

Optimization of GIS-Centric Platforms Replaces “Best-Guess Practices”

Elthron Anderson, GISP (Southgate Water and Sanitation Districts)
Kirk McClurkin, GISP (Woolpert)

A decorative graphic at the bottom of the slide consists of several overlapping horizontal bars. The top bar is yellow, and the bars below it are in shades of green, creating a layered, geometric effect.

Overview

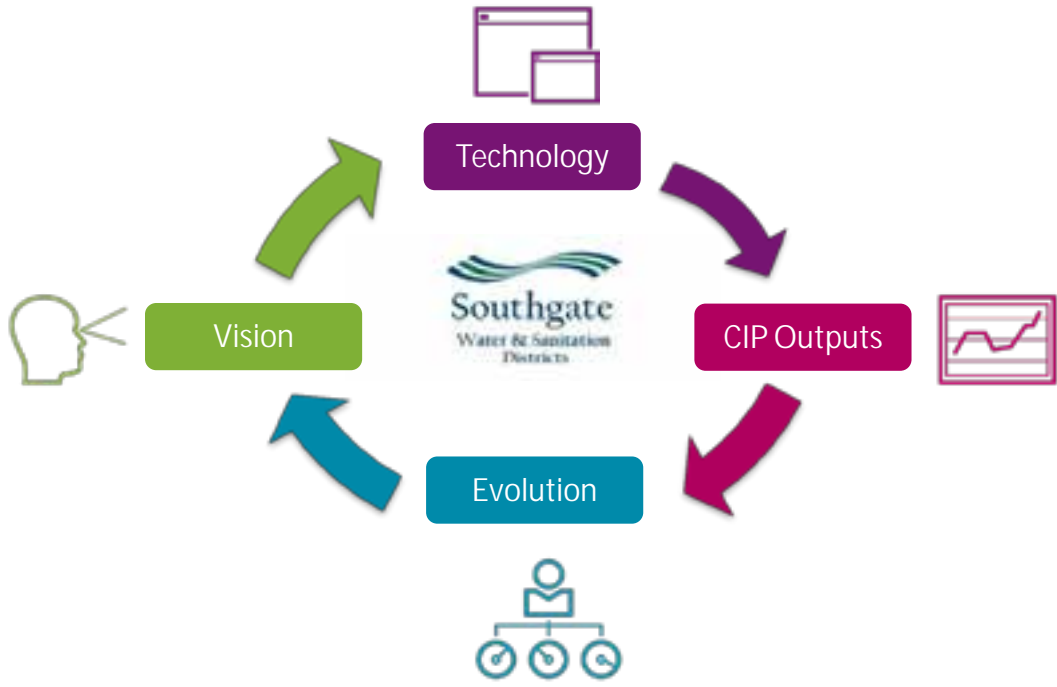
- Learn how Southgate developed upon its initial investment in the ArcGIS Platform and integrated other technologies systems to attain a truly GIS-Centric Asset Management Program.

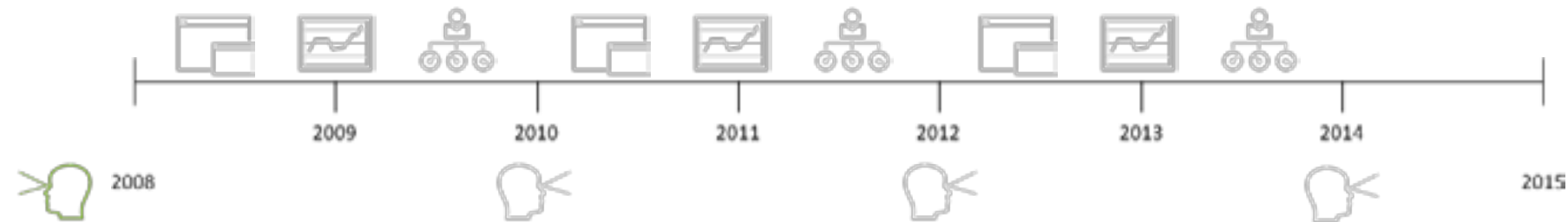


Southgate
Water & Sanitation Districts

- Approximately 88,000 Colorado residents.
- Approximately 235 miles of distribution systems (water)
- Approximately 240 miles of collection systems (wastewater)
- Service area of 18 square miles:
 - Including portions of Cherry Hills Village, Centennial, Greenwood Village, City of Lone Tree, Unincorporated Arapahoe County and Unincorporated Douglas County.







Vision

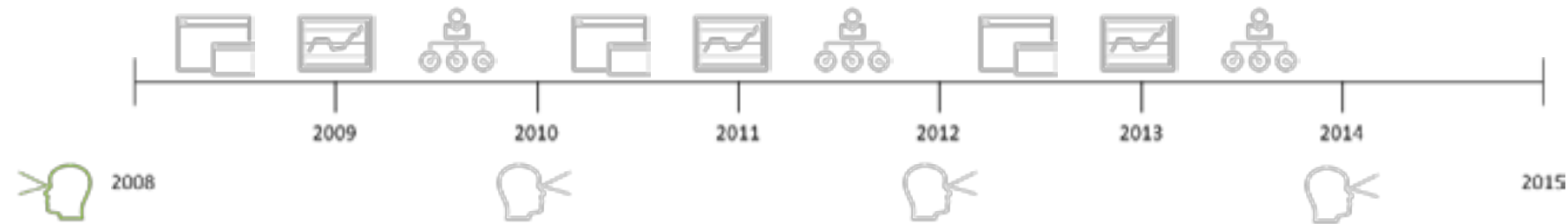
- Rigorous Preventive Maintenance Program
- New Capacity Capital Improvements subject to the periodically updated facility master plan
- 100 year useful life analysis with projection of timing and cost
- Long range Fiscal Forecasting (50 yr) based on 100 year useful life analysis
 - 100% of new capacity capital improvements
 - 100% of rehabilitation and replacement



Technology

- Technologically challenged.
- Limited to hand drawn paper maps
- Computer based CAD mapping and asset inventory (AutoCAD)





