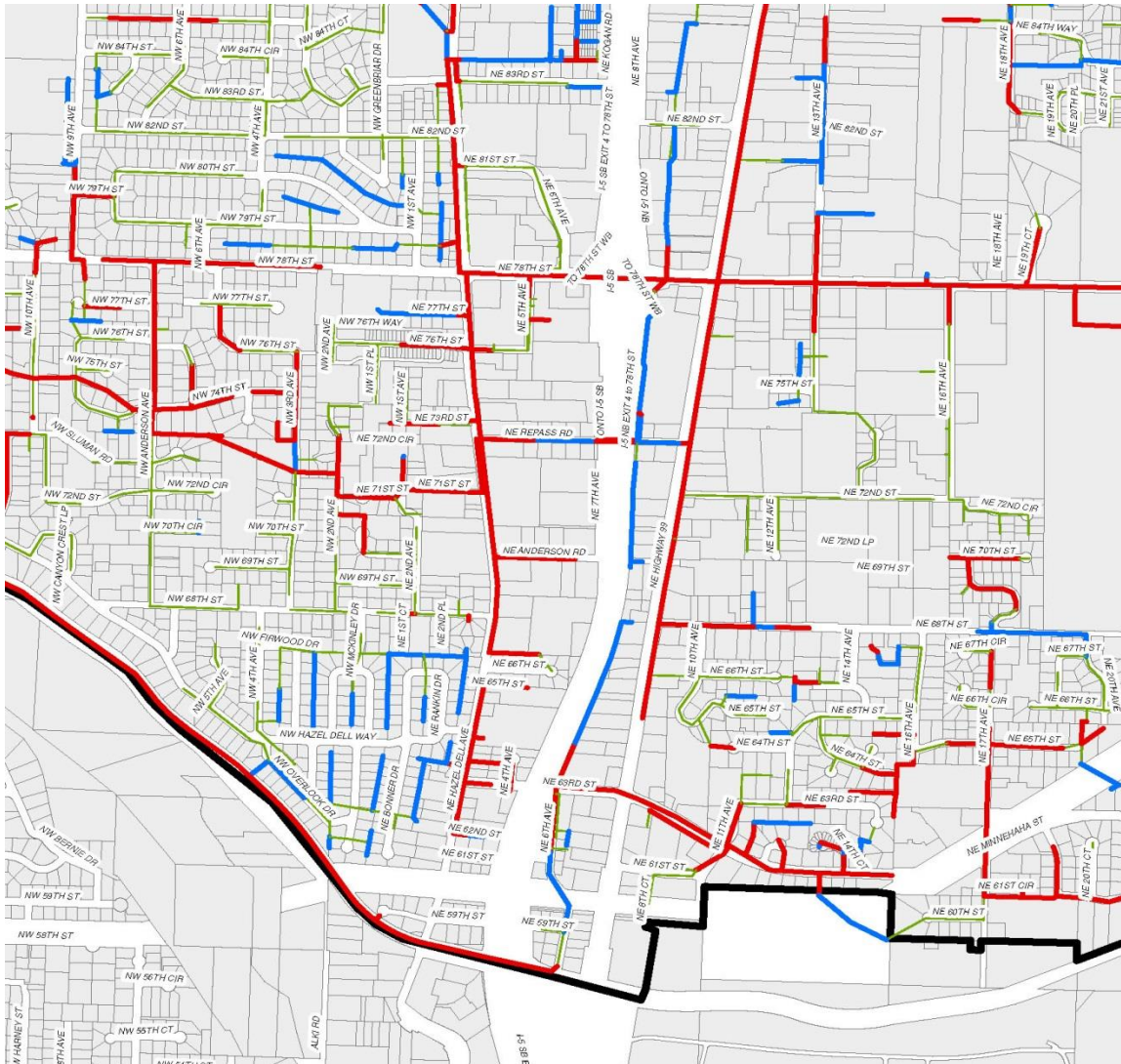


# Performed a criticality analysis

- Defining Criticality
  - 1 to 3 scoring scale
  - Based on consequence



# Critical Sewer Analysis combined with condition assessment data



**Moving  
towards  
prioritization**

# Perform risk analysis (using condition data)

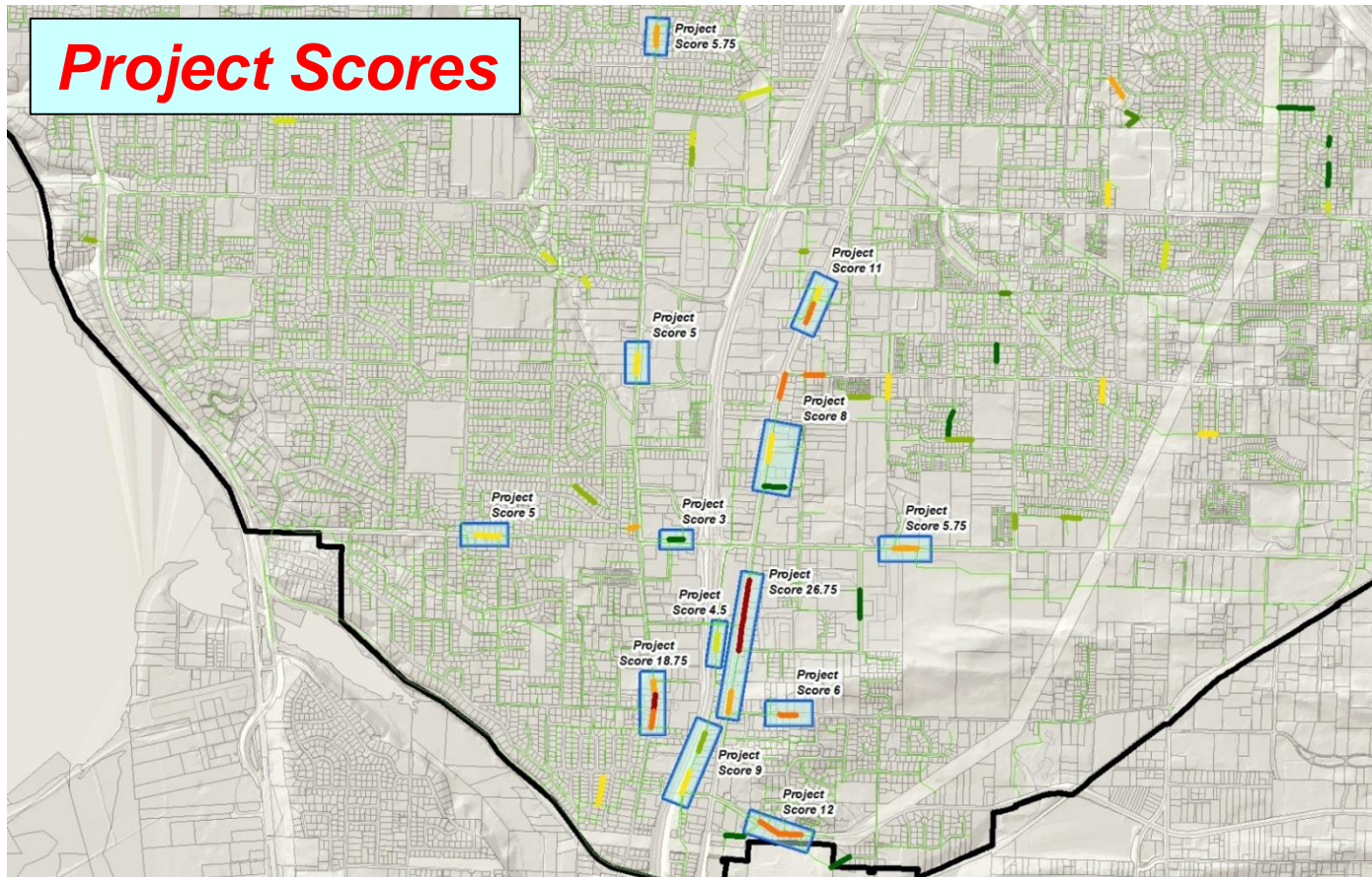
Condition (Risk of Failure)	Red	Watch/Fix Medium Priority 7,584 ft	Fix High Priority 1,651 ft	Fix Now 4,820 ft
	Yellow	Watch Low Priority 10,329 ft	Watch Medium Priority 4,494 ft	Watch High Priority 6,357 ft
	Green	Standard Maintenance	Watch Low Priority	Watch Medium Priority
		1	2	3
		Criticality (Consequence of Failure)		







# The CMMS works directly with the GIS system to provide data driven prioritized projects



**Asset Risk = Criticality + Condition**

# Lessons Learned – Clark Regional

- You have **more data collected than you realize** even before implementation
- Staff support and Management **buy in is crucial** to any systems success
- CMMS systems, once populated, **save time, money**
- Adds quantifiable data to **back rehab needs and cost allocation**
- Provides an **easily searchable data base** to provide history on work/assets, customer issues and inquires, and any other data you may want to “gather”



# Conclusions and Recommendations

# We discussed areas where CMMS systems can help with utility management

Manage Lots of Data



Manage Work



Use the Data  
(report)



Accurately  
Forecast

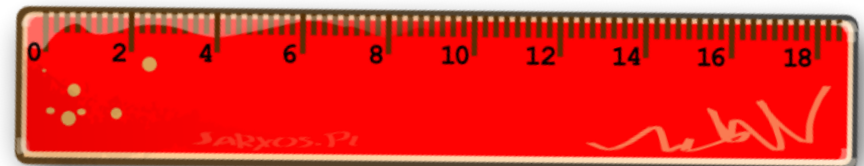


# Benefits to Small Agencies

- Collect reliable data to **measure performance**

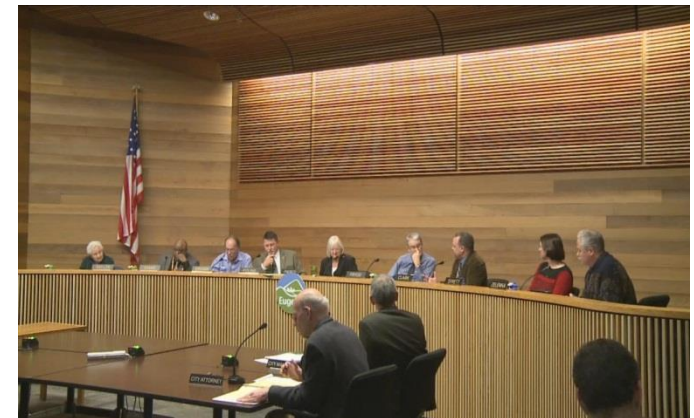
**(better performance = cost savings)**

- Workload backlog
- Productivity
- Effectiveness of preventative maintenance
- Improves focus on critical assets
- True O&M costs



# Benefits to Small Agencies (cont.)

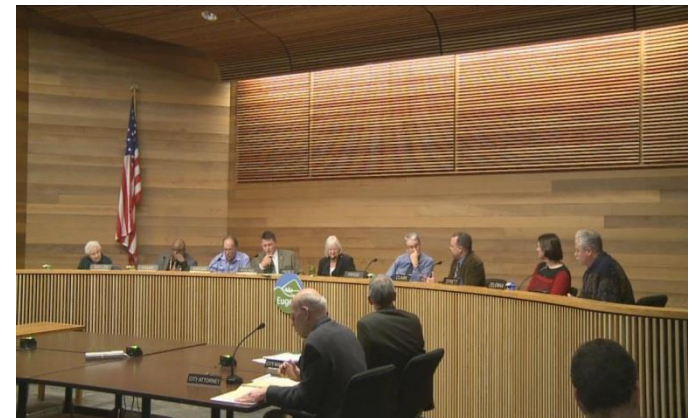
- **Quantify needs** to decision makers
  - demonstrate the need for more resources
  - prove warranty compliance or regulatory compliance
  - Support rate adjustments to decision makers
- Provides **visibility and transparency**
  - Management understands what is happening in the field
  - Field crews understand what is important for effective utility management





# CMMS “Hidden” benefits

- **A vehicle to rally around**
  - Clean up data
  - Improve work practices
  - Benefits effect all parts of the organization
  - Frees up time for other initiatives
  - Common tool to advance culture





# Realistic Expectations for AM

- Takes several years of detailed, *nitty-gritty work* to fully deploy
- Requires eventual *buy-in* commitment of the whole organization
- Needs upfront investment to get started, with *hidden* returns for initial years
- Success will only be as good as the *care and feeding* that goes with any system

## Key message recap:

- CMMS systems can be an effective tool in **running a more efficient utility of any size**
- CMMS systems can be a vehicle to **advance an organizations maintenance culture**



# Questions



**How are we prioritizing projects  
(and work) at my utility?**

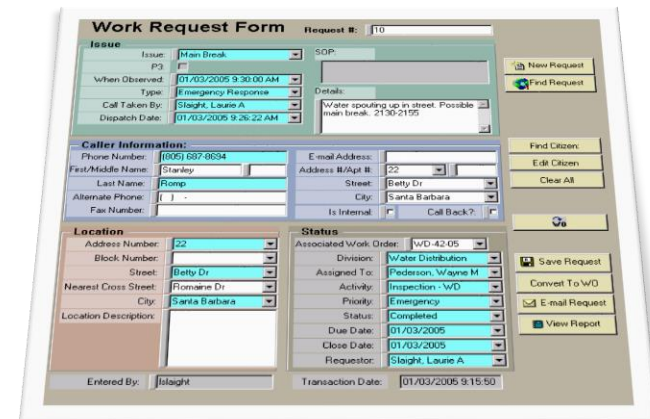
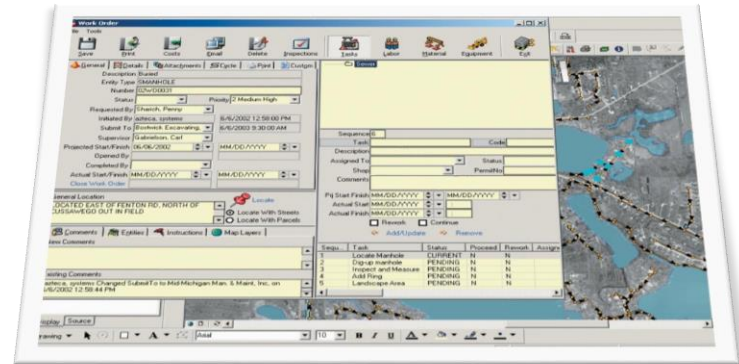
**Data driven (Condition,  
Criticality)?**

**Institutional knowledge driven?**

**Gut Feel?**

# CMMS systems – a functionality recap

- Detailed asset inventory
- Maintenance history
- Maintenance and budget **planning tool**
- Reporting



# Getting started – CMMS implementations are journeys.....not destinations

- **Identify & Evaluate**

- Existing data sources and inventories
- Existing work practices
- Look for gaps (e.g. collections, vertical, work history etc.)
- How are you currently reporting (communicating with decision makers)?

