Newberg

Inflow and Infiltration Study

WES 2017

KELLER associates

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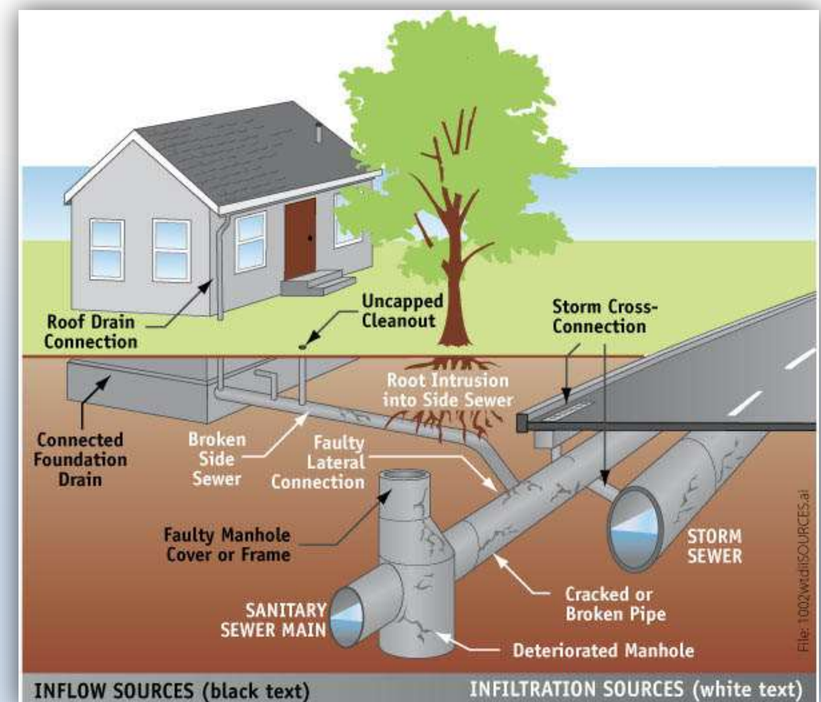
What is Infiltration and Inflow?

Infiltration and inflow (I/I) represent extraneous groundwater and storm water runoff that enters the wastewater system.

Infiltration is groundwater that enters the system through leaky pipes and manholes.



www.kingcounty.gov

Inflow is storm water that enters the system through direct connections, i.e. roof drains, catch basins, C/O, etc.

Infiltration

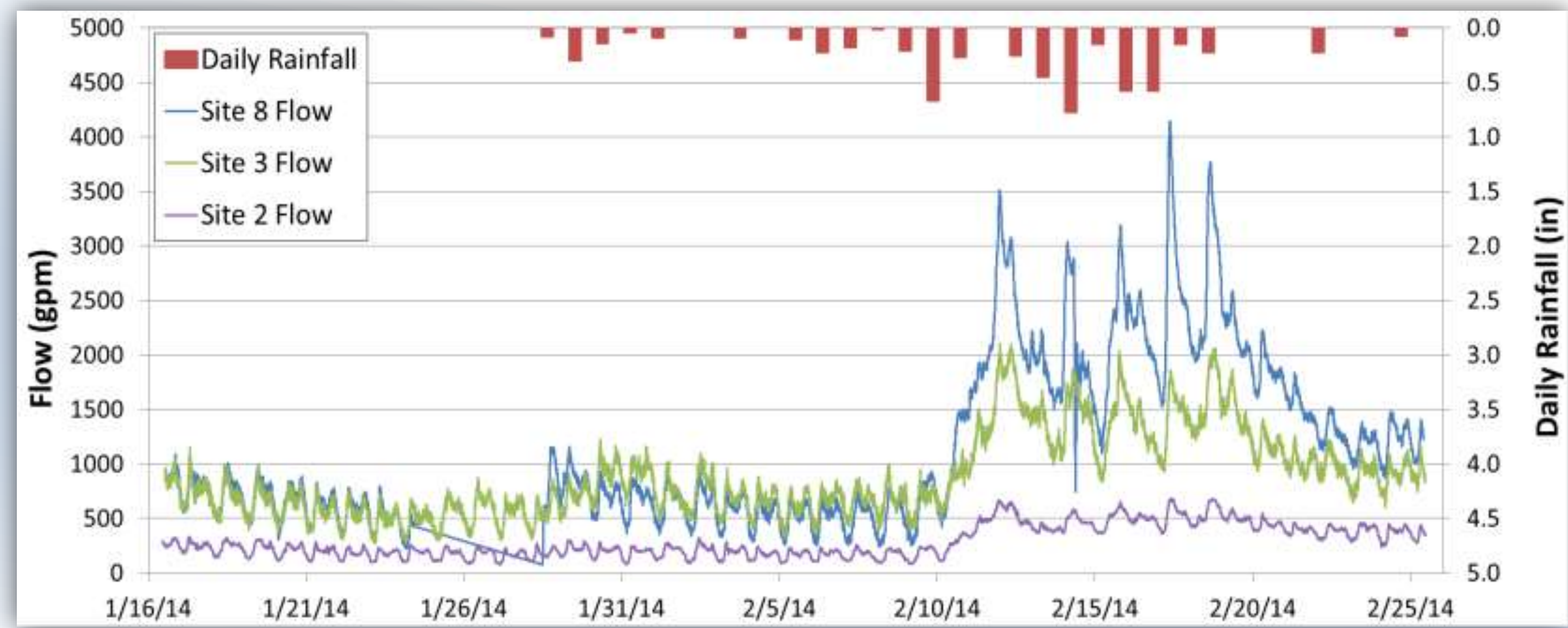
- Groundwater that enters the wastewater system through leaky pipes and manholes.