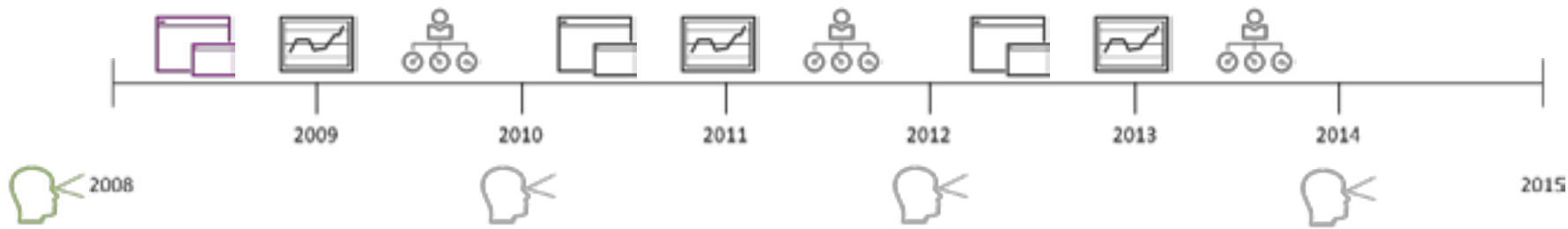
Capabilities

- Tracking of incident reports, breaks and blockages using push pins on aerial photo
- Tracking of sewer condition in a spreadsheet based on video inspection
- Rehabilitation and replacement decisions via interaction between District Engineer and Ops Supervisor
- Update paper maps using CAD mapping and asset inventory



Evolution

- Shift to Esri Platform
 - ArcGIS Desktop



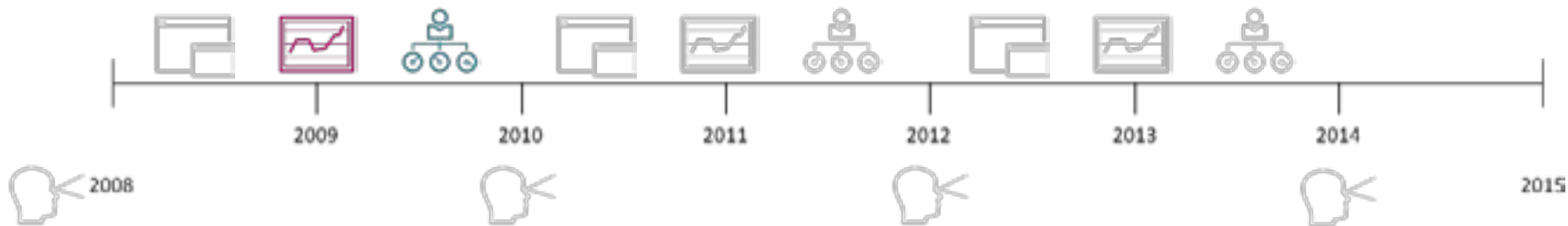
Vision

- Data conversion, collection and storage
- Conduct QA/QC
- Conduct inspections on Sewer mains and manholes
- Track customer complaints and work history on assets digitally
- Flow monitoring



Technology

- ArcGIS Desktop 9.3.1
- ArcGIS Server 9.3.1
- Oracle
- Granite XP
- Granite XP Scoring Module
- Cityworks Desktop 4.5
- Flow Link



Capabilities

- Distinct and disconnected systems
 - Update and maintain asset inventory and asset attribute data (ArcGIS Desktop)
 - Share data throughout the organization both in the Office and in the field (ArcGIS Server)
 - Document complaints and work history on assets (Cityworks Desktop and Anywhere)
 - CCTV inspections of sewer mains
- Monitor flow conditions and establish Diurnal patterns in preparation for Sewer modeling



Evolution

- ArcGIS 10.x
- Shift in focus from Application Development Framework (ADF) to Application Programming Interfaces (APIs). Esri no longer supported support ADF from 10.1 version release and onward

RAVIN

Map of Ravin area showing streets: ONEIDA, BONTIAC, and ST. ANNE. A blue highlighted path is shown with markers 1, 2, and 3. A 'Search' dialog box is open over the map.

Search Dialog:

Find a feature:

Search:

Transaction:

Properties:

Documents - Internet Explorer

Click the document name to display the document.

DOCUMENTS

[RJC - Phase 1 - WQ to SR17.pdf](#)

Internet Explorer window showing a technical drawing titled:

NO DRY CREEK INTERCEPTOR PHASE 2

M.H. W-8 TO M.H. W-10

SOUTH ARAPAHOE SANITATION DISTRICT

ARAPAHOE COUNTY, COLORADO

DATE: 1988

DESIGNED BY: J. W. ...

CHECKED BY: J. W. ...

APPROVED BY: J. W. ...

SCALE: AS SHOWN

PROJECT NO. 88-001

DATE: 1988

BY: J. W. ...

PROJECT NO. 88-001

DATE: 1988

BY: J. W. ...

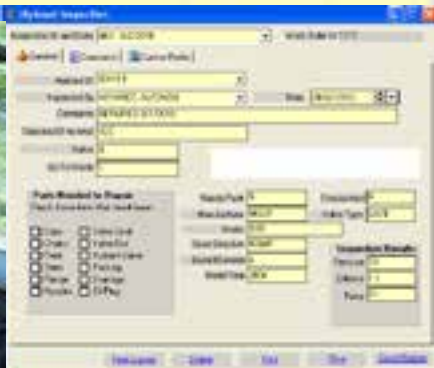
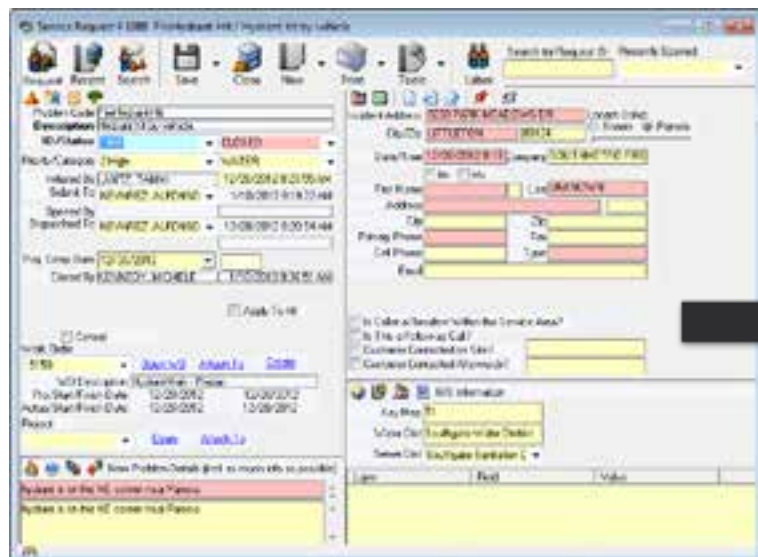
Attributes View - Internet Explorer