- **1st round goals for system**

- Consolidated asset database
- Basic work management
- Basic reporting

**Starting slowly and simply is the key to success!**



# Learn from others.....and find a champion

- **Benchmark**

- What systems are neighboring/similar agencies using?
- How is it working for them?
- Information sharing/user group potential

- **Identify an internal “champion(s)”**

- Day jobs will continuously get in the way
- One or more individuals needs to be focused on the effort and own it
- Other departments (e.g. IT) will need to be on board
- Business processes needed to support the tools



# Bullpen

# LOTWP Asset Management and O&M – Questions we will answer today

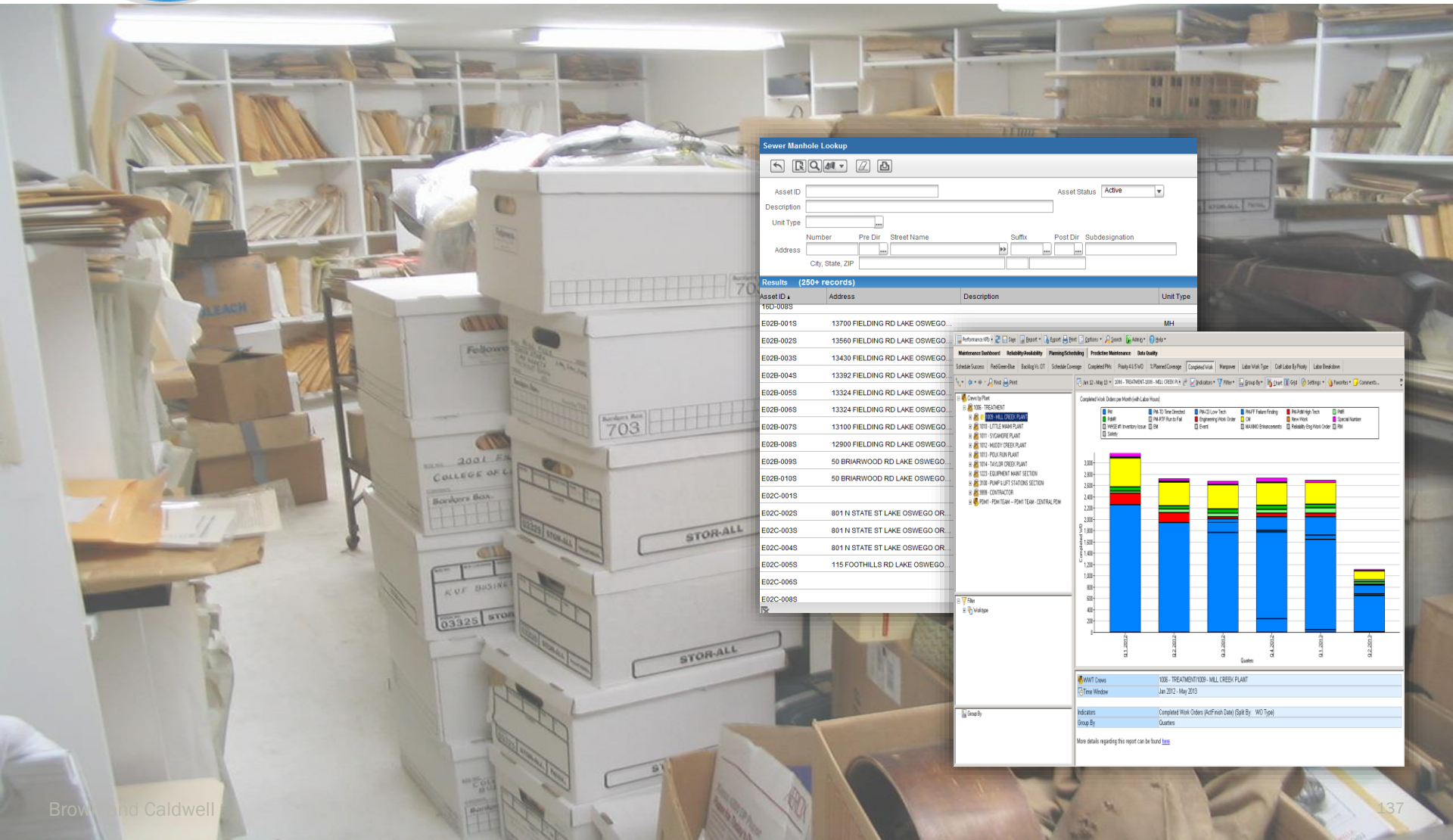
1. What is the LOTWP?
2. What are we trying to accomplish (and avoid)?
3. What is our plan? (and who are the players and what are the tools?)
4. What are our barriers to success and where are we stumbling?
5. What is our current status?
6. What would we do differently?
7. Review of the benefits

# LOTWP Asset Management and O&M – Questions we will answer today

1. What is the LOTWP?
2. What are we trying to accomplish (and avoid)?
3. What is our plan? (and who are the players and what are the tools?)
4. What are our barriers to success and where are we stumbling?
5. What is our current status?
6. What would we do differently?
7. Review of the benefits



# Target – to avoid contracting “cardboard box syndrome”



**Sewer Manhole Lookup**

Asset ID:  Asset Status: Active

Description:

Unit Type:

Address: Number  Pre Dir  Street Name  Suffix  Post Dir  Subdesignation   
City, State, ZIP

**Results (250+ records)**

Asset ID	Address	Description	Unit Type
E02B-001S	13700 FIELDING RD LAKE OSWEGO...		MH
E02B-002S	13560 FIELDING RD LAKE OSWEGO...		
E02B-003S	13430 FIELDING RD LAKE OSWEGO...		
E02B-004S	13392 FIELDING RD LAKE OSWEGO...		
E02B-005S	13324 FIELDING RD LAKE OSWEGO...		
E02B-006S	13324 FIELDING RD LAKE OSWEGO...		
E02B-007S	13100 FIELDING RD LAKE OSWEGO...		
E02B-008S	12900 FIELDING RD LAKE OSWEGO...		
E02B-009S	50 BRIARWOOD RD LAKE OSWEGO...		
E02B-010S	50 BRIARWOOD RD LAKE OSWEGO...		
E02C-001S	801 N STATE ST LAKE OSWEGO OR...		
E02C-002S	801 N STATE ST LAKE OSWEGO OR...		
E02C-003S	801 N STATE ST LAKE OSWEGO OR...		
E02C-004S	801 N STATE ST LAKE OSWEGO OR...		
E02C-005S	115 FOOTHILLS RD LAKE OSWEGO...		
E02C-006S			
E02C-008S			

**Performance Metrics**

Completed Work Orders (PCF/Finish Date) (Sort By: WO Type)

Group By: Quarters

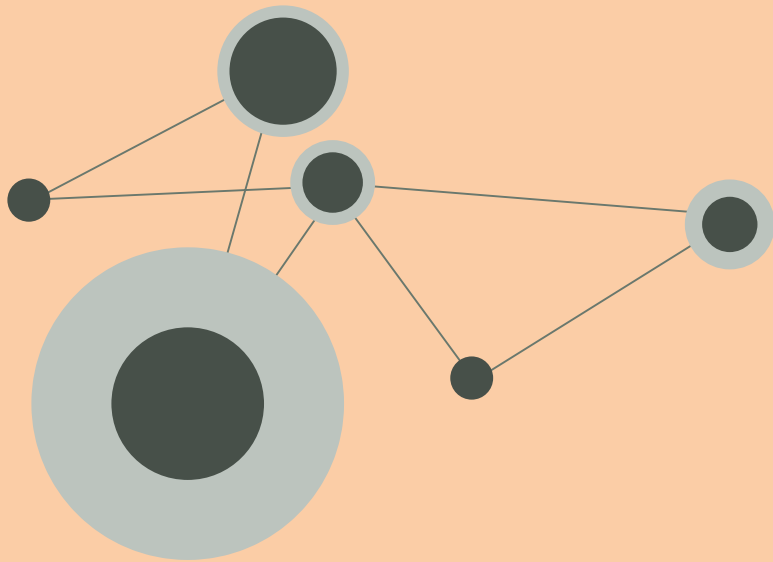
Quarter	Completed Work Orders (PCF/Finish Date)
Q3 2012	~2,800
Q4 2012	~2,500
Q1 2013	~2,400
Q2 2013	~2,300
Q3 2013	~1,000

WAT Cues: 1006 - TREATMENT006 - MILL CREEK PLANT  
Time Window: Jan 2012 - May 2013

Indicators: Completed Work Orders (PCF/Finish Date) (Sort By: WO Type)

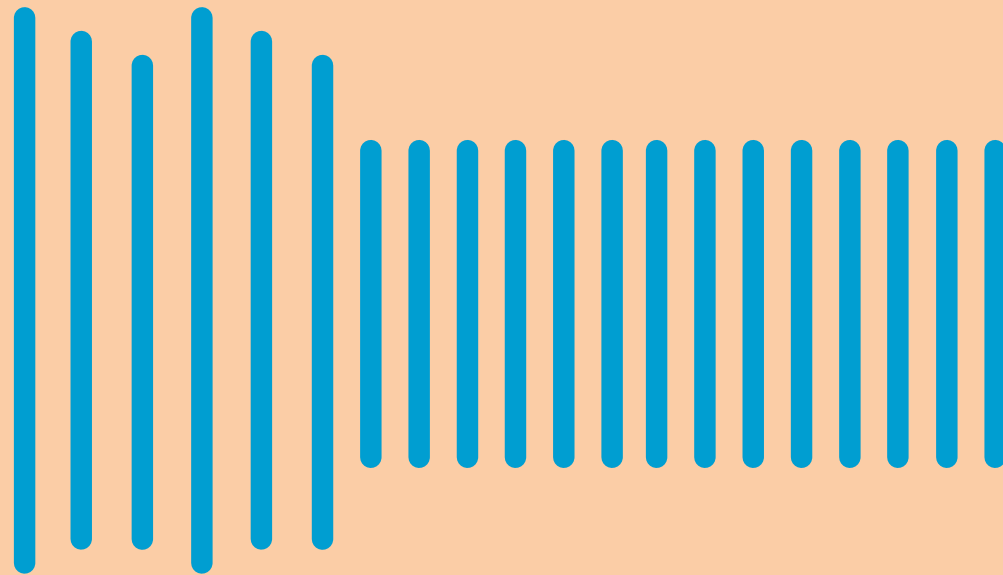
More details regarding this report can be found [here](#)