Inflow

- Storm water runoff that enters the wastewater system through direct connections.
  - Roof drains
  - Holes in manhole lids
  - Catch basins
  - Broken or open cleanouts
  - Foundation drains

Why should you care?

- Infiltration and inflow increases the flow to your wastewater system
  - Accelerates and increases size of capital improvements
  - Increases conveyance, treatment, and mitigation costs
  - Increases risk of sanitary sewer overflows (SSOs) and NPDES violations



Existing EPA Guidance

If the average **dry weather** flow (DWF) is **less than 120 gallons per capita per day** (gpcd), then the amount of infiltration is considered non-excessive[1].

If the average **wet weather** flow (WWF) is **less than 275 gpcd**, then the amount of inflow is considered non-excessive[1].

[1]U.S. Environmental Protection Agency: *Infiltration / Inflow, I/I Analysis and Project Certification*. Ecology Publication No. 97-03, May 1985.

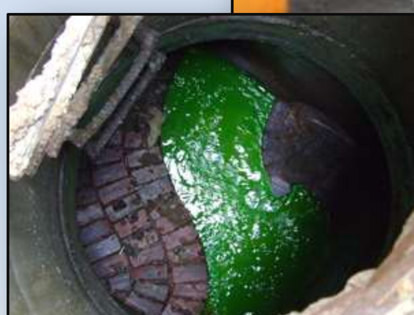
Components of an I/I Program

- Collect data
- Identify I/I sources
- Identify appropriate rehabilitation approach
- Focus on areas where you get greatest return on investment
  - Look for smoking guns
  - Perform cost/benefit analysis
- Develop budget and capital improvement plan
- Monitor improvements

Collect Data

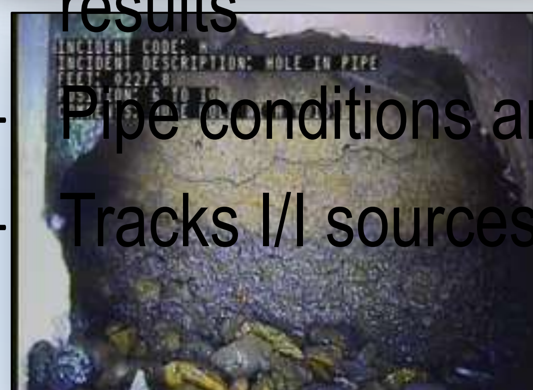
A good program requires good data.

- Basic, Ongoing Data
  - Daily lift station pump run time data
  - Precipitation data
  - Hourly SCADA data (at WWTP and lift stations)
  - Regular CCTV data
  - GIS (material and condition data)
- Periodic, Supplementary Data
  - Flow monitoring
  - Night-time monitoring
  - Smoke testing
  - Dye testing



Identify I/I Sources

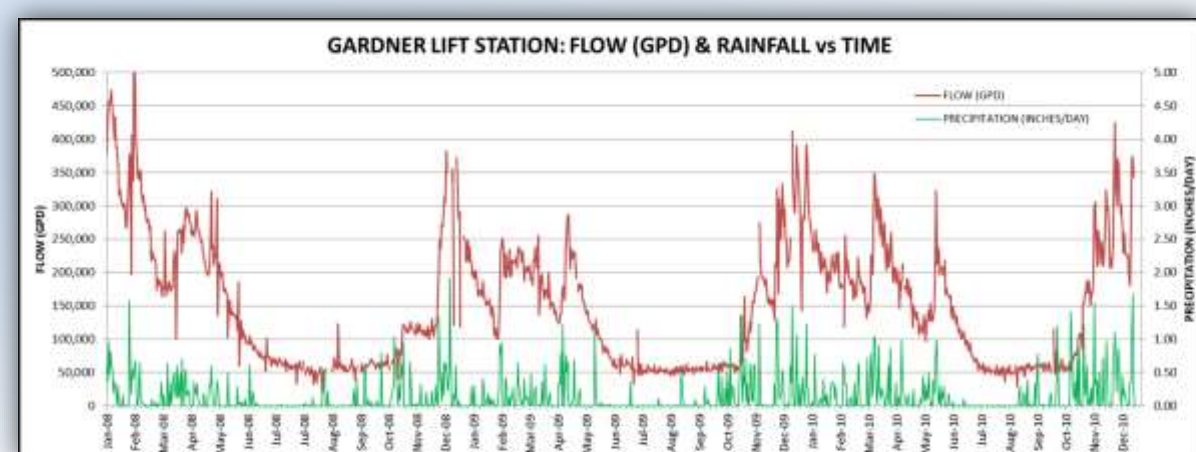
- Pump run time analysis
  - Narrows down worst basin/s
- Flow monitoring
  - Narrows down worst areas
- Smoke testing
  - Smoking guns
- Night time monitoring
  - Narrows down flow monitoring results
- Video inspection
  - Pipe conditions and indicators
- Dye testing
  - Tracks I/I sources



Identify I/I Sources

Use the data to quantify I/I and focus efforts.