Attribute Information

Show Column Filter | Print | Export to Excel

Selected Layers: 9 Water Main

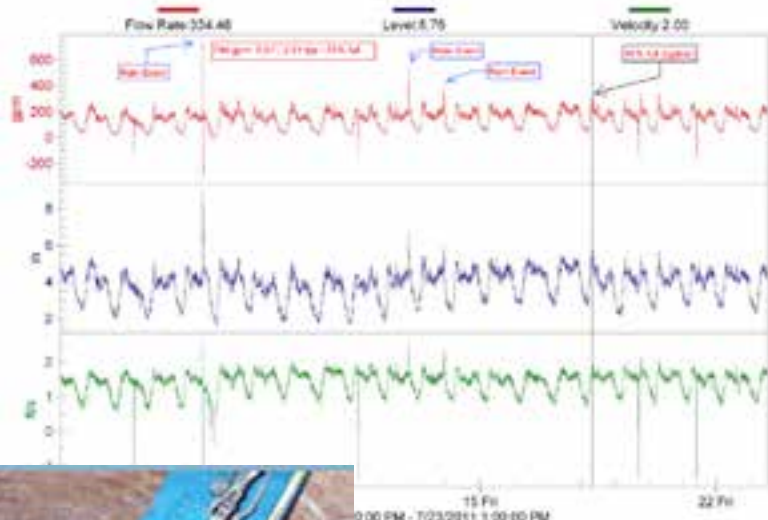
	FACILITYID	DIAMETER	MATERIAL	SEGMENTLENGTH	MADE
Highlight Zoom Box	12-118	12	DI	282	60
Highlight Zoom Box	12-143	12	DI	195	60

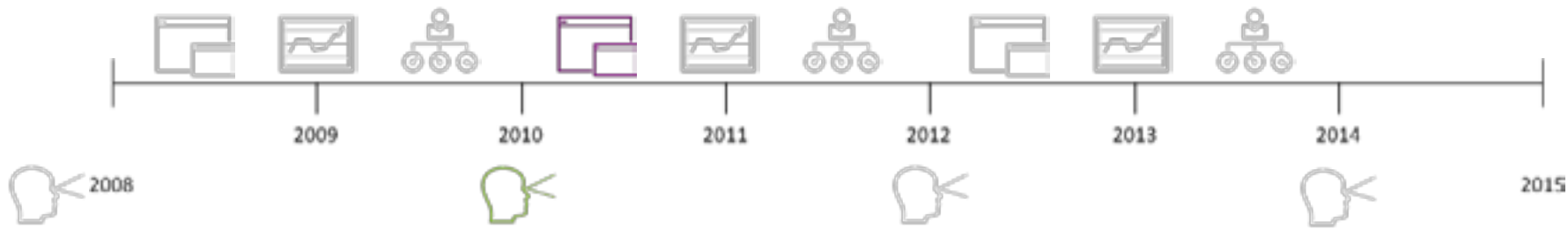




MH 51-E3-2 Inv In (S) 12 inch

Flow In





Vision

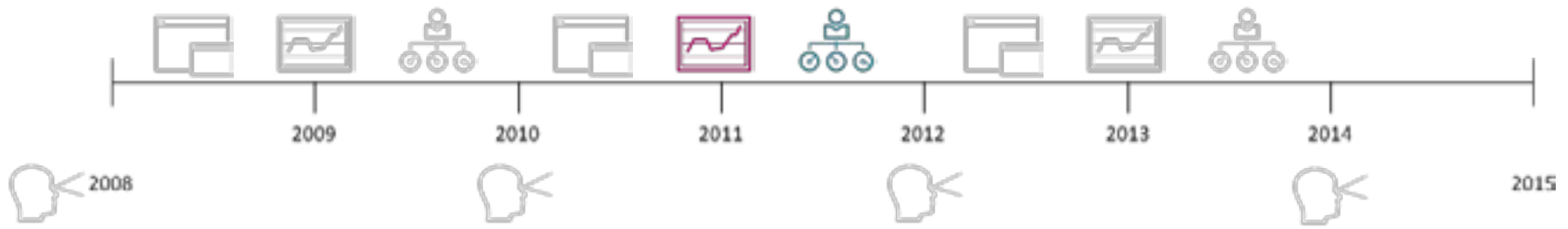
- Derive a repeatable framework to help determine where and how to direct resources
- Determine risk, predict present and future costs and facilitate decision-making for rehabilitation, repair and replacement strategies through cost-based scenarios



Technology

- ArcGIS Desktop
- ArcGIS Server
- Cityworks Desktop v 4.5
- Granite XP
- Granite XP Scoring Module
- Flow Link
- Infrastructure Optimization Toolset (IO)





Capabilities

- Asset condition (Physical)
(based on institutional knowledge)
- Fiscal Forecasting
- Decision-making through cost-based scenarios for rehabilitation, repair and replacement strategies



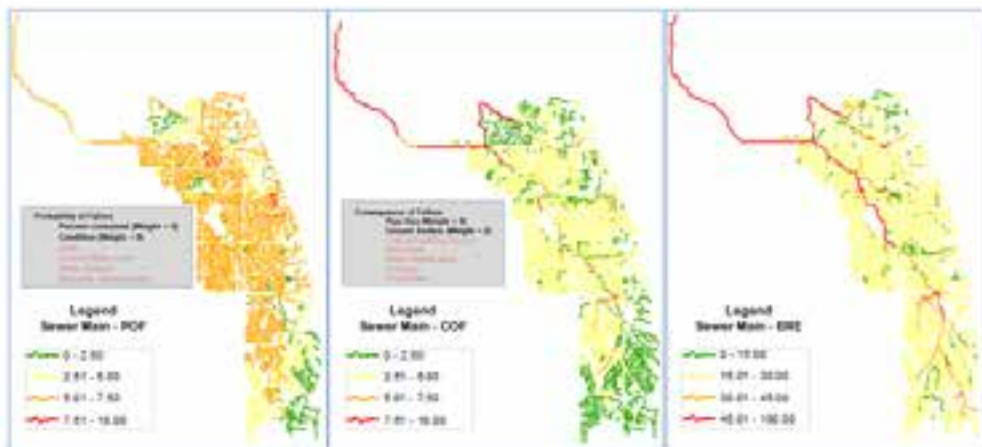
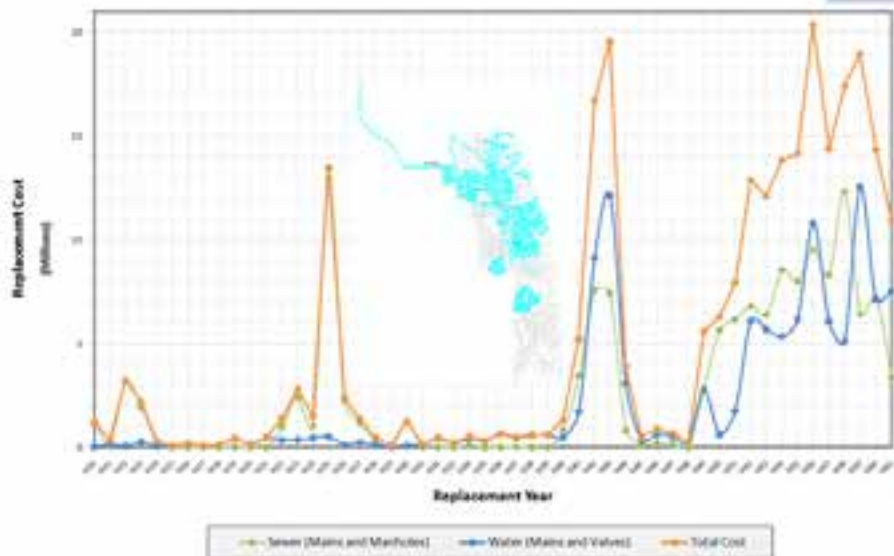
Evolution