# Disparate

Data base

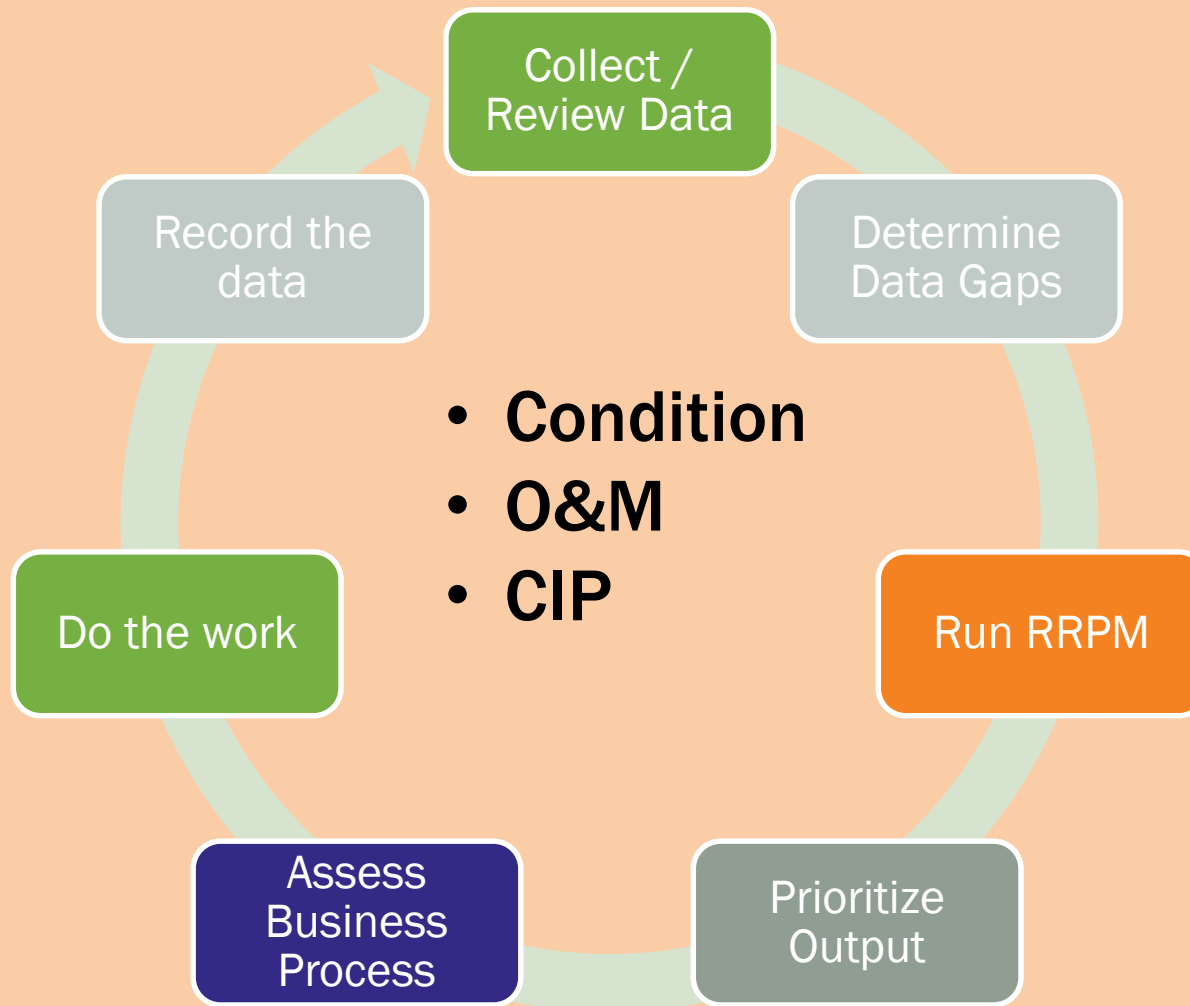


# Organized

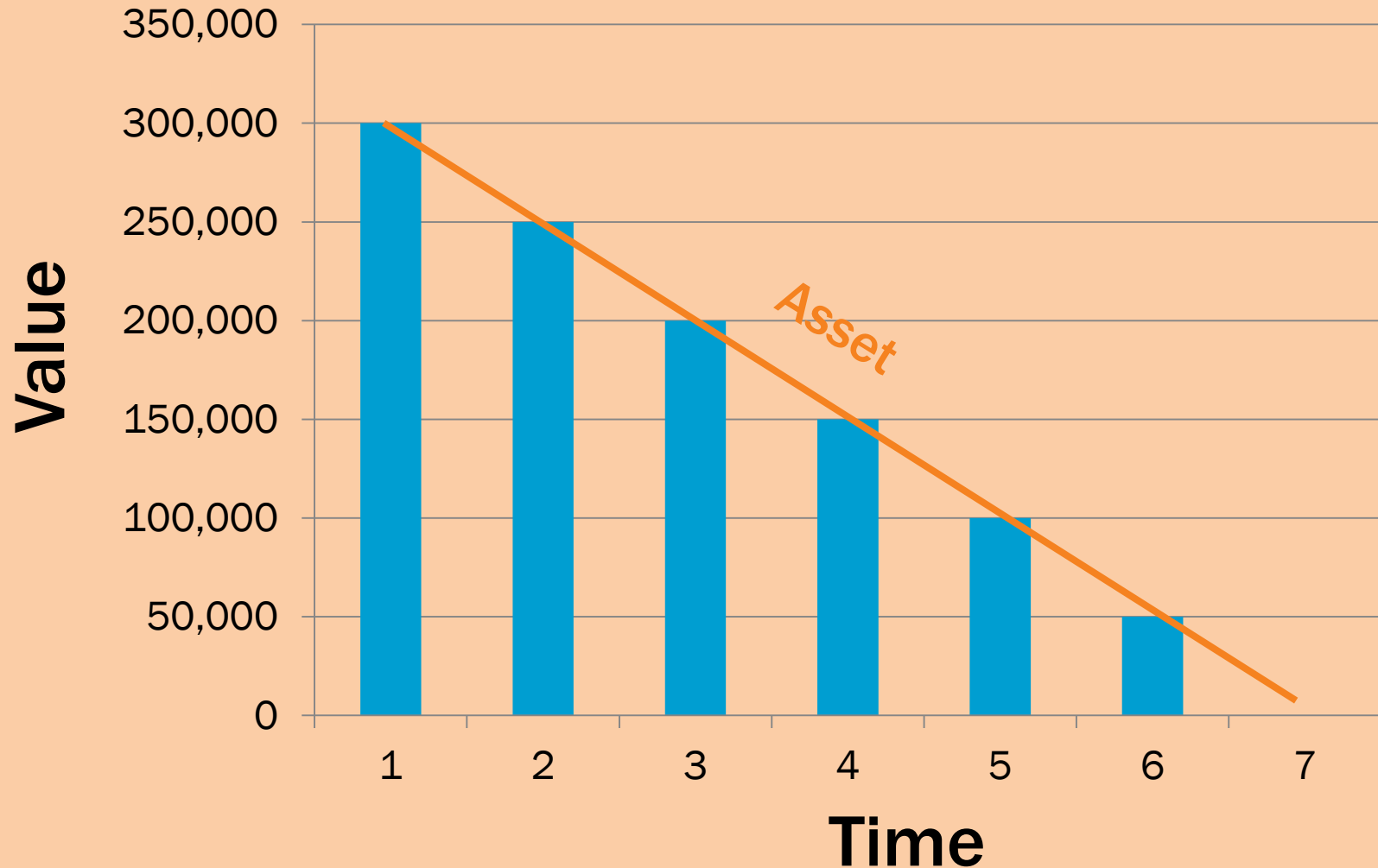
Data base



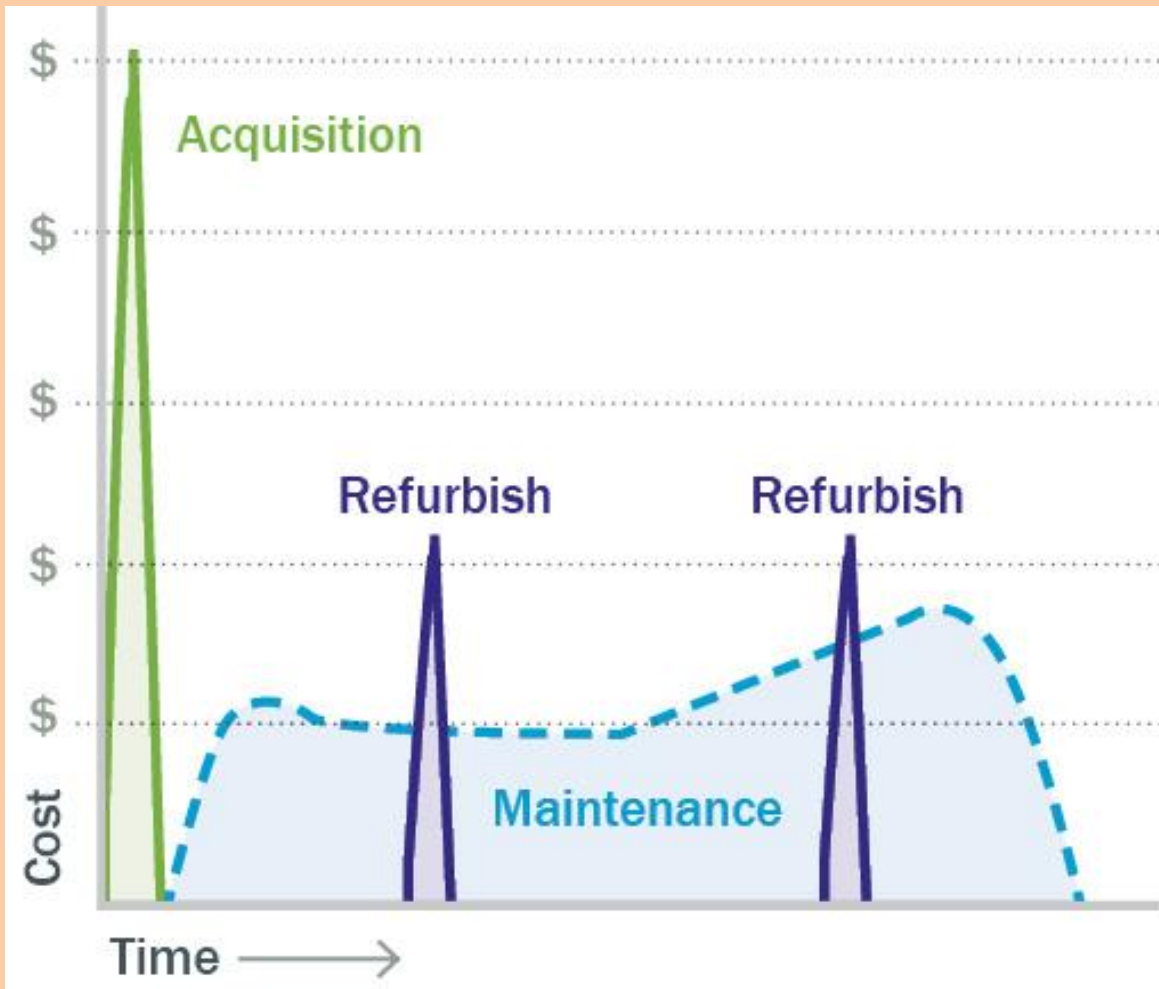
# AM “continuous improvement” cycle – e.g. AM programs don’t really “end”



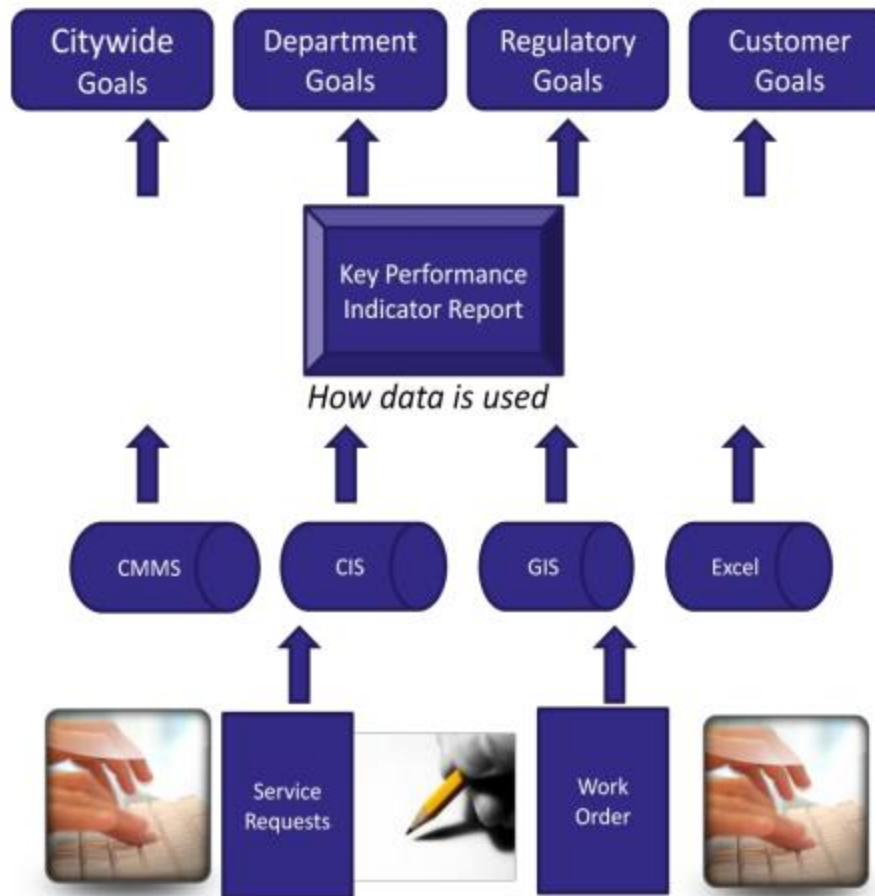
# They typically don't live like this!