- Compare flows in basins to wintertime water consumption
- Look at seasonal changes
- Look at responses to storm events (may need to get out in the rain)
- Look at night-time flows
- You may need help gathering and processing the data



Identify Appropriate Rehabilitation Approach

- Pipeline rehab
  - Open trench
  - Trenchless
  - Spot repairs
- Lateral rehab
  - Full replacement
  - Grouting
  - Liners
- Manhole rehab
  - Full replacement
  - Grouting
  - Lining



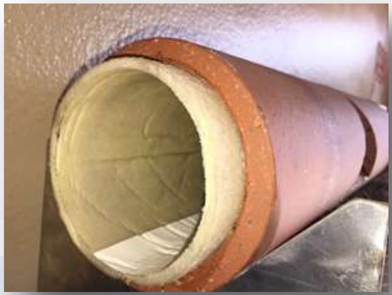

Identify Appropriate Rehabilitation Approach

OPEN CUT

- Appropriate when surface repair is minimal, when pipe sags need to be repaired, when pipe needs to be upsized more than one nominal size, and when there are many lateral repairs

PIPE BURSTING

- Appropriate trenchless technology; typically allows upsizing of one nominal size
- Open cut still required at lateral and near insertion/extraction pits; special considerations for some pipe types, soil materials, and shallow bury depths



CURED-IN-PLACE PIPE (CIPP)

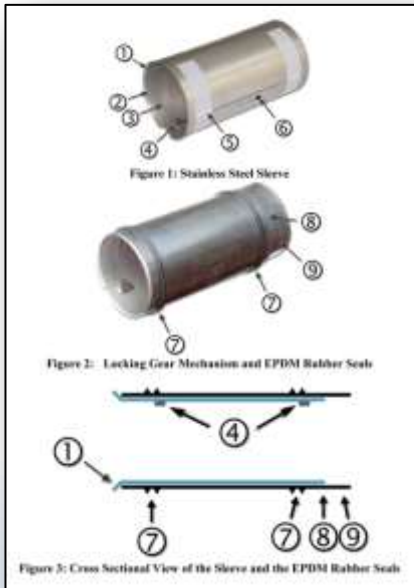
- Appropriate trenchless technology when host pipe is desired size and grade
- Lateral repairs possible, but costly

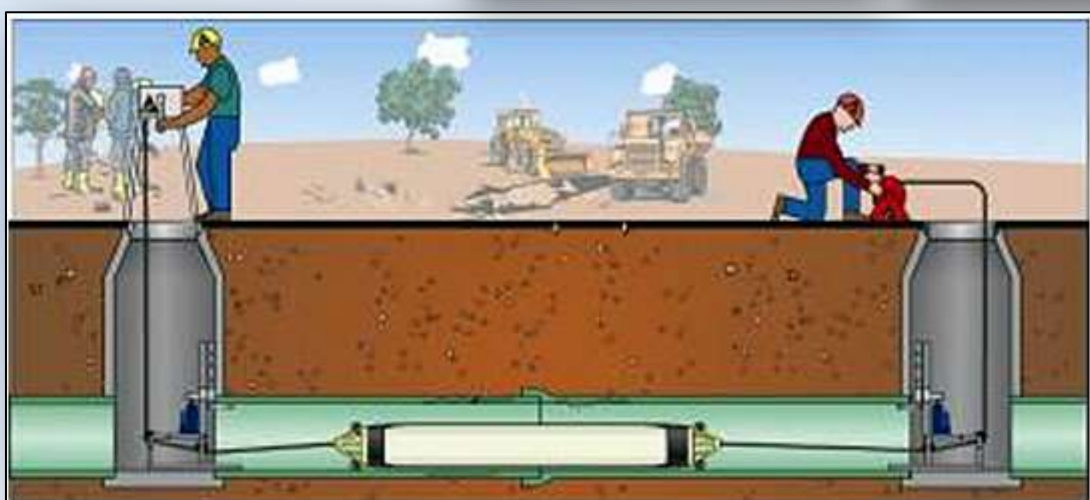
OTHER METHODS

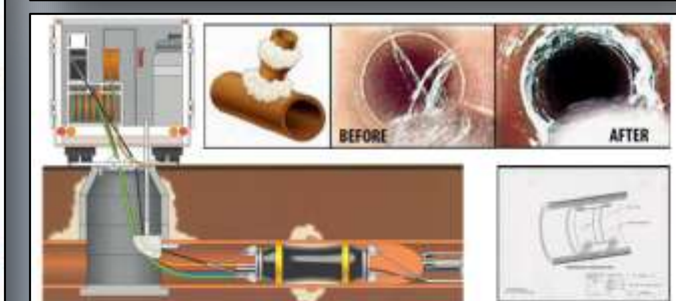
- Directional drilling, bore, slip lining, host of spot repair options