- Granite XP v 4.6.1 and Esri (ArcMap) Integration
- Inspections captured in PACP and MACP format



RISK

Replacement Cost Per Year Per Scenario





Decisions Editor

Decisions Analysis for Test Main

Risk Replacement

Copy replacement information Copy Clear decision information for selected asset Clear

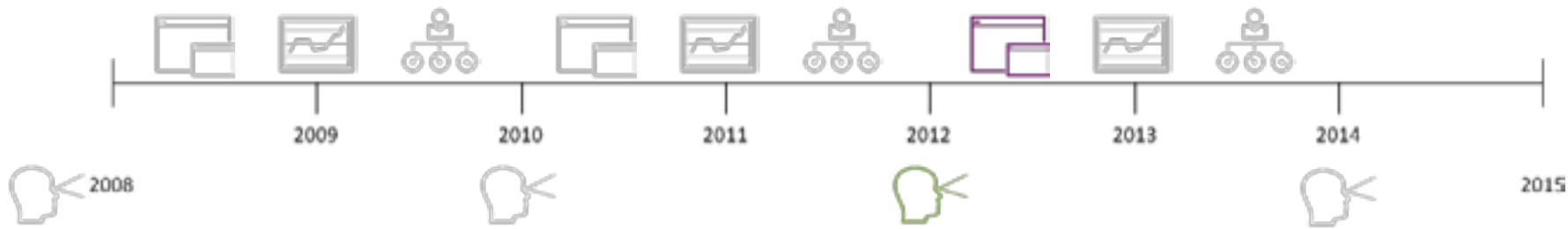
R & R Maintenance

Strategy Rehabilitation Activity Cured in Place Pipe (CIPP) Activity type Project 2012 Connector Add Future Year 2012

ID	Strategy	Activity	Activity Type	Contractor	Description	Description2	Unit	Unit Cost
88	Rehabilitation	Cured in Place P			8" x 4.5 mm CIPP		Linear feet	80.00
89	Rehabilitation	Cured in Place P			8" x 4.5 mm CIPP		Linear feet	35.00
90	Rehabilitation	Cured in Place P			8" x 6.0 mm CIPP		Linear feet	35.00

Cost Factor: 11 Unit Cost: 36.00 Total Cost: 711 Additional Cost: 450 Comments: review spec for install

ID Status: Perform Work Assets Add Adjusted EBL Comments: Add to CIP 2012 Connector Project



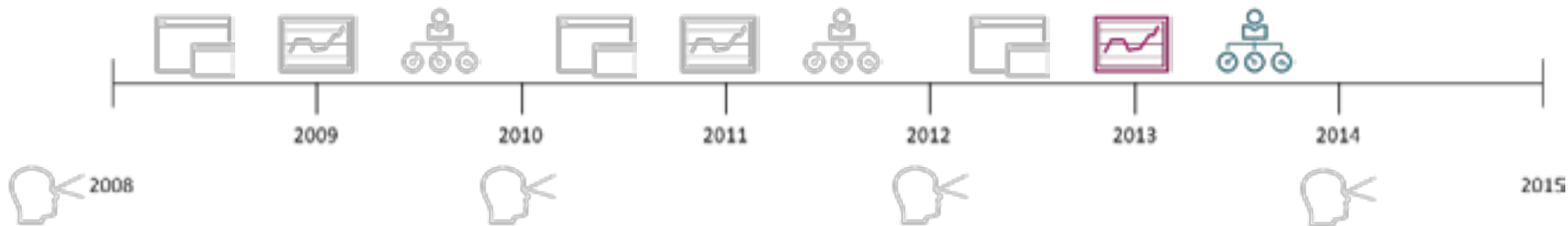
Vision

- Access data within one interface versus very distinct and disconnected systems
- Determine physical conditions of Sewer mains and Manholes based on Industry Best Practices
- Determine hydraulic conditions of Sewer mains based on Industry Best Practices
- Streamline organizational workflow



Technology

- ArcGIS Desktop
- ArcGIS Server
- Cityworks Desktop v 4.5
- Granite XP
- Granite XP Scoring Module
- Flow Link
- Infrastructure Optimization Toolset
- InfoSewer
- CCTV Interface for PACP



Capabilities

- Streamlined workflow between and amongst systems and departments
- Condition scores (Physical and Hydraulic) based on Industry Best Practices
- Fully integrated system
- No duplicate data entry between systems
- Better data to be mined for decision-making



Evolution

- Cityworks Desktop 2013 and Cityworks Server AMS 2013
 - Condition scoring of assets (Water)
- Integration between data derived from Hydraulic Modeling (InfoSewer) and ArcGIS

2010 - 2011 Environment

SQL DB

Oracle DB

MS Access

Esri9.3.1

Project
Management

Granite XP

ArcSDE

ArcMap

ArcGIS
Server

Cityworks 4.5
Desktop

Document
Attachments
and Map Atlas

RAVIN

Infrastructure
Optimization
Toolset

2012 - 2013 Environment

SQL DB

Project
Management

Esri10.1

Granite XP

ArcSDE

ArcGIS Server

ArcMap

SSRS Report
Services

Cityworks
Server 2013

Cityworks 2013
Desktop

RAVIN
Plug-ins

Infrastructure
Optimization
Toolset

IO Viewer
Plug-in

Cityworks
CCTV Interface
for PACP

InfoSewer

Citizen-sourced Data (Service Requests)