# For point assets (e.g. plants, pumps etc.) the life-cycle looks more like this....



- ✓ Asset specific life-cycle analysis results in accurate costs
- ✓ Distributed failure of linear assets spreads replacement costs over time
- ✓ Actuarial calculations lead to more accurate useful life estimates



*People perform workflows to achieve the Goals and input data into the systems.*

**Assessment of CMMS Software Options.** In addition to the functionality requirements listed above, consideration in selecting CMMS software should also be given to specific needs of DWM as well as ease of use and application flexibility. DWM's CMMS selection should also be characterized by:

- Flexible Reporting – Produces standard, customizable, and custom-created reports from within the application
- Modular – Can be expanded to additional assets and additional users
- Usability – Logical configuration and use
- Vendor Support – Vendor qualified and responsive to install and configure the software and qualified and available to provide all required training to operate and maintain the system
- Mobile Support – Compatible with use from remote facilities or via mobile devices, including “smart phones”
- Architecture – Client-server application platform or Web-based



# Managing Work



# The term “Asset Management” often doesn’t go over too big

- Many agencies don’t want an “AM” program, but want to do better
- Finding best next steps for that agency
- They are likely already doing some form of an AM program







# Success comes with agency support (and belief)

- Benefits are not immediate
- Need internal “champions” to drive new processes
- Need managerial support for folks to step outside their “day-jobs”
- Often too much emphasis on tools and not enough on process
- Decision makers may be hard to convince of the long term benefits



# Maintenance work

*Scheduling, completing, tracking  
and reporting*



# Agency assets – what we all would like to know.....

What do we own and where is it?

What condition is it in?

What are the likelihood and consequence of failure?

How should we maintain it?

Focus on critical assets

Analyze how data is collected

Work Orders (WO's) go to prioritized assets

Better updates for financial forecasting (and rates!)

Basic

Advanced

# CMMS systems - manage the detail of both assets and the work performed

## The “What and When”

- Detailed asset inventory
- Maintenance history
- Maintenance and budget planning tool
- Generates reports
- Dynamic/transactional
- What you own, what you’ve done, what you have to do

The image displays two overlapping software windows from a CMMS system. The top window, titled 'Work Order', shows a detailed record for a 'SHAMHOLE' entry. It includes fields for 'Requested By' (Shaich, Penny), 'Submitted To' (Schnack, Esmeraldo), 'Project Start/Finish' (06/06/2002), and 'Actual Start/Finish' (MM/DD/YYYY). A map on the right shows the location. The bottom window, titled 'Work Request Form', contains a 'Main Break' issue reported on 01/03/2005 at 9:30:00 AM. It includes caller information for Stanley Romp, location details for 22 Betty Dr, Santa Barbara, and status information such as 'Completed' and 'Requested by Slight, Laurie A'.

# Working towards long term benefits

- Collect reliable data to measure performance
  - Workload backlog
  - Productivity
  - Effectiveness of preventative maintenance
  - Improves focus on critical assets
  - True O&M costs

## Standardize O&M practices

- Extend useful life and reduce O&M-related equipment failures
- Facilitates continual improvement
- Captures system O&M knowledge
- Streamline work practices

# Benefits to Small Agencies

## Standardize O&M practices

- Extend useful life and reduce O&M-related equipment failures
- Facilitates continual improvement
- Captures system O&M knowledge
- Streamline work practices

# **Santa Barbara - Accomplishments for Water Distribution**

- Early stages of implementation
- Developing visibility of what it really takes to maintain system
- Standardized work processes improves performance and versatility
- Starting to see and react to patterns, inefficiencies and costs
- Improved communication and visibility between work groups and management



# Preventative Maintenance Metrics

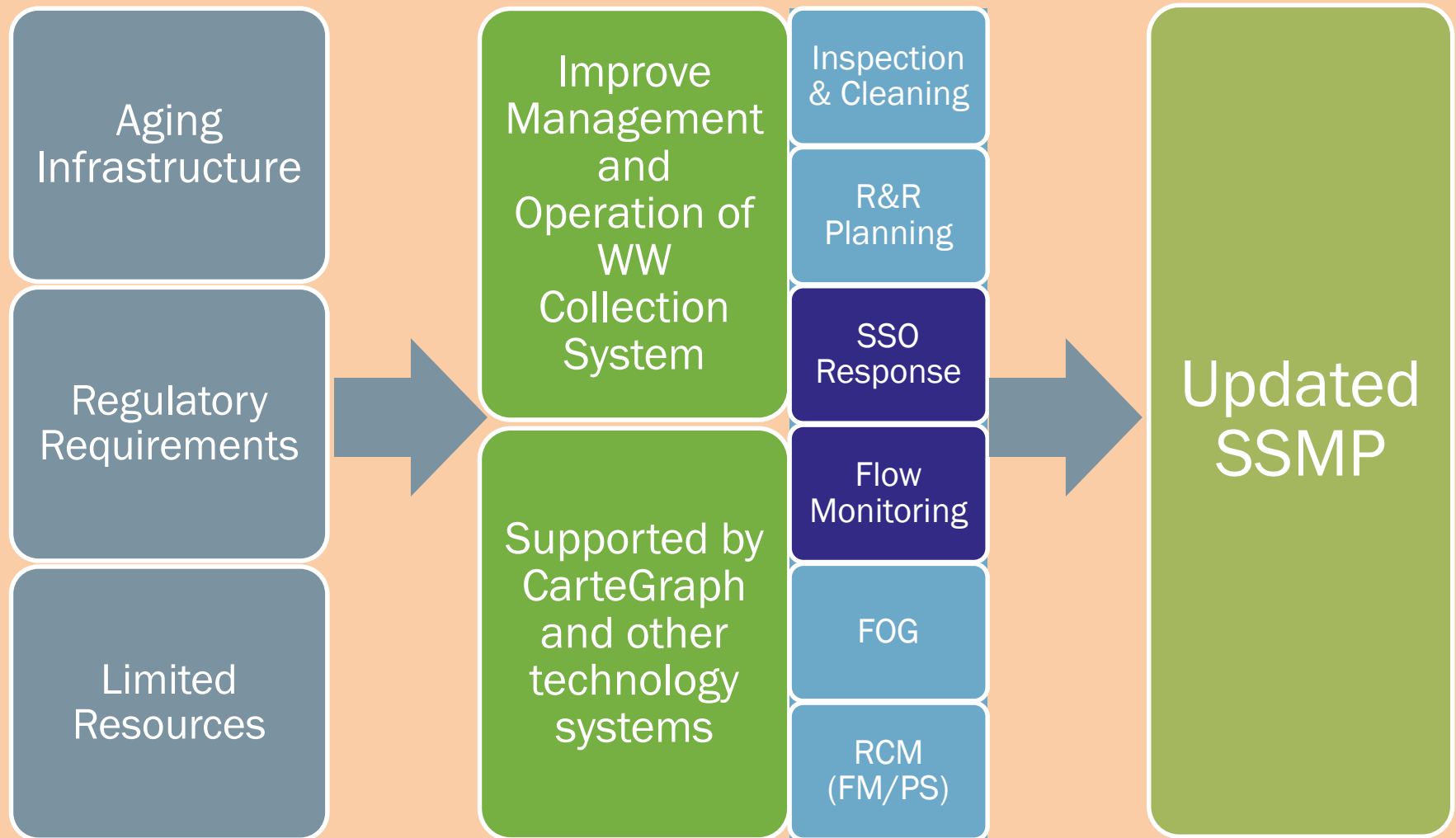
Facility	User Requested Reporting Date Range (i.e. 1/12 to 12/12)						PMs Total Hours	CMs Total Hours	% CMs vs. PMs	CM/PM vs. PMs Completed
	PMs Planned	PMs Completed	%PMs Completed	Hours Estimated	Hours Actual	Hours Actual vs. Estimated				
Bothin Pump Station	89	67	75%	40	67	168%	40	67	168%	167 : 75
Escondido Pump Station	88	67	76%	88	67	76%	88	67	76%	76 : 76
Rocky Nook Pump Station	78	67	86%	99	67	68%	99	67	68%	67 : 85
Alameda Well	140	130	93%	170	130	76%	170	130	76%	76 : 92
San Roque Well	150	130	87%	120	130	108%	120	130	108%	108 : 86

- **PMs Planned:** The number of schedule PMs for the time period defines the overall maintenance plan.
- **PMs Completed:** How many of the planned PMs were actually completed?
- **%PMs Completed:** How well was the plan followed?
- **Hours Estimated:** Number of planned hours for preventative maintenance
- **Actual Hours:** Number of hours spent on preventative maintenance
- **Hour Actual vs. Estimated:** How close is the plan to the actual execution?
- **PMs total hours:** Same as Actual Hours.
- **CMs Total Hours:** Number of hours spent on corrective maintenance.
- **% CMs vs. PMs:** Helps identify high areas of unplanned maintenance.
- **CM/PM vs PMs Completed:** Compares areas of high unplanned maintenance with how effective the planned preventative maintenance program is being executed.

# Collections Results (a few highlights of many)

- New processes and systems in use for 2 years
- Decreased annual SSOs over 40% (on average)
- Successfully meeting Consent Decree requirements
- On track to clean entire system over 5 years
- On track to inspect entire system over 10 years
- Developed new Sewer CIP process that is managed by Engineering instead of Collection Systems
- Formalized FOG Restaurant Inspection program
- Developed Sewer Lateral Inspection Program
- Updated and audited Sewer System Management Plan

# Standard Workflows Supported by Technology Helped Santa Barbara Achieve its Goals



# Clark Regional Slides

# Vision

- 10 Attributes of Effectively Managed Utilities



# Vision

# Vision

- **Financial Viability**

- Understand full life-cycle cost of utility
- Establish & maintain effective balance between:
  - Long-term debt
  - Asset values
  - Operations / maintenance expenditures
  - Operating revenues
- Establish predictable rates (consistent with community expectations / acceptability) adequate to recover costs
- Provide for reserves
- Maintain support from bond rating agencies
- Plan / invest for future needs



# Vision

- Infrastructure Stability
  - Understand condition of & costs associated with critical infrastructure assets
  - Maintain / enhance condition of all assets
    - Over long-term at lowest possible life-cycle cost
    - Acceptable risk consistent with customer, community & regulator-supported service levels
    - Consistent with anticipated growth & system reliability goals
  - Assure asset repair, rehabilitation & replacements are coordinated to minimize disruptions & other negative consequences

# Vision

- Customer Focused
  - Meet customer expectations - public values survey
- Environmental Stewardship / Protecting Water Resources
  - Proactive management of the system minimizes backups, I&I and unexpected pipe failures
- Financial Responsibility
  - Stable rates
  - Staffing and workload planning
  - Minimize the high cost of emergency repairs and overflows
  - Prioritizing limited resources - Fix the Worst First!
- Responsible Management
  - Practicality of managing 9,500 main line pipes segments
- Supporting Economic Development
  - Reliable sewer system
  - Targeted investments

# Program Development

# Program Development

- Develop a ground level record system capable of Work order and asset management

AND

- Critical Sewers Analysis
- Condition Assessment
- Asset Risk
- Project Prioritization Process
- Program Level Project Scoping
- Documentation



# Program Development

- Program Outline
  - ☑ Identify Existing Data
    - GIS and CCTV Investments
    - Historical data and “tribal Knowledge”
  - ☑ Critical Sewer Analysis
    - Consequence of Failure (GIS Analysis)
  - ☑ Asset Condition
    - Probability of Failure (CCTV Data)

# Program Development

- Program Outline
  - Asset Risk
    - Combining Condition and Criticality (GIS Analysis)
  - Develop Prioritization Concept
  - Define R&R Projects
  - Prioritize R&R Projects
  - Project Priority Array

# Existing Data



# Gaining Staff Buy In



# Non Tech Savvy?



# Giving Ownership



# Existing Data

- Identify Existing Data
  - Assets
    - GIS
    - Hand written WO
  - Asset Condition
    - CCTV Data
      - 475 miles of CCTV in Maintenance Management System (Granite & Lucity)
      - Data collected since 2005, 95% of main lines
      - All lines televised at some point
    - Tribal Knowledge of known defects





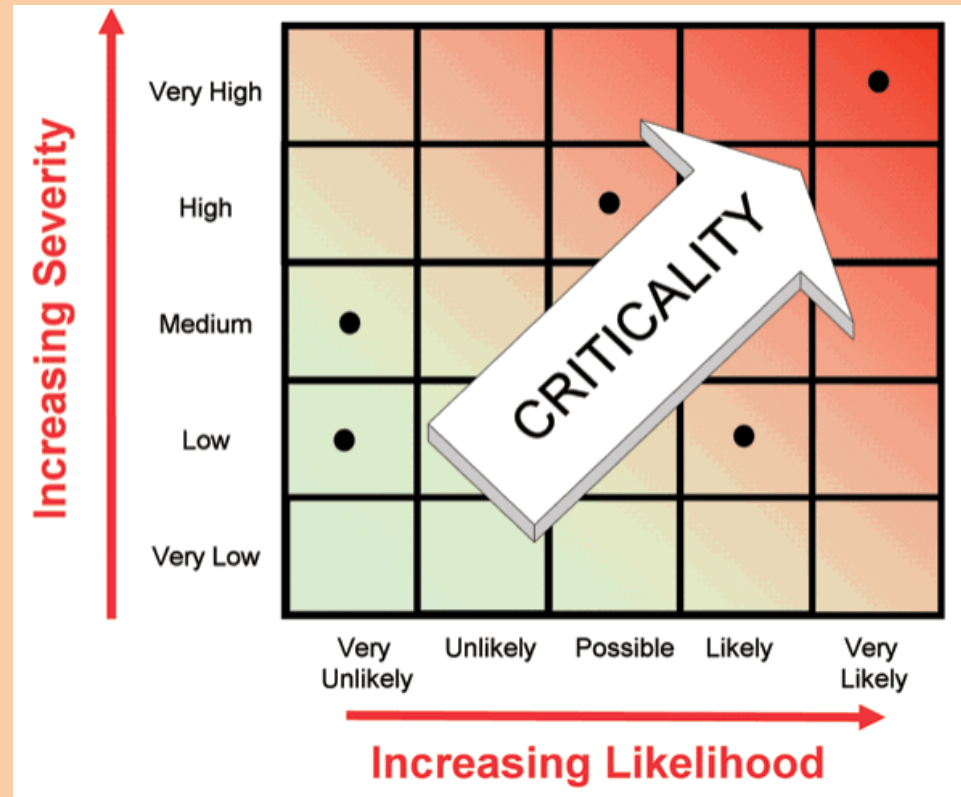


**An example of non Work Order  
usage:**

**Critical Sewer Analysis**

# Critical Sewer Analysis

- Defining Criticality
  - 1 to 3 scoring scale based on potential impact of asset failures or “consequence of failure”