Rehabilitation Options

Spot repairs

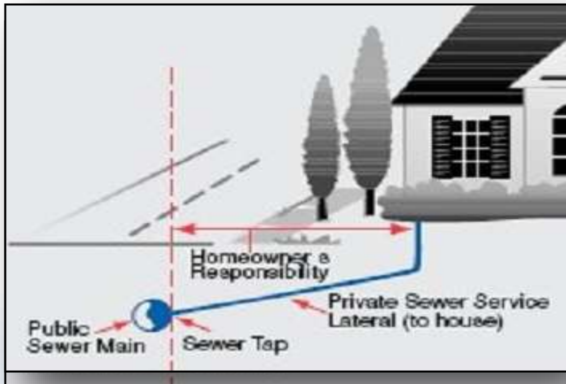


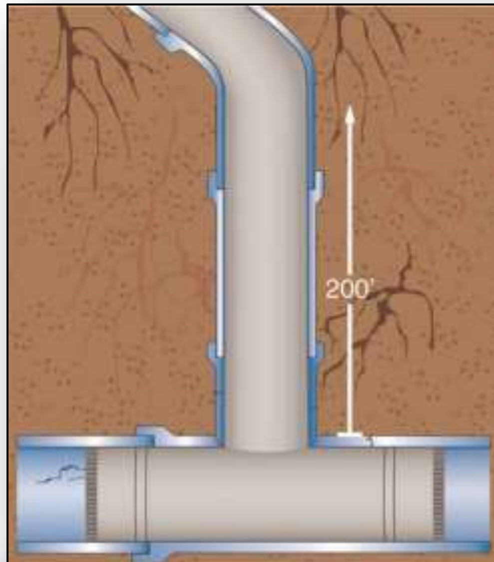




Rehabilitation Options

Lateral rehabilitation





Rehabilitation Options

Manhole rehabilitation

Rehabilitation Options

Disconnect direct connections

After You Have the Data

- Risk considerations
- Cost / benefit analysis
- Prioritizing improvements
- Developing annual replacement plan and budget
- Maintaining I/I reduction program

Risk Considerations

- Risk = likelihood of failure (x) consequence of failure
- Consequence considerations
  - Trunk line

    (size, number of connections)
  - Schools, hospitals, etc.
  - Risk of SSO's

    (proximity to waterway)

Prioritizing Improvements

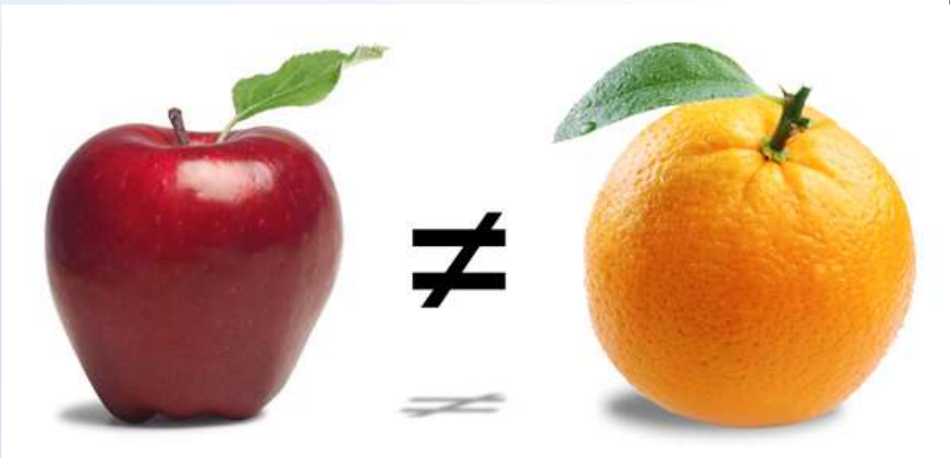
- Prioritize based on multiple criteria
  - CCTV reports
  - Pipe age and material
  - Observed infiltration
  - Consequence of failure
- Grouped projects
  - Separate lists for cross connections and spot repairs, organized by $/gpm

Cost / Benefit

- Estimated cost of rehabilitation
- Estimated cost to convey and treat wastewater
- Calculated annual replacement budgets

Cost / Benefit Analysis

- Compares cost to convey and treat versus cost of rehabilitation
- Challenges
  - Quantifying flow reduction
  - Assigning conveyance and treatment cost to an incremental increase/decrease of flow
  - Assessing impacts for offsetting / delaying capacity-required capital construction costs



Rehabilitation Costs

- Traditional pipe replacement (8” line) – $180/LF
- Trenchless pipe replacement – Up to 40% savings
- Spot repairs – $2000 for 3 ft spot repair liner
- Lateral rehabilitation – $50/LF open trench
  – $3500/lateral trenchless lining
- Manhole rehabilitation – $60/sqft rehab and lining

Costs are variable and function of pipe size and length, material, depth, water table, location, etc.




Sample Cost / Benefit Analysis

- Cost to convey and treat
  - Fixed and variable costs
- I/I inconsistent flow, based on rainfall and groundwater
  - Variable intensity of rainfall
  - Variable duration of rainfall

Wastewater Fund	2012 Budget	2012 Actual	2013 Budget	2013 Actual	2014 Budget	2014 Actual
Administrative	$ 1,012,123	$ 998,541	$ 1,015,456	$ 1,009,070	$ 1,198,528	$ 1,201,023
Engineering	$ 296,200	$ 247,157	$ 192,306	$ 199,725	$ 246,865	$ 250,357
Operations (WWTP)	$ 1,718,746	$ 1,489,899	$ 2,053,923	$ 1,941,149	$ 2,044,137	$ 1,964,612
WW Collection (Maint)	$ 981,379	$ 653,889	$ 817,337	$ 598,013	$ 1,017,266	$ 766,426
Debt Service Payments	$ 736,877	$ 736,877	$ 729,408	$ 729,430	$ 1,467,558	$ 1,467,558
Transfers Out						
Total	$ 4,745,325	$ 4,126,363	$ 4,808,430	$ 4,477,387	$ 5,974,354	$ 5,649,976
Total minus Debt service	$ 4,008,448	$ 3,389,486	$ 4,079,022	$ 3,747,957	$ 4,506,796	$ 4,182,418