Questions

Question 1: What is your address? (Is the address within the district?)
Answer: YSA

Question 2: What is the problem?
Answer: LOW WATER PRESSURE IN 10 OF 25 UNITS

Question 3: Do you have a PR#?
Answer: UNKOWN

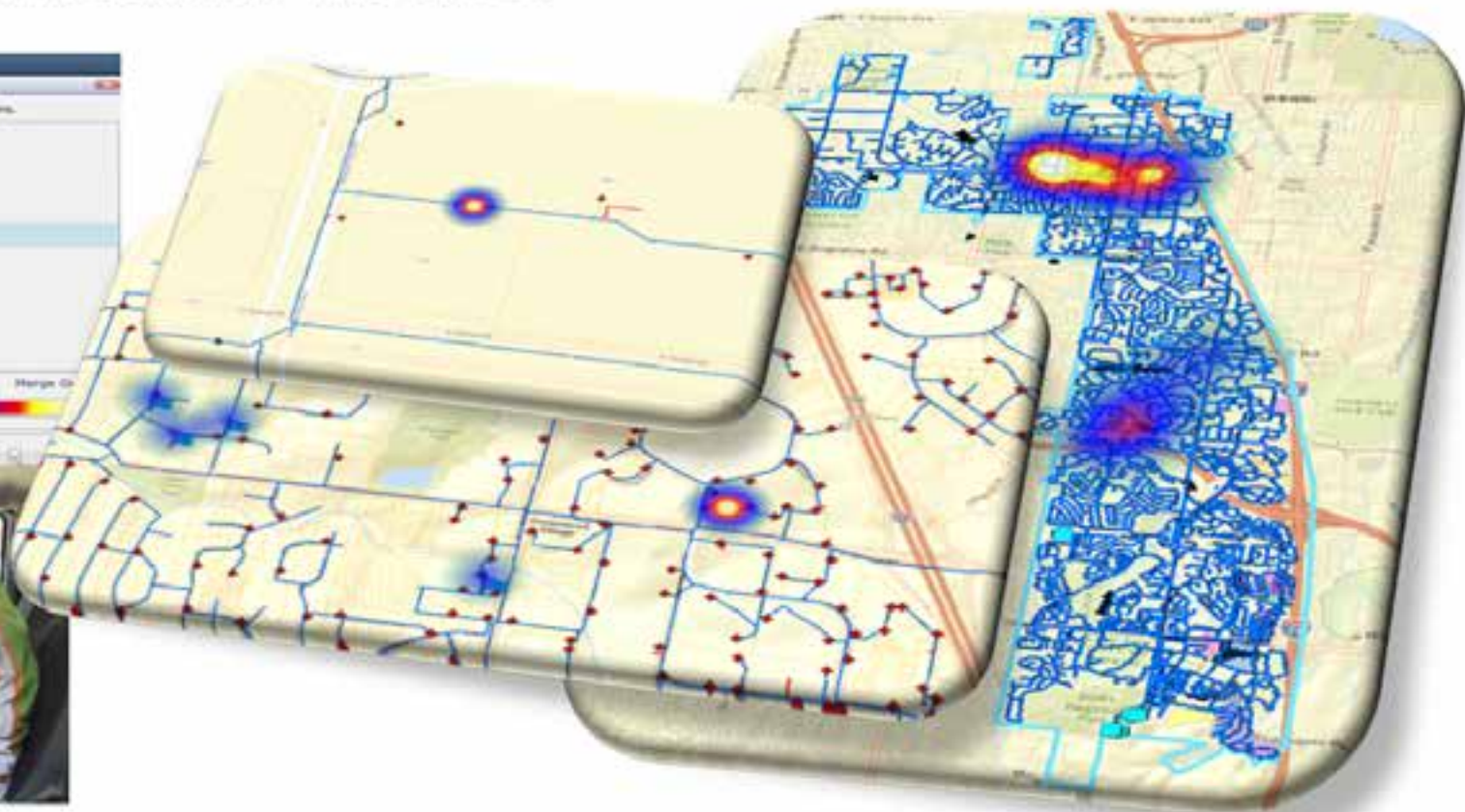
Question 4: Do you notice the difference in pressure on the outside or inside?
Answer: Inside

Question 5: (SYSTEMS) Is the pressure high or low?
Answer: low

Question 6: Is it at one faucet?
Answer: NO



Work History Tells Us Which Assets Need Our Attention The Most



Access to Tangible Evidence Within One Interface

Cityworks | Inbox | Request | Work Order | Inspection | GIS | Main

Home | Update GIS | Print | Delete

Inspection ID: 2605 | Work Order ID: 8772

General | Misc. | Observations | Notifications | Custom Fields

Map Location: [Map ID: 0108-0-0108-0] | Project Type: 00000

Map Number: [] | Length: 200.2 Ft. | Material: [] | Meter: [] | Meter: []

Flow Direction: [] | In. Depth: [] | Out. Depth: [] | In. Depth: [] | Out. Depth: []

Run to Street: 6.6 | Run to Street: 6.4

Run to Grade: [] | Run to Grade: []

Unit Type: [] | Unit Length: []

Living Method: [] | Year Built: []

Year Permitted: [] | Failure Method: []

Inspection

Inspection ID: 01-02-0 | Inspection Type: []

Location: []

Observations

Observation ID: 01-02-0 | Observation Type: []

Location: []

Methods & Ratings

Inspected By: [] | Date Inspected: 12/22/15

Inspection Method: [] | Meter: ALUMINUM ONE

Flow: [] | Meter: []

Hydraulic: [] | Rate: []

Wind Bl: [] | Overall Rating: []

Reverse Slope: [] | Inflow Meter: []

Cityworks | Inbox | Request | Work Order | Inspection | GIS | Main

Home | Update GIS | Print | Delete

Inspection ID: 2605 | Work Order ID: 8772

General | Misc. | Observations | Notifications | Custom Fields

Task Library: [] | Meter Type: []

Video Type: [] | VPI Number: []

VPI Label From: [] | Meter Size: []

Router Category: [] | Router Size: []

Total Tr. Length: 214.7 | ID Number: []

Customer: SUDMGATE | Franchise No.: 18756

Date Cleared: [] | Pre-Cleaning: No Pre-Cleaning

Flow Control: No Control | Pre-Cleaning: No Pre-Cleaning

Ground Check: []