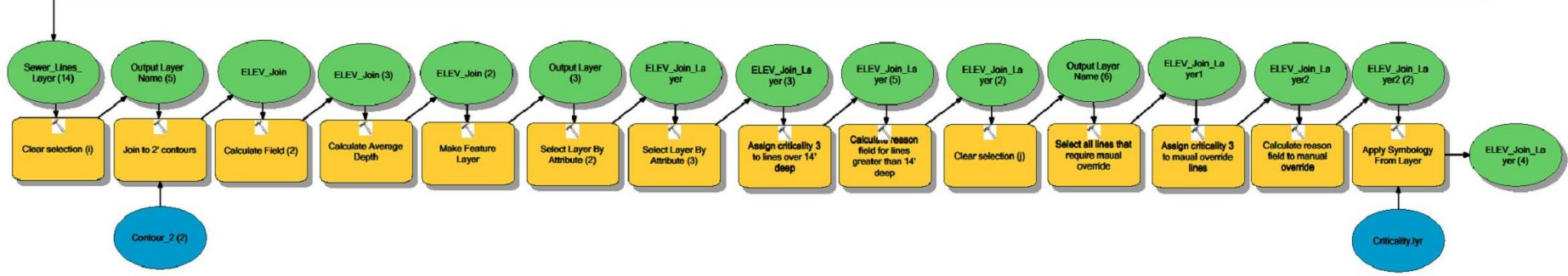
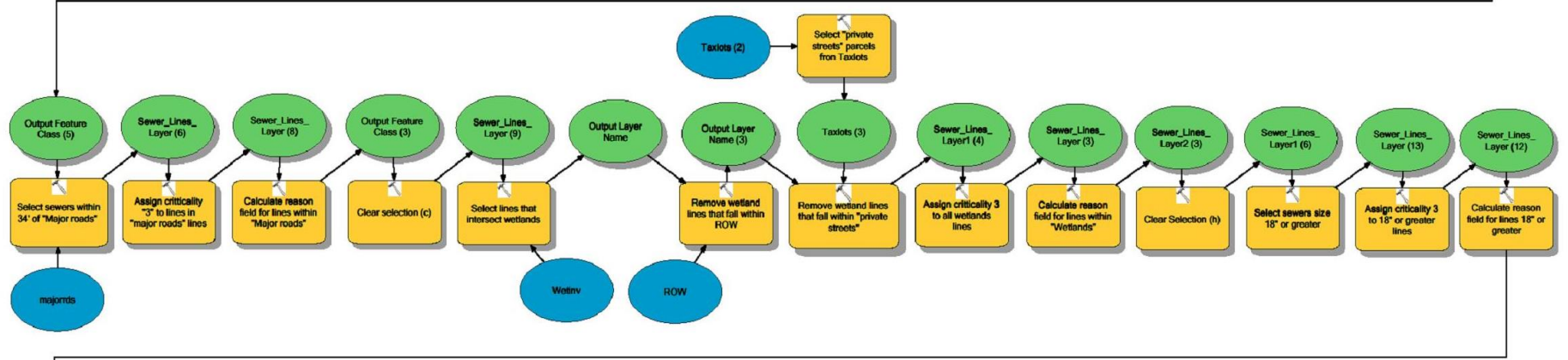
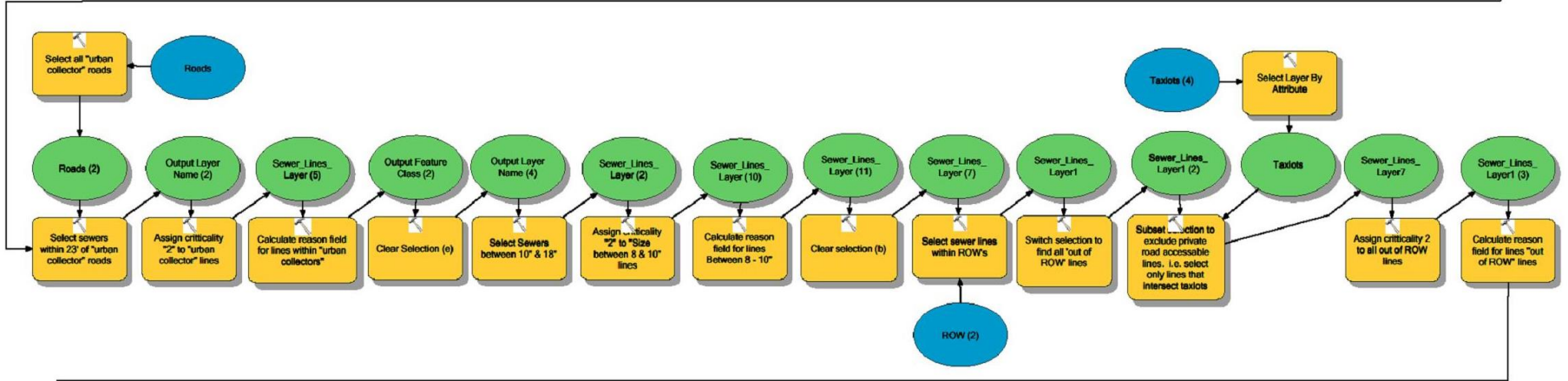
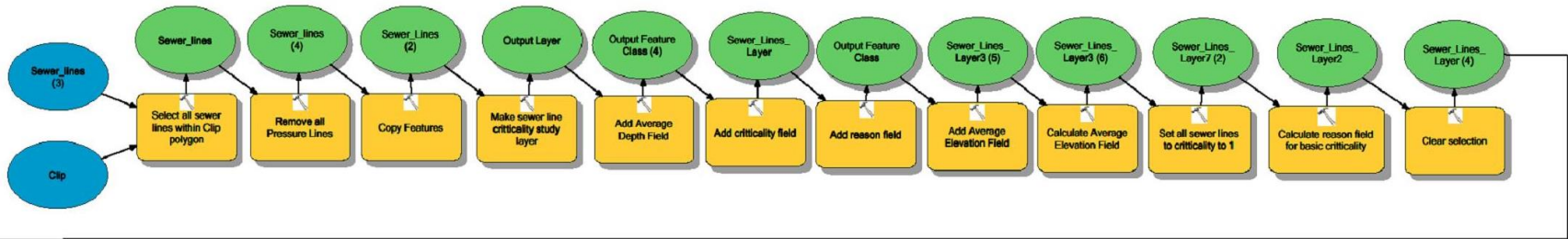




# Critical Sewer Analysis

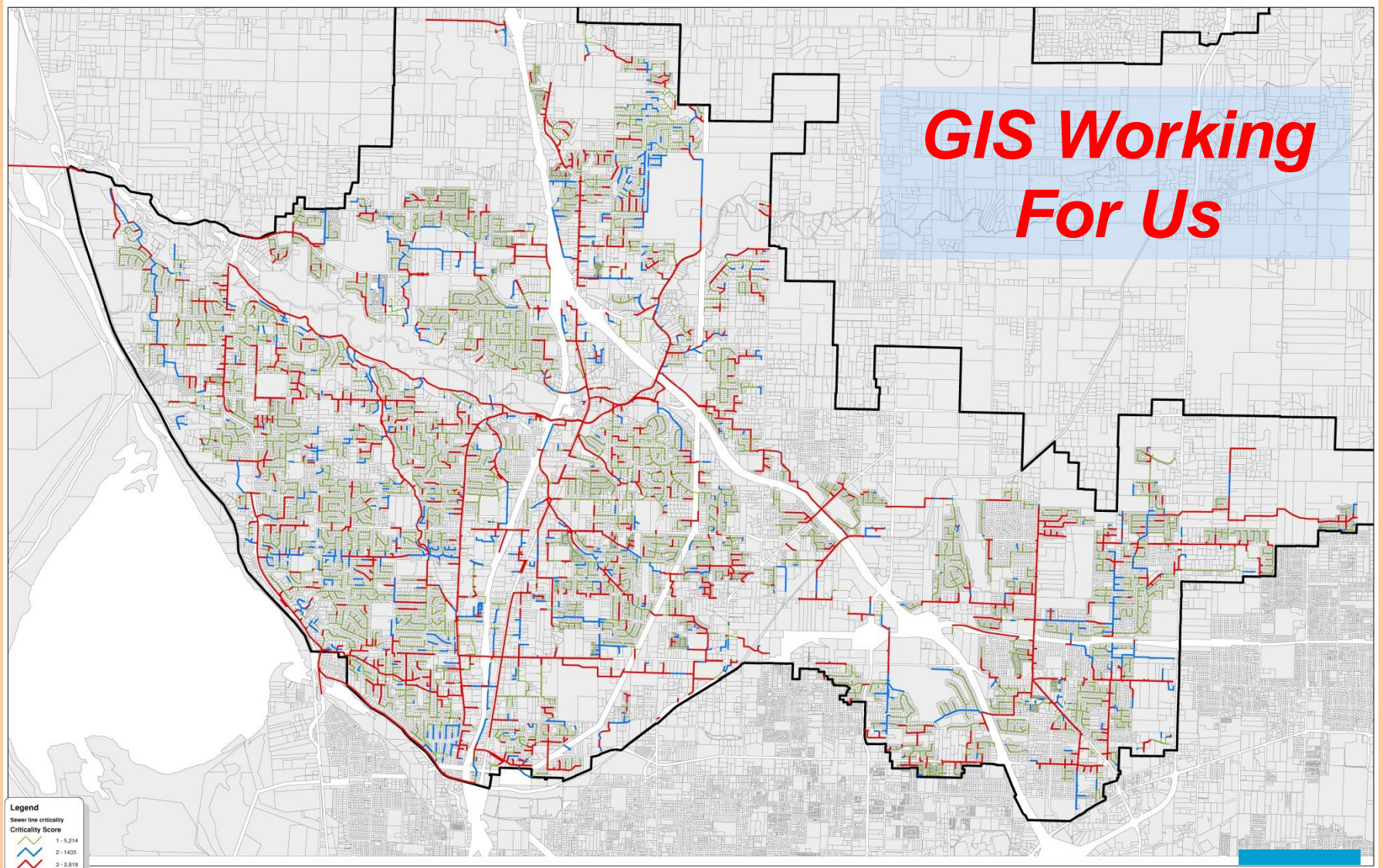
- Score of 3 includes pipes:
  - in major roads (parkways, arterials)
  - in environmentally sensitive areas
    - Includes all difficult to access canyon lines
  - Greater than 18" diameter
  - More than 14' deep
- Score of 2 includes pipes:
  - In urban collectors
  - Inaccessible lines
  - 10" to 18 " diameter
- Score of 1 includes all other pipes







# Critical Sewer Analysis



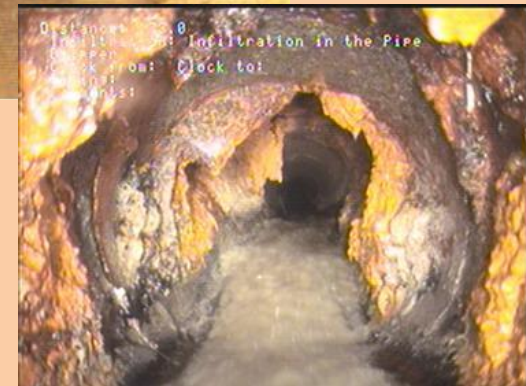




# Condition Assessment

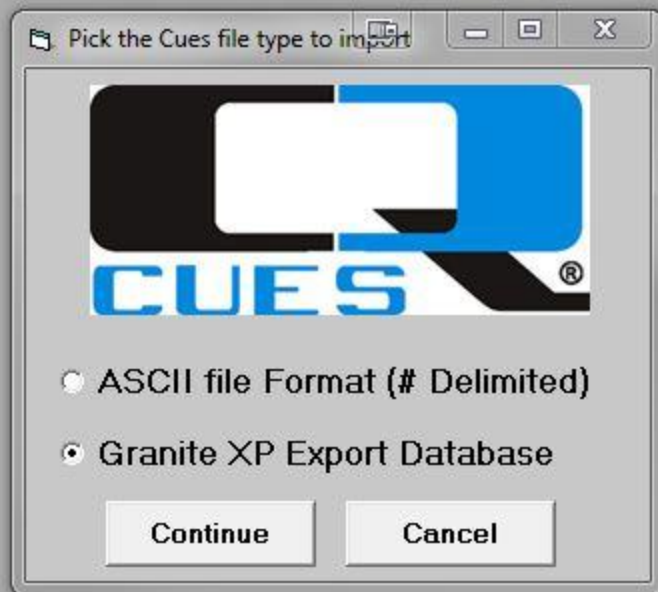
# Condition Assessment

- CCTV Data
  - Infiltration / Inflow
  - Structural – Cracks / Shears
  - Sags
  - Roots
  - Fats, Oils, Grease (FOG)



# Condition Assessment

- CCTV Data Collected from Cues CCTV trucks.