Dry Season flow		1.7	mgd	1181	gpm
Wet Season flow (avg)		5.1	mgd	3542	gpm
Wet Season flow (peak)		17.6	mgd	12222	gpm
				$ 3,542.75	$/gpm
	$	0.82	$/gallon/day	$ 1,180.92	$/gpm
				$ 342.20	$/gpm

Operations (WWTP)			
Operating supplies	$ 144,580	10%	$ 14,458
Utilities	$ 282,655	40%	$ 113,062
Equipment Repair and Maintenance	$ 147,680	25%	$ 36,920
Pump Station Maintenance	$ 6,531	50%	$ 3,266
WW Collection			
Supplies & Tools	$ 15,867	25%	$ 3,967
Inflow/Infiltration	$ 4,105	100%	$ 4,105
Wastewater Rehabilitation	$ 58,000	75%	$ 43,500
Wastewater System Replacement	$ 6,417	50%	$ 3,209
Manhole Rehabilitation	$ -	50%	$ -
Lateral Replacement	$ 16,012	70%	$ 11,208
Equipment Repair and Maintenance	$ 4,510	25%	$ 1,128
Pipe and Materials	$ 20,541	25%	$ 5,135
			$ 239,957

average daily flow	3.4	mgd
average daily flow	2361	gpm
cost per gpm removed	$ 101.63	$/gpm
payback in 10 years	$ 1,016.29	

This does not account for potential to offset treatment plant or other capital improvements

Focus on Areas Where You Get Greatest Return on Investment

1) Look for smoking guns

2) Utilize cost/benefit analysis

Smoking Guns

- Manhole “gushers”
- Disconnect direct connections
- Often highest return for lowest cost:
  - Roof drains
  - Catch basins
  - Open/broken C/O caps
  - Storm system connections

Sample Cost/Benefit Analysis – Smoking Guns

- Cross Connections
  - Rational Method
  - Cost to remove
  - GPM benefit
  - Relative comparison

Table H.1 – Estimated Inflows and Improvement Costs for Cross-Connections

Picture ID	Address	Inflow Source	Area of Inflow, A (ac)	Runoff Coefficient, C	Rainfall Intensity, i (in/hr)	Inflow, Q (cfs)	Inflow, Q (gpm)	Estimated Improvement City Cost	Cost per GPM
9	3813 Coffey Ln	driveway drain	0.02	0.75	1.85	0.03	12	$500	$40
26	1205 Hawthorne Loop	roof drain	0.07	0.90	1.85	0.12	52	$300	$6
31	1300 Villa Rd	roof drain	0.04	0.90	1.85	0.07	30	$300	$10
48	1542 E 1st St	roof drain	0.06	0.90	1.85	0.10	45	$300	$7
49	1544 E 1st St	roof drain	0.06	0.90	1.85	0.10	45	$300	$7
75	503 N College St	roof drain	0.04	0.90	1.85	0.07	30	$300	$10
107	417 & 419 S Main St	roof drain, driveway drain	0.19	0.84	1.85	0.30	133	$800	$6
115	112 S Edwards St Dormer's Embroidery	roof drain	0.24	0.90	1.85	0.40	179	$300	$2
128	406 S Meridian St	roof drain	0.06	0.90	1.85	0.10	45	$300	$7
153	904 S River St	roof drain	0.03	0.90	1.85	0.05	22	$300	$13
42	E 1st St and Everest Rd	roadside swale	0.8	0.75	1.85	1.11	498	$500	$1
43	E 1st St and Everest Rd	roadside swale	0.8	0.75	1.85	1.11	498	$500	$1
45	E 1st St and Everest Rd	catch basin (3x)	0.55	0.59	1.85	0.60	271	$14,500	$54
66	300 N Lincoln St (K V Mini Storage)	catch basin (1x)	0.6	0.59	1.85	0.66	295	$9,500	$32
86	E Sheridan St and N College St	catch basin (2x)	0.63	0.59	1.85	0.69	310	$33,500	$108
87	E Sheridan St and N Edwards St	catch basin (2x)	0.65	0.59	1.85	0.71	320	$34,000	$106
93	E Sheridan St and N Washington St	catch basin (2x)	0.65	0.59	1.85	0.71	320	$35,000	$109
97	W 1st St and S Grant St	catch basin (4x)	0.48	0.59	1.85	0.53	236	$20,000	$85
99	W 1st St between Grant St and Main St	catch basin (1x)	0.15	0.59	1.85	0.16	74	$14,500	$196
111	E 2nd St and S Howard St	catch basin (4x)	0.7	0.59	1.85	0.77	345	$20,000	$58
117	E 2nd St and S Meridian St	catch basin (2x)	0.6	0.59	1.85	0.66	295	$9,000	$30
121	E 3rd St and S Edwards St	catch basin (3x)	0.7	0.59	1.85	0.77	345	$14,500	$42
123	E 3rd St and S Meridian St	catch basin (4x)	0.63	0.59	1.85	0.69	310	$20,000	$64
126	E 4th St and S Meridian St	catch basin (2x)	0.8	0.59	1.85	0.88	394	$30,000	$76
127	E 4th St and S Center St	catch basin (4x)	0.8	0.59	1.85	0.88	394	$20,000	$51
137	1215 E 4th St	catch basin (2x)	0.76	0.59	1.85	0.83	374	$42,000	$112
144	S Chehalem and E 6th St	catch basin (4x)	0.85	0.59	1.85	0.93	419	$20,000	$48
						Totals:	6000	$342,000	$57