Surface: []

Photo Type: []

Scan: []

Inspection

Inspection ID: [] | Inspection Type: []

Location: []

Cityworks | Inbox | Request | Work Order | Inspection | GIS | Main

Home | Update GIS | Print | Delete

Inspection ID: 2605 | Work Order ID: 8772

General | Misc. | Observations | Notifications | Custom Fields

Description	Description Score	CCTV Code	Cause	Remarks
Manhole	0	AMB4	0	SURVEY BEGINS
Water Level	0	MWL	0	
Factory Made Active	0	TFA	0	9630 S. ROSEMONT AVE
Factory Made Active	0	TFA	0	9644 S. ROSEMONT AVE
Factory Made Active	0	TFA	0	9640 S. ROSEMONT AVE
Manhole	0	AMB4	0	SURVEY ENDS



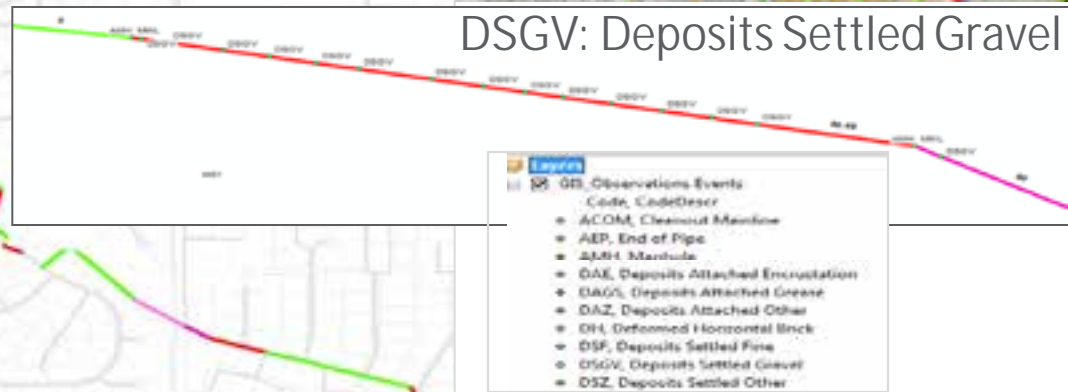
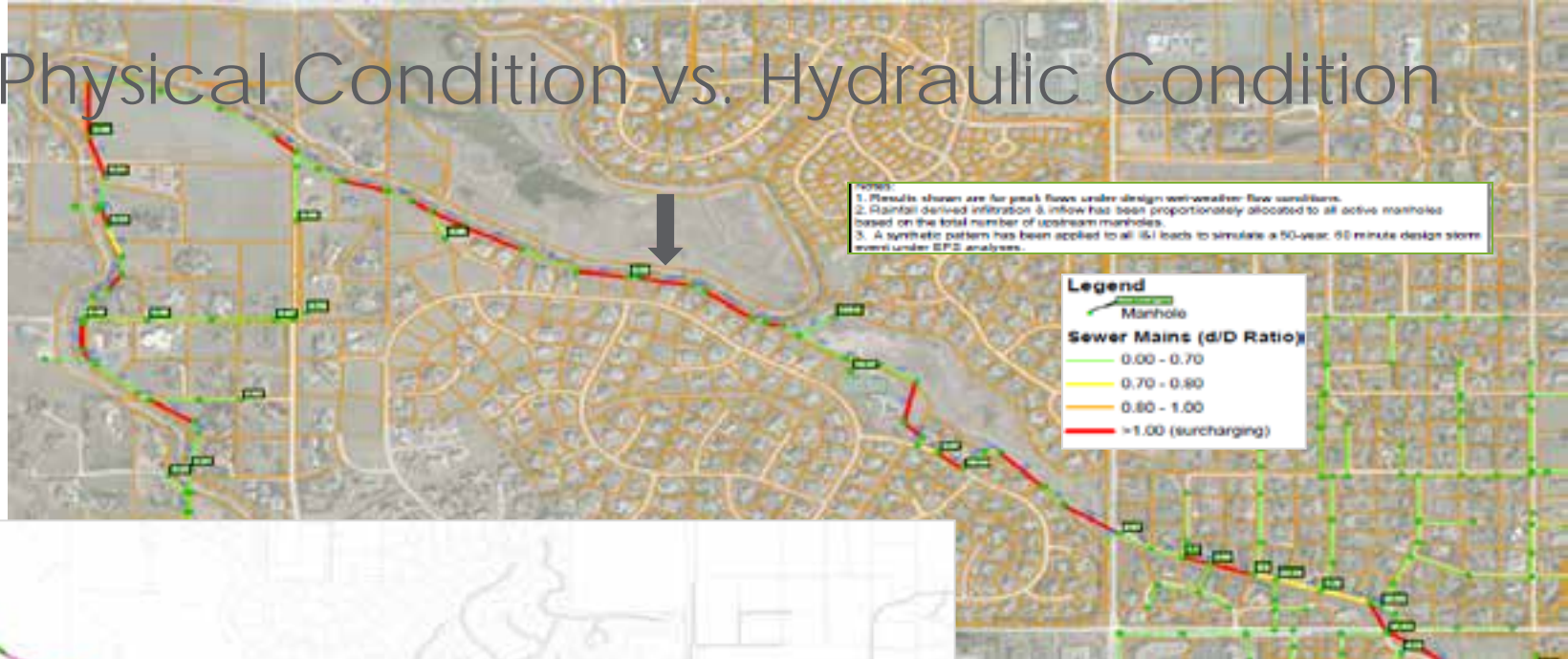


Condition Scores Based on Best Industry Practices

Condition Scores Based on Institutionalize Knowledge



Physical Condition vs. Hydraulic Condition



Determining the Best Approach

Notes:

1. Results shown are for peak flows under design wet-weather flow conditions.
2. Rainfall derived infiltration & inflow has been proportionately allocated to all active manholes based on the total number of upstream manholes.
3. A synthetic pattern has been applied to all I&I loads to simulate a 50-year, 60 minute design storm event under EPS analyses.