# Condition Assessment

- CCTV Data Scoring “Weight”

Lucity Inspection Setup - No Filter

Flow Basin: DEFAULT

ALL FLOWS IN GPM

TV/Lamp Infil | TV/Lamp Struc | TV/Lamp Clean | Struct Flow | Struct Cover | Struct Structural | Smk/Dye/Bldg | Bldg Sumps

Field Code /	Defect Type	Structure Rating 1	Structure Rating 2	Structure Rating 3	Structure Rating 4	Structure Rating 5
01	Crack-Radial	1	2	5	10	20
02	Crack-Horizontal	1	2	5	10	20
03	Broken Pipe	30	50	70	100	130
04	Collapsed Pipe	0	0	0	200	400
05	Wye Service	0	0	0	0	0
06	Break-in Conn	100	125	150	175	200
07	Extended Tap	1	5	10	25	100
08	Offset	0	0	25	70	120
09	Gapped Joint	0	0	25	70	120
10	Roots	1	5	10	75	100
11	Debris	0	0	0	0	0
12	Grease	0	0	0	0	0
13	Corrosion	3	6	10	25	75
14	Scaling	3	6	10	25	75
15	Sag	1	2	5	10	25
16	Infiltration	0	0	0	0	0
17	New Manhole	0	0	0	0	0
18	Other	0	0	0	0	0
31	Pipe Seal	5	10	20	30	50
35	Belly in Pipe	15	25	50	60	75
36	Cavity	30	50	70	100	130
37	Clean Out					
38	CONTINUE DS					
39	CONTINUE US					
40	Crack	1	2	5	10	20
41	Deposits					
42	End Inspection					
44	H2S Erosion	25	30	50	60	75
46	Joint - Infiltration	5	6	25	30	50

Record 1 of 1 | View Mode | Ready...

# Condition Assessment

Sewer TV Inspection - Unnamed Filter Set

43-180         3444  
 43-167             2333  
 3474         Most Recent Inspect

Set-up | Pipes | Data | TV Observation | Summary | Rehab | Custom | Comment

# of TV Connections

Distance (ft)/	VCR Counter	Location Text	Description Text	Rating (1-5)	Start Clock	Document Available	La
8.00			START US	0		No	
8.70			Grease	3		No	
39.20			Root-in-Joint	1		Yes	
41.80			Root-in-Joint	1		Yes	
44.40			LAT	0	2	No	
51.00			Root-in-Joint	1		Yes	
62.70			LAT	0	10	No	
94.00			Root-in-Joint	3		Yes	
102.30			Root-in-Joint	3		Yes	
105.40			Root-in-Lateral	1	10	Yes	
105.40			LAT	0	2	No	
105.40			LAT	0	10	Yes	
108.60			Root-in-Joint	3		Yes	
117.90			Root-in-Joint	5		Yes	
120.80			Root-in-Joint	5		Yes	
127.00			Root-in-Joint	5		Yes	
130.00			Root-in-Joint	5		Yes	
133.50			Root-in-Joint	5		Yes	
136.50			Root-in-Joint	1		Yes	
148.30			LAT	0	10	No	
153.80			Root-in-Joint	1		No	

Record 1 of 25    View Mode    Ready...



# Condition Assessment

- CCTV Data Simplified Based on Score



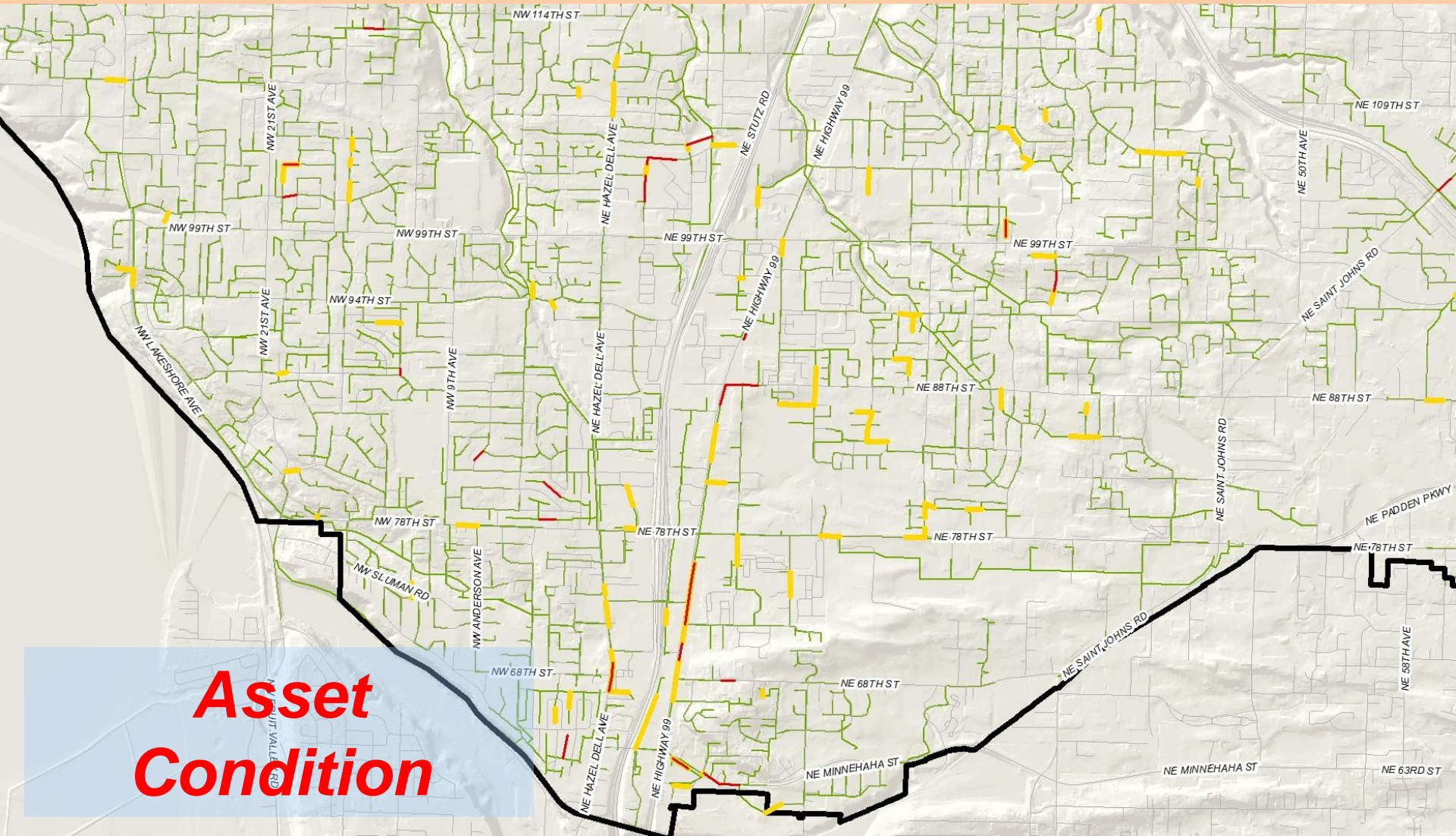
= Failing: Imminent failure

= Poor: Monitor, proactive repairs

= Good: No concerns



# Asset Assessment



# Asset Risk

# Asset Risk

- Integrating Criticality & Condition
  - Criticality – Consequence of Failure
    - Score 1, 2, or 3
  - Condition – Risk of Failure
    - Score Red, Yellow, Green
- Extra point, or fraction of a point added for hot spots.

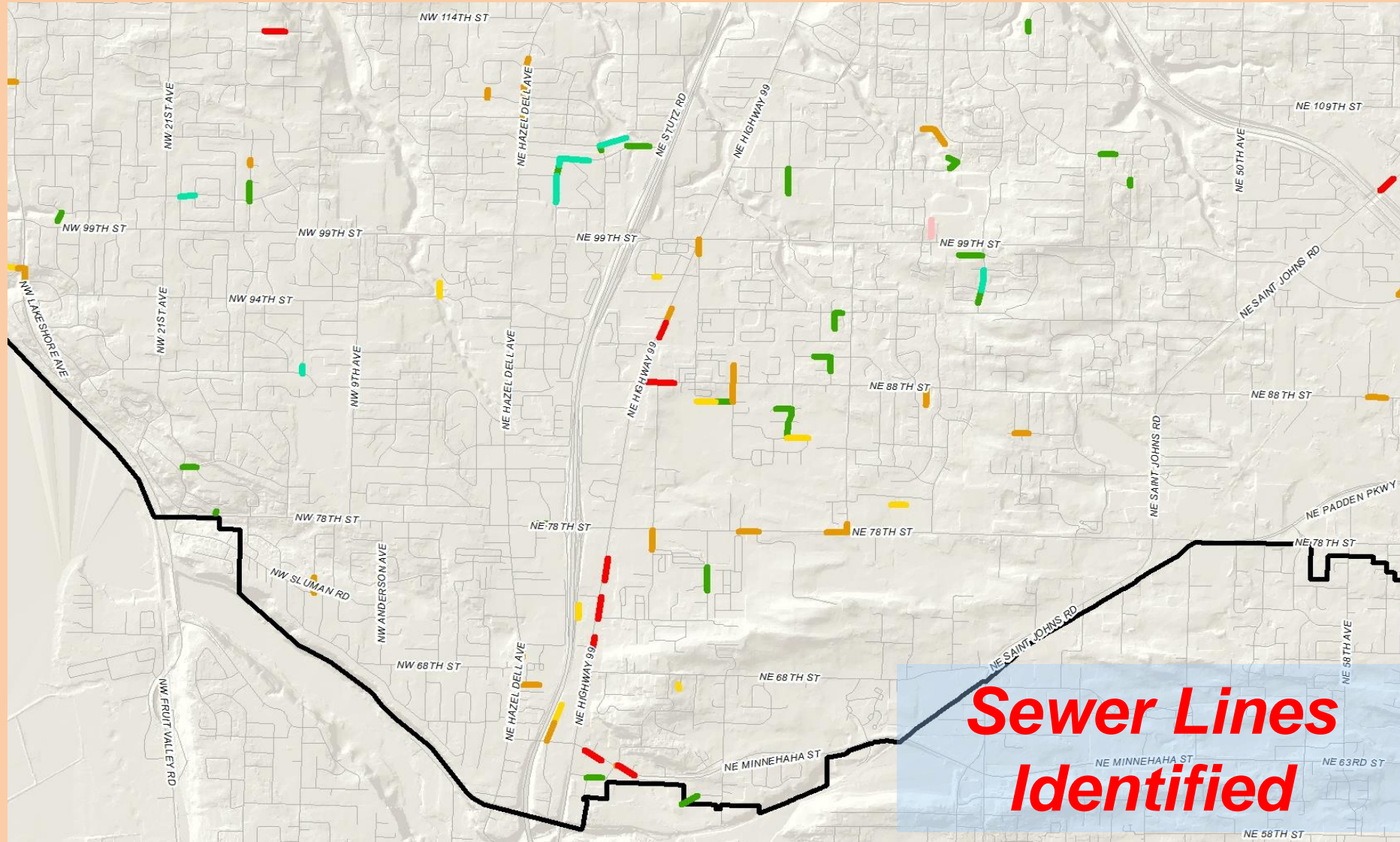
$$\text{Asset Risk} = \text{Criticality} + \text{Condition}$$



# Asset Risk

Condition (Risk of Failure)	Red	Watch/Fix Medium Priority 7,584 ft	Fix High Priority 1,651 ft	Fix Now 4,820 ft
	Yellow	Watch Low Priority 10,329 ft	Watch Medium Priority 4,494 ft	Watch High Priority 6,357 ft
	Green	Standard Maintenance	Watch Low Priority	Watch Medium Priority
		1	2	3
		Criticality (Consequence of Failure)		