Annual Budgets & Capital Improvement Plan

- Identified projects become part of CIP
- Educate and present budget
- Additional budget elements:
  - Pipeline replacement/rehab
  - Lateral replacement/rehab
  - Manhole replacement/rehab
  - Inspections/monitoring

Replacement Budgets

Annual asset replacement quantity for sustainable system:

$$\frac{Quantity\ of\ Asset}{Life\ Cycle\ of\ Asset} = Quantity\ of\ Asset\ per\ Year\ to\ be\ replaced$$

Example:

$$\frac{75\ miles\ of\ mainline}{100\ year\ life\ cycle} = 0.75\,\frac{mile}{year}\left(3{,}960\,\frac{ft}{year}\right)\ \textit{to be replaced}$$

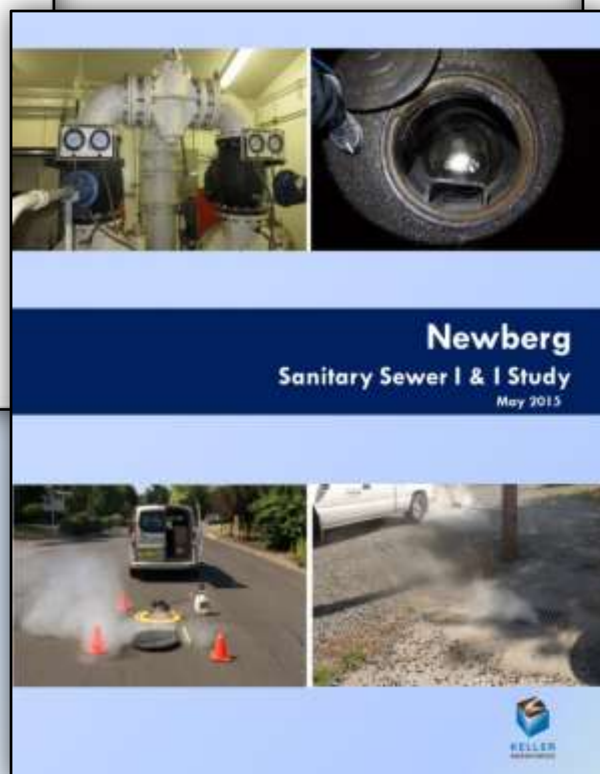
Monitor Improvements

- Continue to collect data
  - Flow monitoring
  - Pump run times
  - SCADA
- Monitor rehabilitation for improvements
  - Results of rehab can be used to plan future I/I elimination projects
  - NPDES requirements
- Share your successes!