Legend

Manhole

Sewer Mains (d/D Ratio)

- 0.00 - 0.70
- 0.70 - 0.80
- 0.80 - 1.00
- >1.00 (surcharging)

Layers

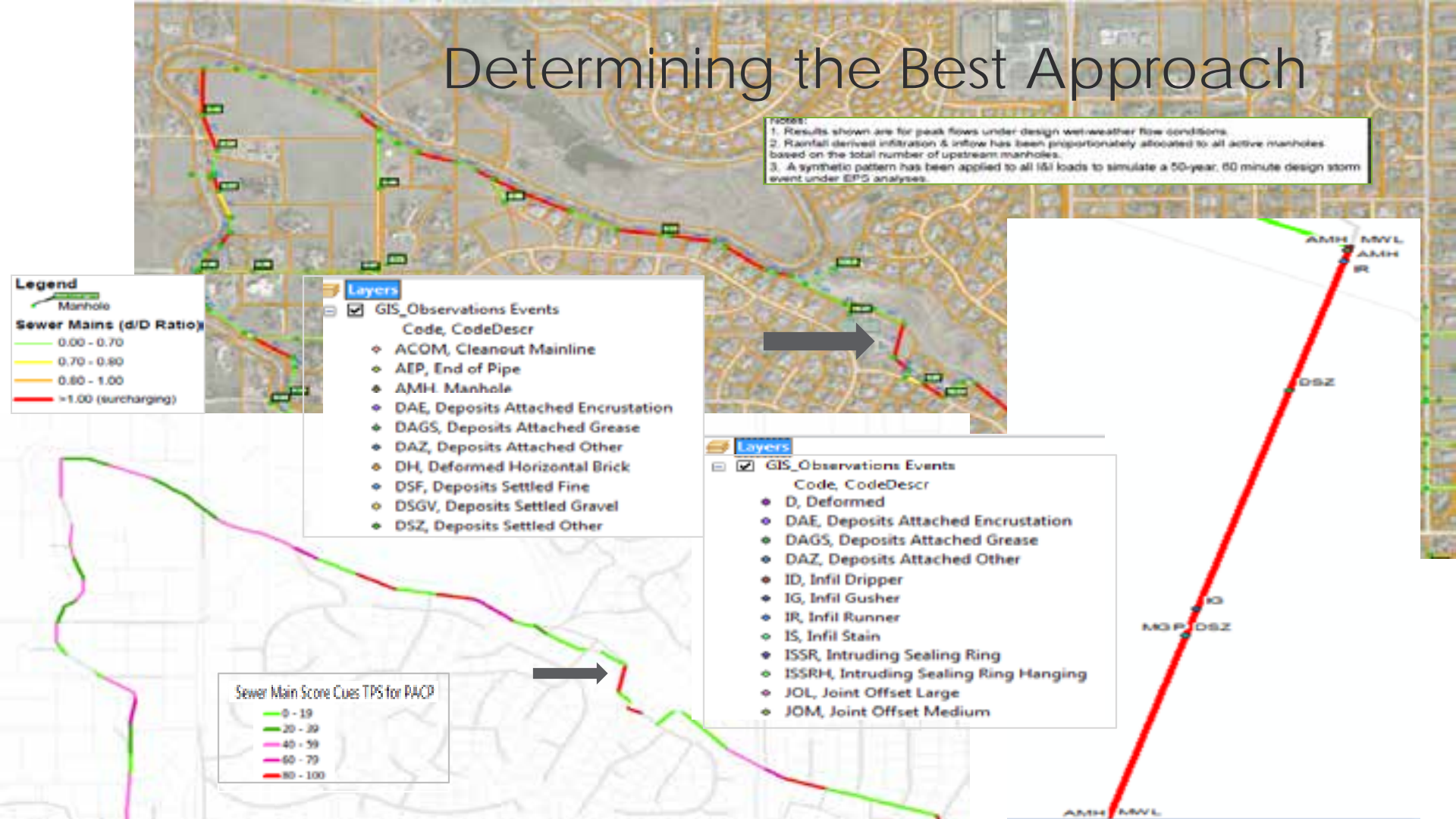
- GIS_Observations Events
 - Code, CodeDescr
 - ACOM, Cleanout Mainline
 - AEP, End of Pipe
 - AMH, Manhole
 - DAE, Deposits Attached Encrustation
 - DAGS, Deposits Attached Grease
 - DAZ, Deposits Attached Other
 - DH, Deformed Horizontal Brick
 - DSF, Deposits Settled Fine
 - DSGV, Deposits Settled Gravel
 - DSZ, Deposits Settled Other

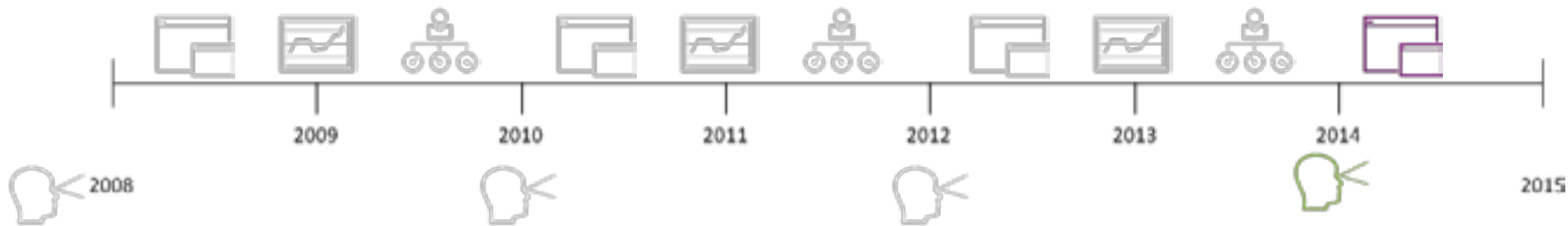
Layers

- GIS_Observations Events
 - Code, CodeDescr
 - D, Deformed
 - DAE, Deposits Attached Encrustation
 - DAGS, Deposits Attached Grease
 - DAZ, Deposits Attached Other
 - ID, Infil Dripper
 - IG, Infil Gusher
 - IR, Infil Runner
 - IS, Infil Stain
 - ISSR, Intruding Sealing Ring
 - ISSRH, Intruding Sealing Ring Hanging
 - JOL, Joint Offset Large
 - JOM, Joint Offset Medium

Sewer Main Score Cues TPS for PACP

- 0 - 19
- 20 - 39
- 40 - 59
- 60 - 79
- 80 - 100





Vision

- Extend Asset Management into the field in real-time
- System impacts for operational decisions