# Asset Risk





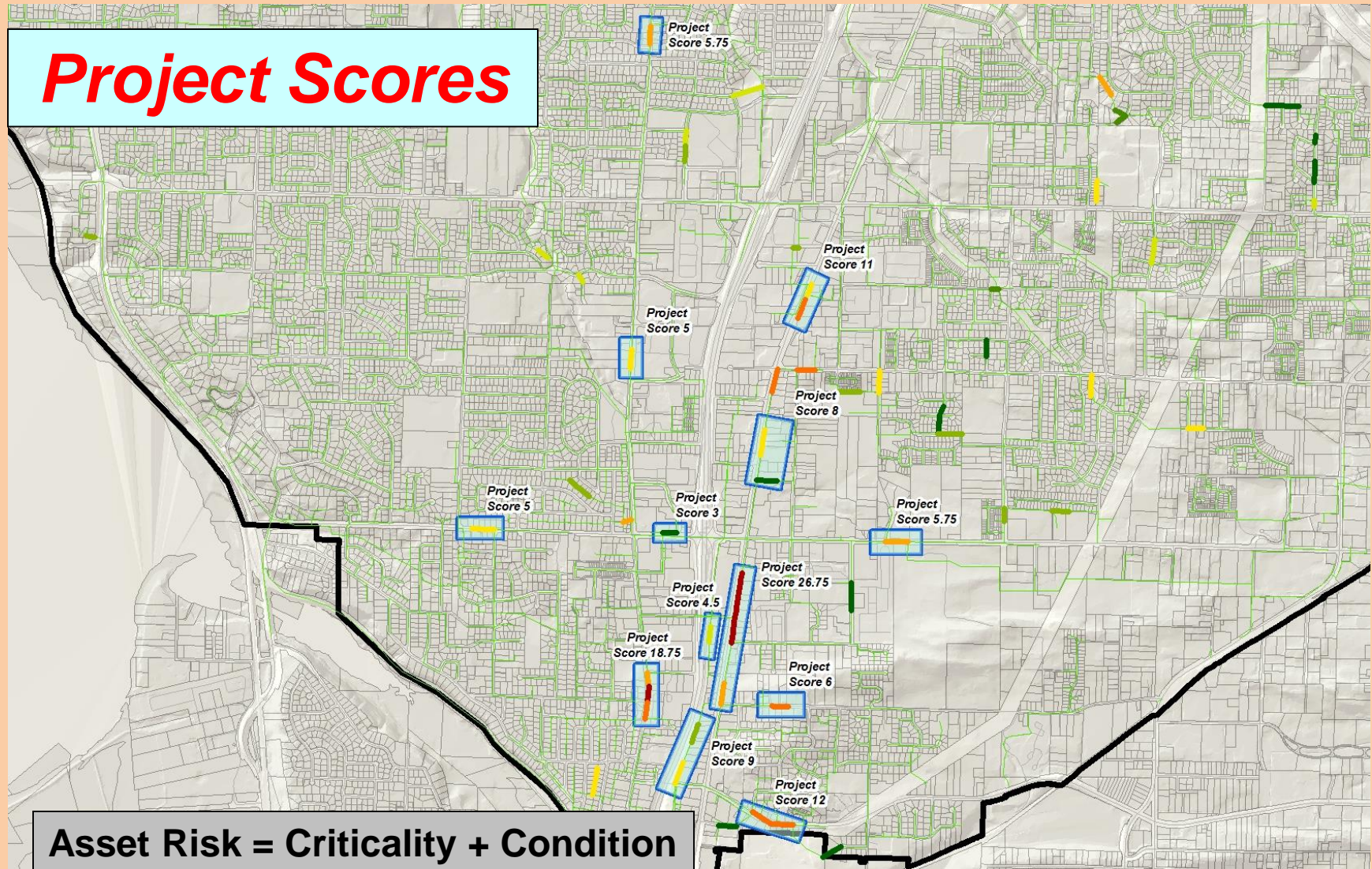


# Project Scoring



# Project Scoring

## *Project Scores*



# Next Steps

# Lucy Rehab module

- Expand on our use of the rehab module.

Pipe Rehab Work Tasks - No Filter

Task: 1115 point repairs main dig up

WO Task Code: 1115

Rehab Units: 3 Each

Rehab Class:

% I/I Removed:

Min Rehab Length: 3

Pt Repair Min Dist: 1

Default Task Cost - Up to 10 feet Deep

	Easy	Difficult
Unpaved	10000.00	15000.00
Paved	15000.00	20000.00
Heavy Traffic	20000.00	20000.00

Cost per each VF > 10 ft: 10.00

Cost per Pipe Diameter

Dia /	Unpaved-Easy	Paved-Easy	Heavy-Easy	Unpaved-Diff	Paved-Diff	Heavy-Diff	Cost>10Ft

Record 2 of 8 View Mode Ready...



# Next Steps

- Project Priority Array
- Capital Project component
- Pump Stations
- Force Mains
- Rework codes/weights to work with

PACP



# Lessons Learned

- You have more data collected than you realize even before implementation
- Staff support and Management buy in is crucial to any systems success
- CMMS systems, once populated, save time, money.
- Adds quantifiable data to back rehab needs and cost allocation.
- Provides an easily searchable data base to provide history on work/assets, customer issues and inquires, and any other data you may want to “gather”

# Clark Regional – Existing Data

- Identify Existing Data
  - Assets
    - GIS
    - Hand written WO
  - Asset Condition
    - CCTV Data
      - 475 miles of CCTV in Maintenance Management System (Granite & Lucity)
      - Data collected since 2005, 95% of main lines
      - All lines televised at some point
    - Tribal Knowledge of known defects



# If my CMMS was fully populated with asset and work information benefits can include...



streamline and focus work management

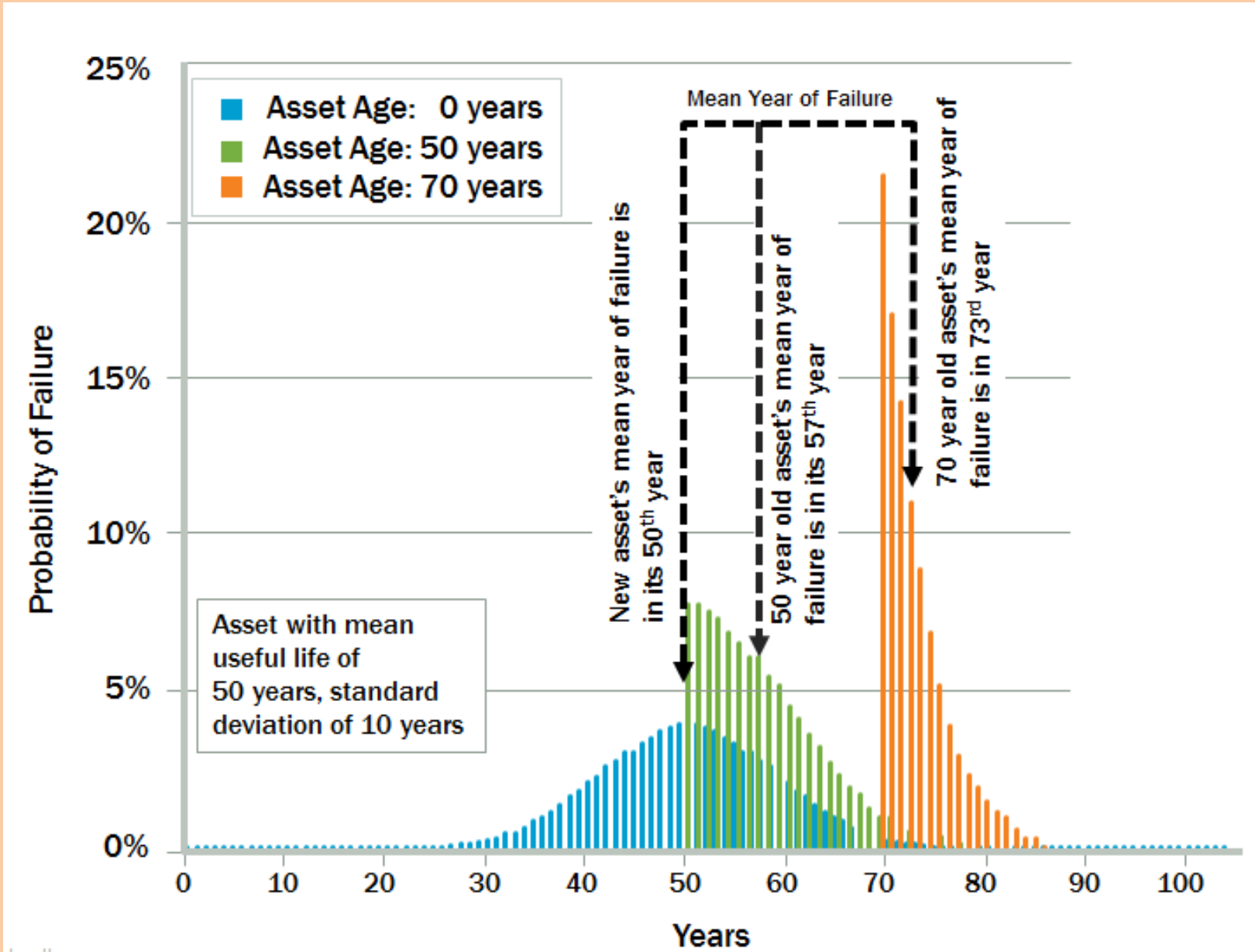
systematically prioritize work and record work history

Can report across groups of assets

Easier to find information gaps

Good data to other systems (e.g. financial or HR/staffing)

# And Linear Assets fail more like this.....



# More realistic R&R planning supports financial forecasts.....

**Scenario Management**

Select scenario:  Copy from:

## R&R Planning Model Control Panel

**Actions**

Protected mode  Create logs

**Changes in asterisked items require re-running the simulation. Blue entries or labels indicate changes not yet saved.**

**Study Parameters**

Initial study year*	2014	<input checked="" type="checkbox"/>
Length of study (Years)	30	<input checked="" type="checkbox"/>

**Basic R&R Fund Parameters**

2014 fund balance (000s)	\$25,500	<input checked="" type="checkbox"/>
Future cost escalation (%)	3.50%	<input checked="" type="checkbox"/>
Earnings rate (%)	1.04%	<input checked="" type="checkbox"/>
Borrowing rate (%)	3.00%	<input checked="" type="checkbox"/>

**Other R&R Fund Parameters**

Funding filter, low (000s)*	\$0	<input checked="" type="checkbox"/>
Funding filter, high (000s)*	\$100,000	<input checked="" type="checkbox"/>
Portion of R&R funded (%)	100%	<input checked="" type="checkbox"/>
Portion of WTP R&R funded (%)*	40%	<input checked="" type="checkbox"/>
Portion of Pipe Planned For Renewal Using CIPP (%)	10%	<input checked="" type="checkbox"/>

**R&R Fund Options**

Include refurb  Chg int on neg bal

**R&R Fund Revenue Sources**

Annual transfers	Transfers...	<input checked="" type="checkbox"/>
R&R bond issues	Bonds...	<input checked="" type="checkbox"/>
R&R Surcharges	Surcharges...	<input checked="" type="checkbox"/>
Other cash flows	Other flows...	<input checked="" type="checkbox"/>

**Failure Parameters**

Failure handling	Distributed	<input checked="" type="checkbox"/>
Pipe lives (% of default)*	100%	<input checked="" type="checkbox"/>

= Click to copy current value to all scenarios  = Values differ among saved scenarios

Current dollars  Smoothed (Scale in \$000s)

Year	Value
2014	28000
2016	32000
2018	35000
2020	37000
2022	38000
2024	35000
2026	28000
2028	20000
2030	12000
2032	5000
2034	0
2036	-10000
2038	-20000
2040	-25000
2042	-15000





# CMMS systems - What does a utility need to get started?



# Don't get lost in the alphabet soup of an AM program

Small

Medium

Large

- Consequence of Failure (COF) and Probability of Failure (POF)
- Focus on a critical asset class to collect additional data
- Update CMMS
- Update financial

- COF and POF
- Asset Management Program Evaluation (AMPE)
- Business Process Analysis (BPA)
- Collect additional data
- Update CMMS
- Update financial

- COF+ and POF+
- BRE
- AMPE
- Teams
- BPA
- BCE
- SAMPs
- Resiliency
- ISO
- IIMM
- ISI
- CMMS
- Financial

# Getting started – CMMS implementations are journeys.....not destinations

- **Identify & Evaluate**

- Existing data sources and inventories
- Existing work practices
- Look for gaps (e.g. collections, vertical, work history etc.)
- How are you currently reporting (communicating with decision makers)?