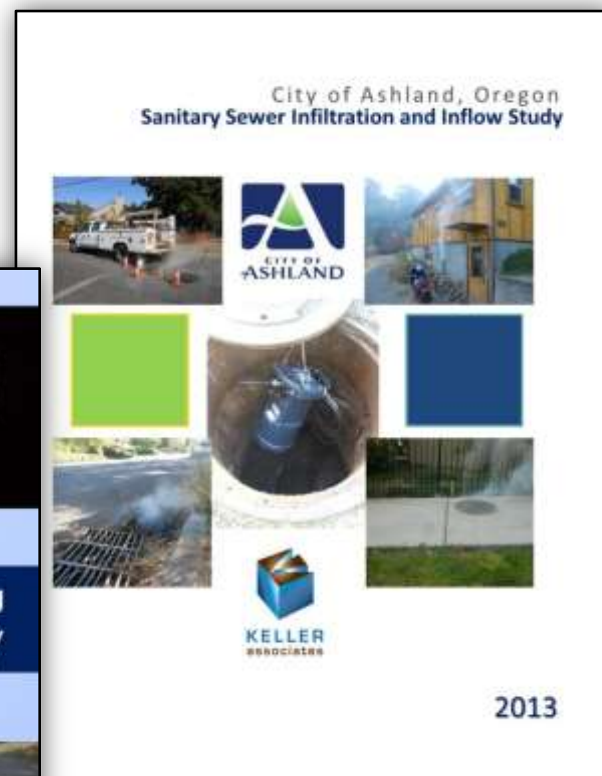
Case Studies

Stayton, OR

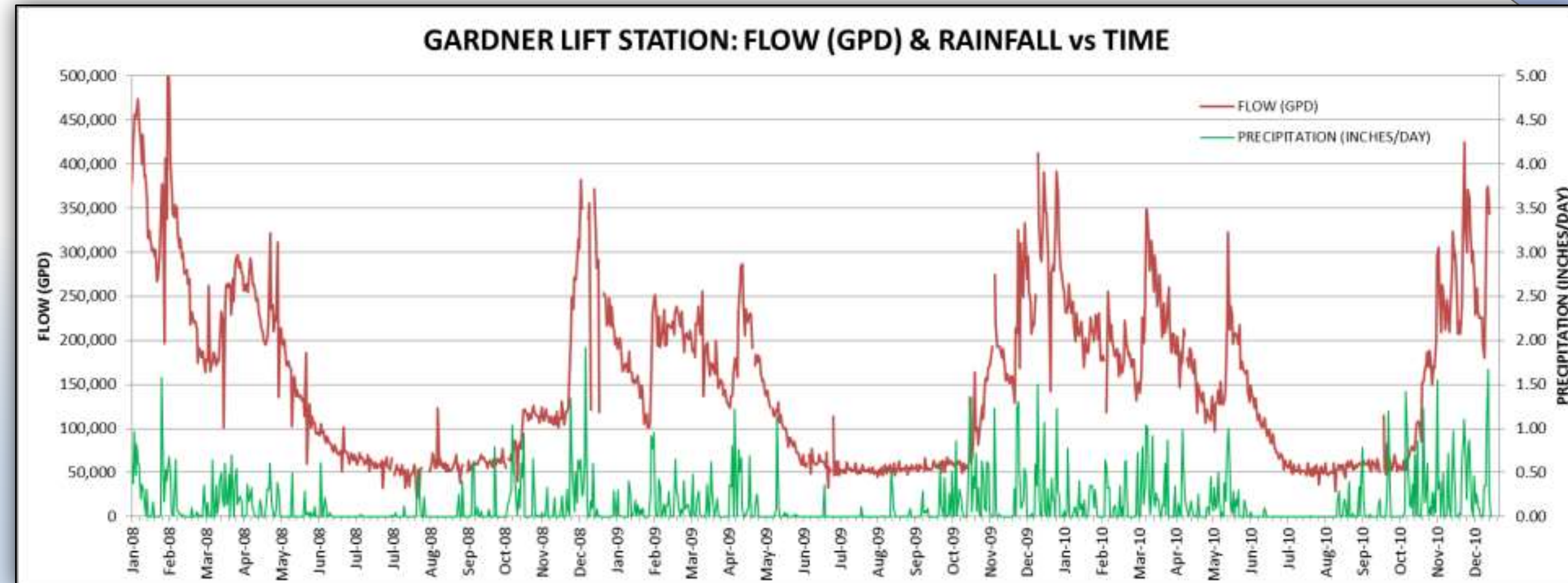
Newberg, OR



Ashland, OR



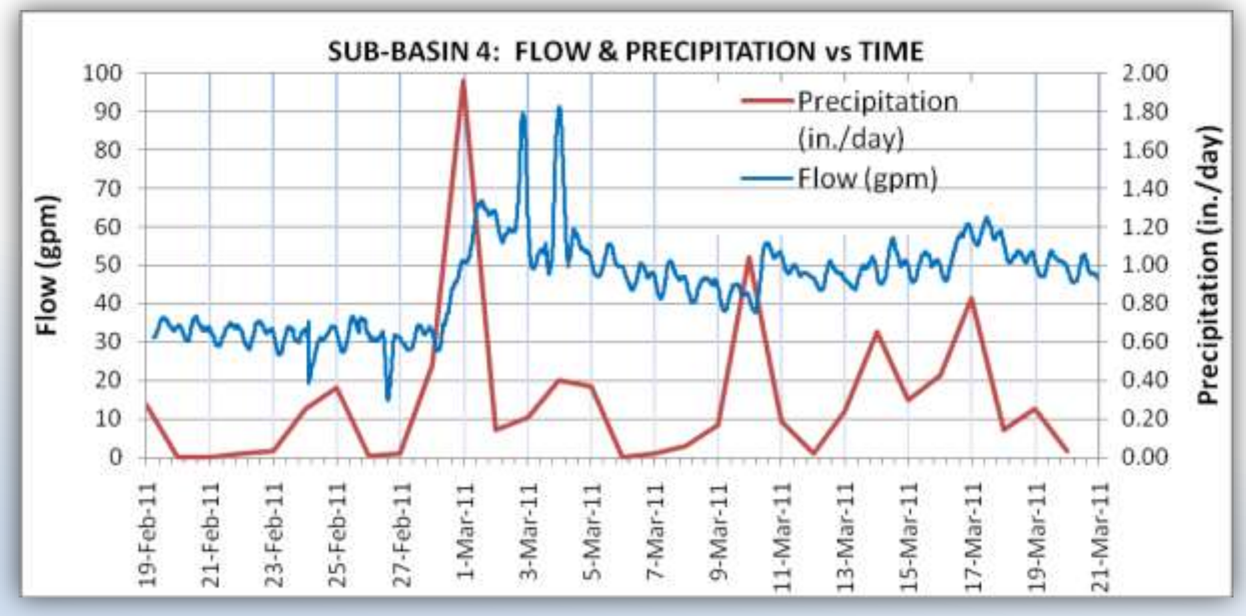
Case Study: Stayton, OR



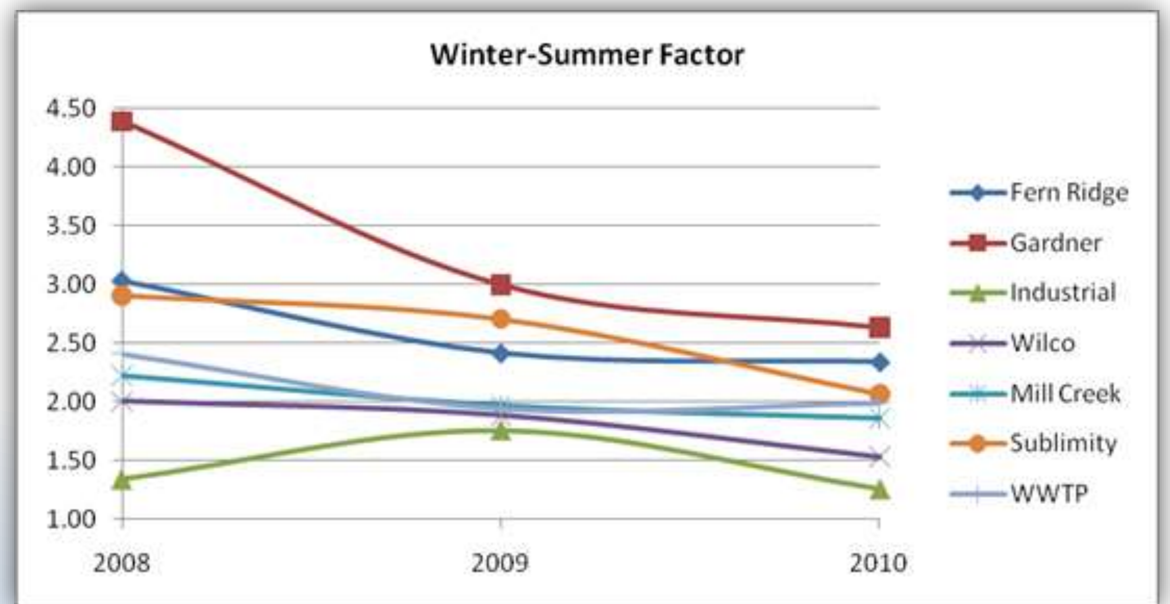