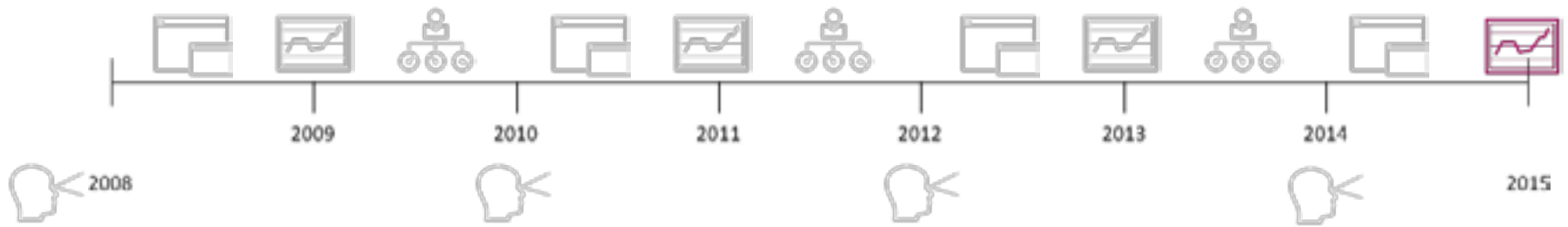
Technology

- ArcGIS Desktop
- ArcGIS Server
- Cityworks Desktop 2013
- Cityworks Server 2013
- Granite XP
- Granite XP Scoring Module
- Flow Link
- Infrastructure Optimization Toolset
- InfoSewer
- Sedaru

IDMODELING™



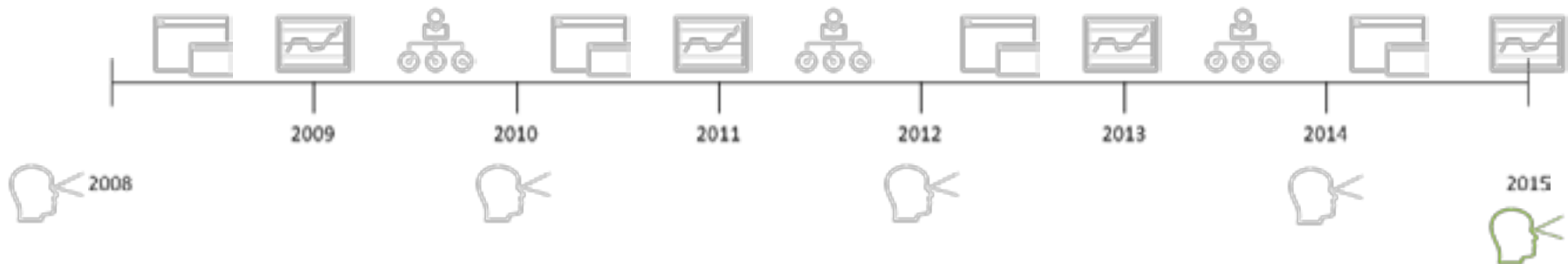
SEDARU®



Capabilities

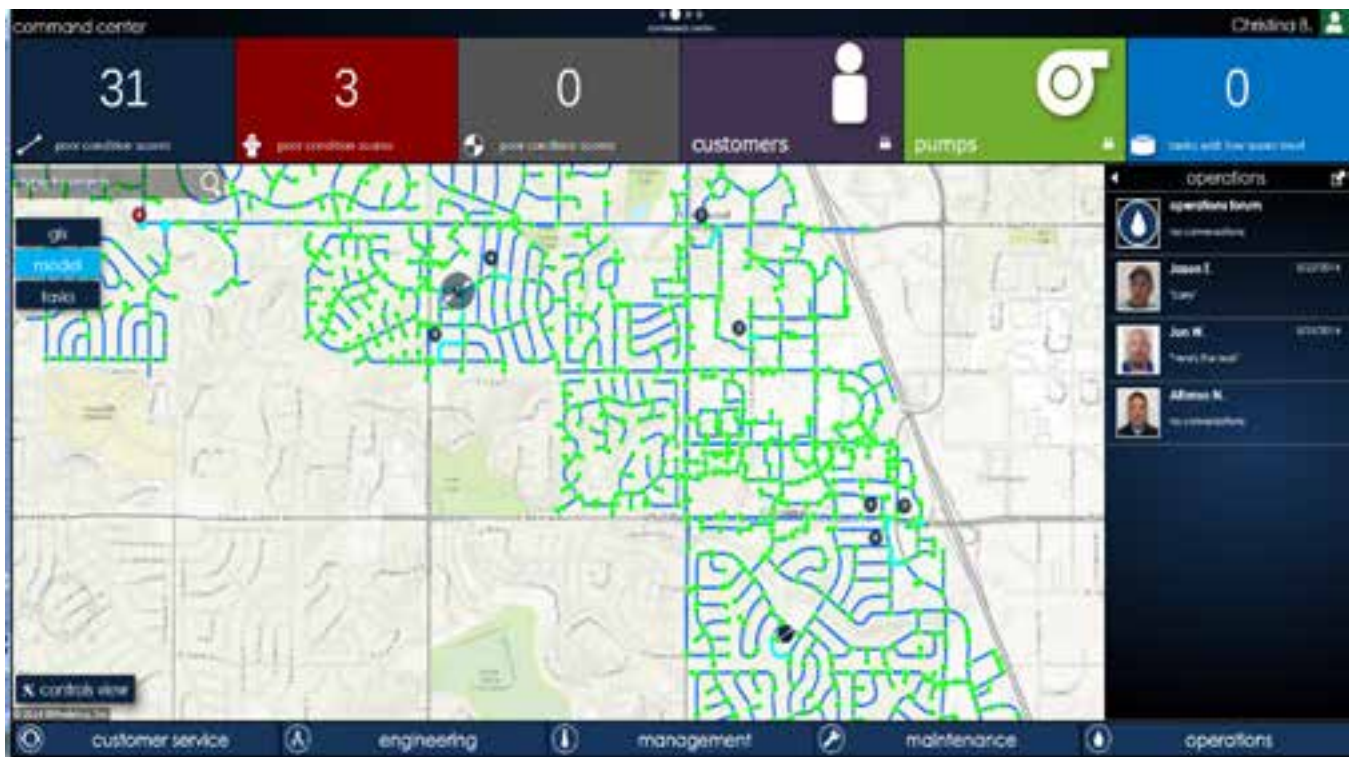
- Optimized environment for data collection on mobile devices
- Increased communication between office and field staff
- Assists with immediate and long-term risk, consequences of decisions and impacts to system facilities and customers
- System Monitoring






Vision

- Pumps and SCADA
- Sewer
- Project Management



Questions

Contact Info

Elthron Anderson:

eanderson@southgatedistricts.org

Kirk McClurkin:

Kirk.McClurkin@Woolpert.com