- **1st round goals for system**

- Consolidated asset database
- Basic work management
- Basic reporting

**Starting slowly and simply is the key to success!**

# Choose a CMMS system that meets your agencies needs/goals now.....but is expandable

PRODUCT Attribute	Advantis	Infor	Hansen	GBA Master Series	CityWorks	MUNIS Work Management	Maximo
Plant-Asset Focused		✓	✓			✓	✓
Linear-Asset Focused	✓	✓	✓	✓	✓		✓
Client-Server							
Web-Based	✓	✓					
Relative Cost of Licensing & Implementation	Med	High					

- **Evaluation considerations**

- Flexible reporting
- Modular (can add assets/users)
- Ease of use
- Vendor support
- Mobile applications
- Cost

# Learn from others.....and find a champion

- **Benchmark**

- What systems are neighboring/similar agencies using?
- How is it working for them?
- Information sharing/user group potential

- **Identify an internal “champion(s)”**

- Day jobs will continuously get in the way
- One or more individuals needs to be focused on the effort and own it
- Other departments (e.g. IT) will need to be on board
- Business processes needed to support the tools



# CMMS systems – Benefits Recap



# Benefits to Small Agencies

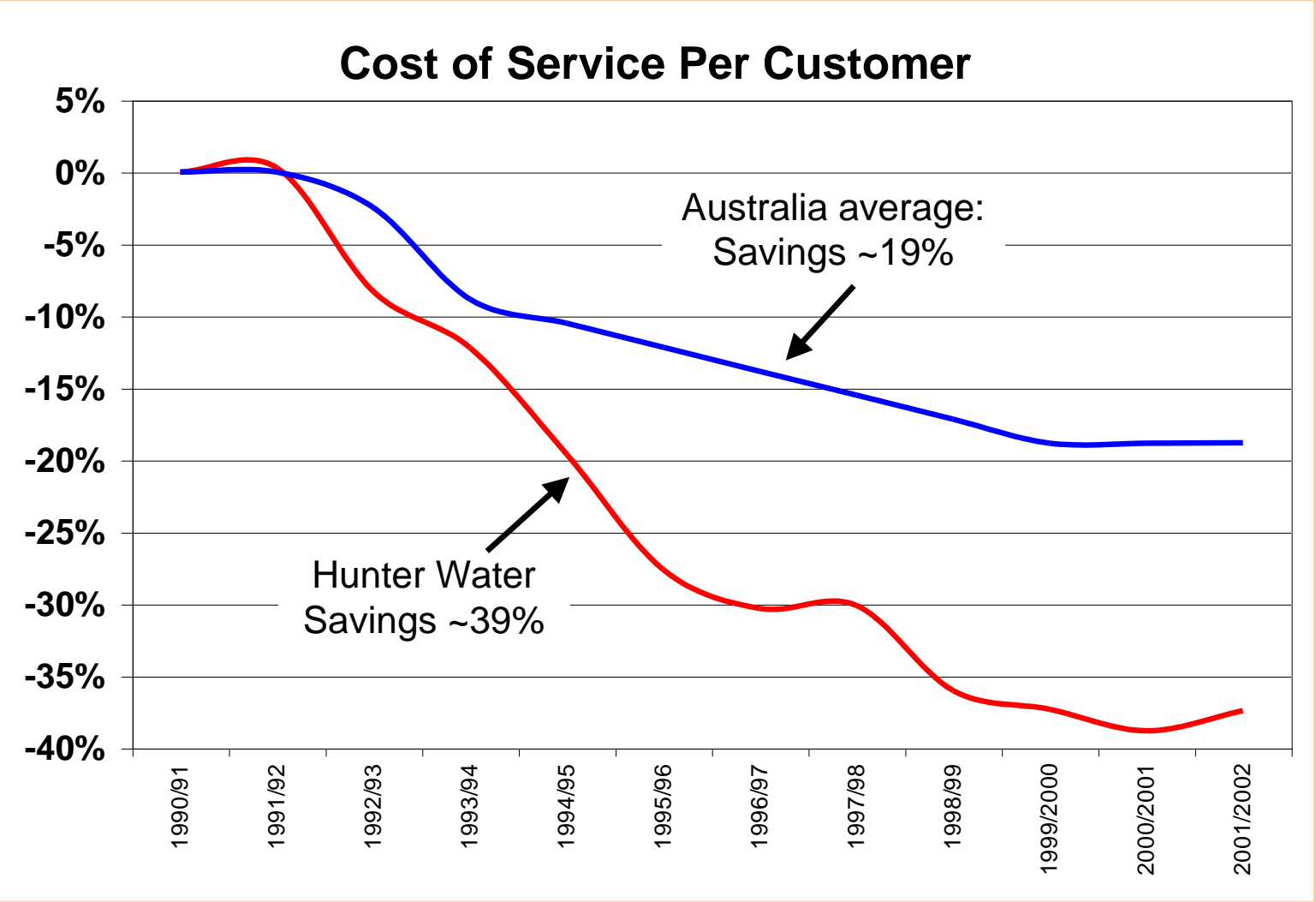
- Collect **reliable data** to **measure performance**
  - Workload backlog
  - Productivity
  - Effectiveness of preventative maintenance
  - Improves focus on critical assets
  - True O&M costs
- **Standardize** O&M practices
  - Extend useful life and reduce O&M-related equipment failures
  - Facilitates continual improvement
  - Captures system O&M knowledge
  - Streamline work practices

# Benefits to Small Agencies (cont.)

- **Quantify needs** to decision makers
  - demonstrate the need for more resources
  - prove warranty compliance or regulatory compliance
  - Support rate adjustments to decision makers
- Provides **visibility and transparency**
  - Management understands what is happening in the field
  - Field crews understand what is important for effective utility management



# Opportunity to capitalize on (and quantify) savings



# What Prompts DOC Now? (2 of 2)

- Increased scrutiny on rates and spending
- Accountability (to decision makers, rate payers or utility partners)
- Ability and confidence in providing proper LOS
- Ability to look further down the “funding road”
- Being asked to “*Tell the Story*” better

While physical infrastructure assets age, information technology advances.....

# Assumptions and Limitations

- Agencies of the same size are all different in areas like
  - General culture
  - How they embrace technology
  - Decision making process and governing bodies
  - Financial situation
  - Internal champions (or lack thereof)
  - Many others

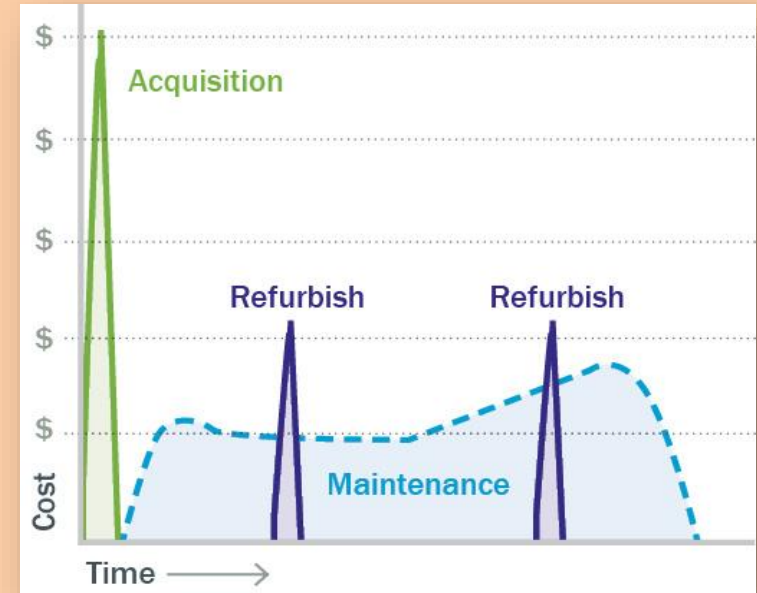
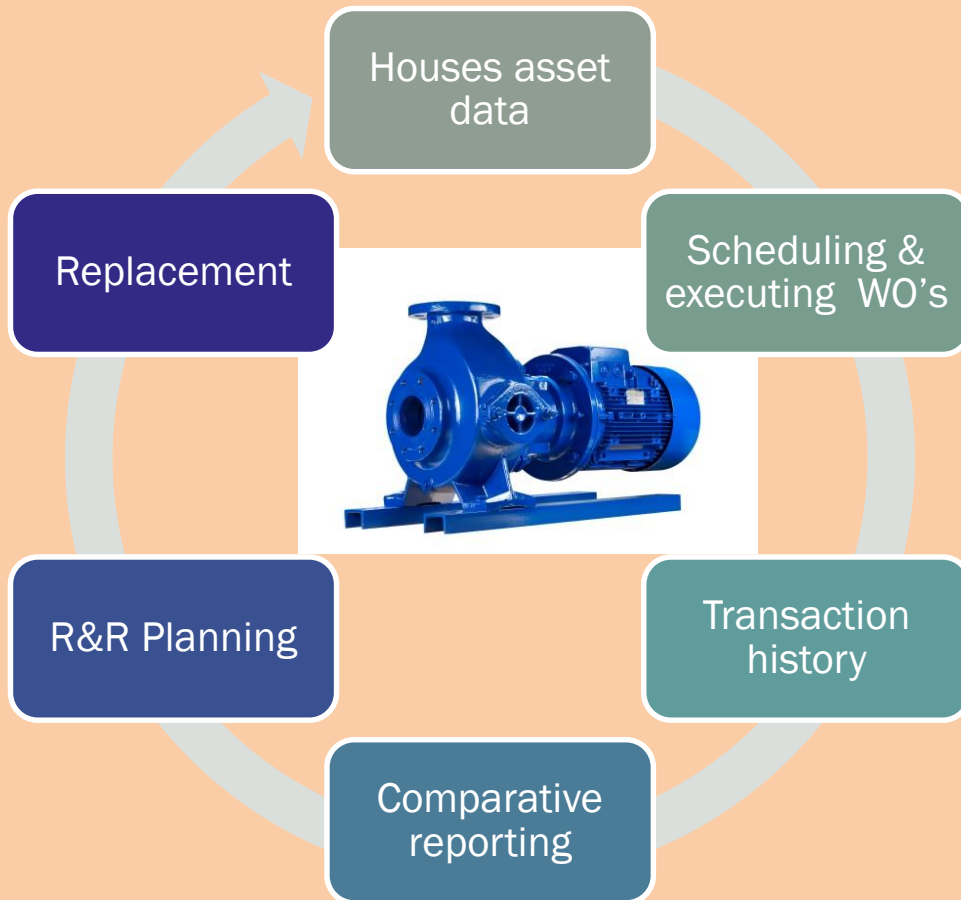
# View 5: Five core questions

#	Core Question	Detailed Questions
1	What is the current state of my assets?	<ul style="list-style-type: none"><li>▪ What do I own?</li><li>▪ Where is it?</li><li>▪ What condition is it in?</li><li>▪ What is its remaining useful life?</li><li>▪ What is its remaining economic value?</li></ul>
2	What is my required level of service (LOS)?	<ul style="list-style-type: none"><li>▪ What is the demand for my services by my stakeholders?</li><li>▪ What do regulators require?</li><li>▪ What is my actual performance?</li></ul>
3	Which assets are critical to sustained performance?	<ul style="list-style-type: none"><li>▪ How does it fail? How can it fail?</li><li>▪ What is the likelihood of failure?</li><li>▪ What does it cost to repair?</li><li>▪ What are the consequences of failure?</li></ul>
4	What are my best O&M and CIP investment strategies?	<ul style="list-style-type: none"><li>▪ What alternative management options exist?</li><li>▪ Which are the most feasible for my organization?</li></ul>
5	What is my best long-term funding strategy?	<ul style="list-style-type: none"><li>▪ Should we issue debt?</li><li>▪ Should we raise rates?</li></ul>

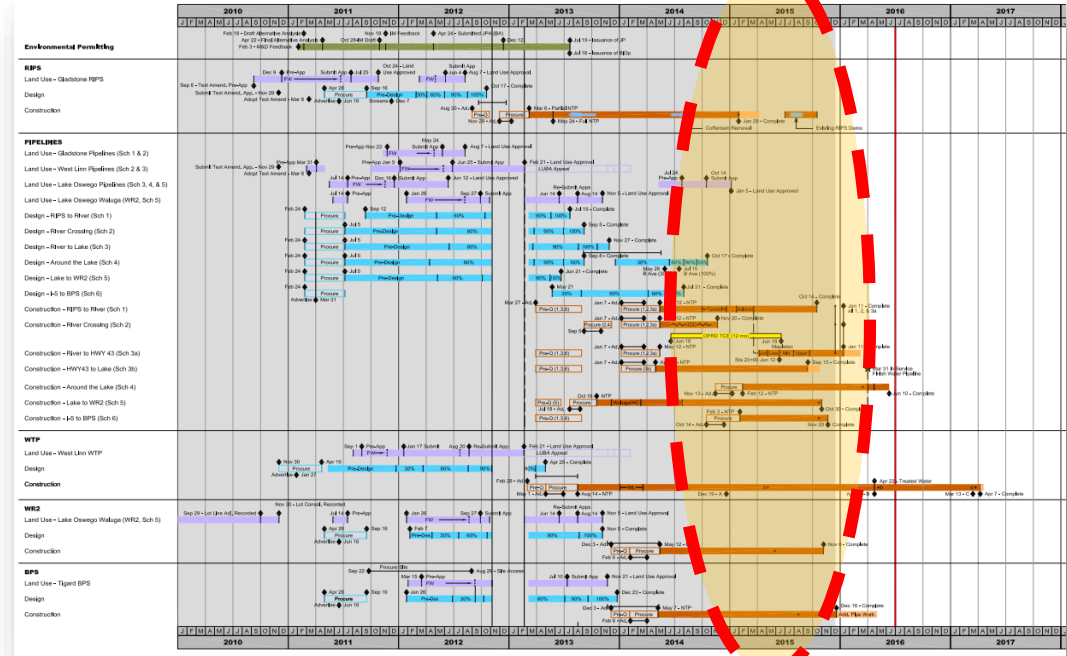




# Every asset will “live a different life” complicating decision making



# All projects under construction at the same time



**11 major construction projects occurring simultaneously \$180+M**

**11 major construction projects occurring simultaneously \$180+M**