- Seasonal (shallow groundwater) infiltration
- Storm response

Case Study: Stayton, OR

- Pump run time analysis
- Flow monitoring
- Night-time monitoring
- Dye tests
- Reviewed CCTV logs



Case Study: Stayton, OR

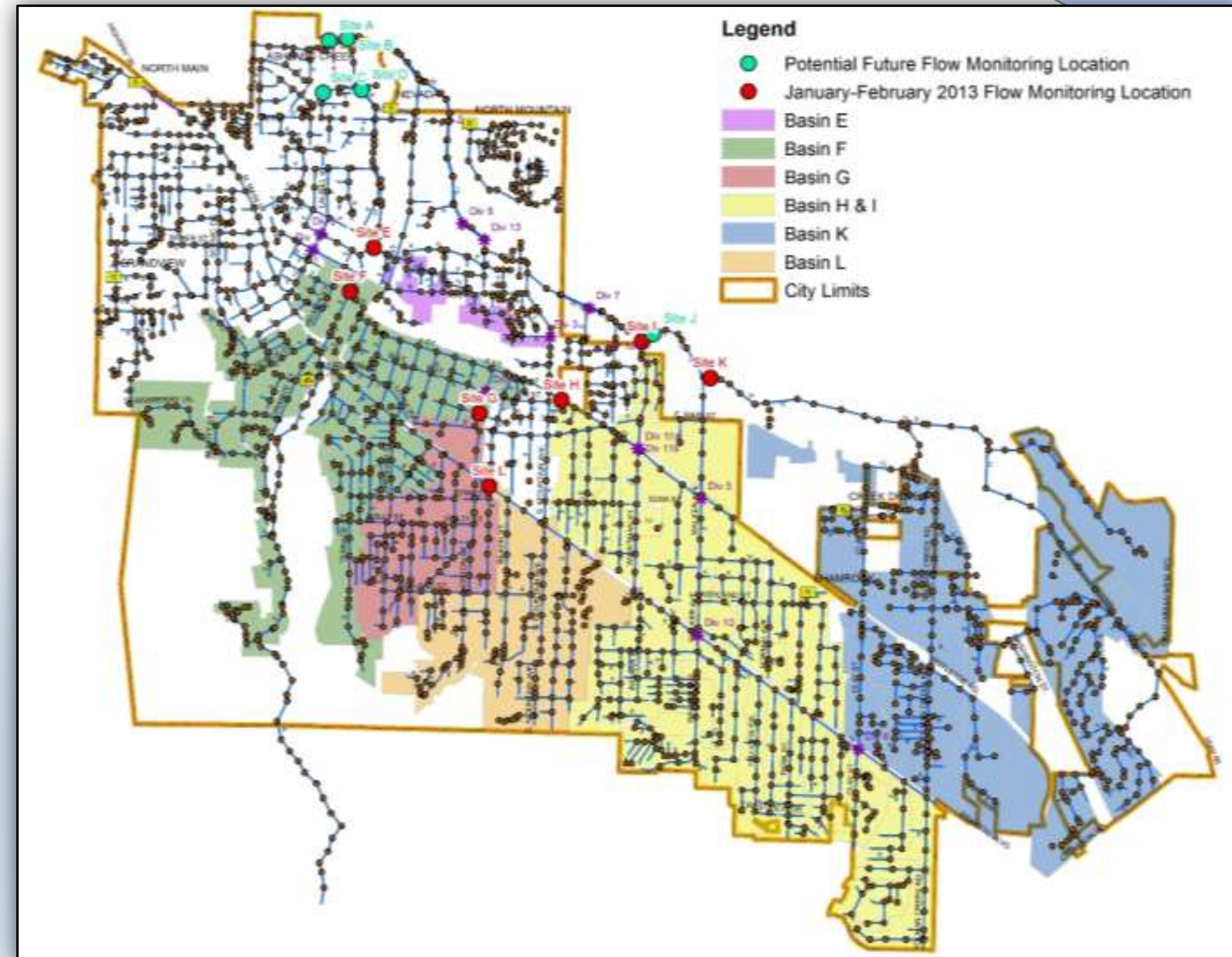


- Demonstrated I/I improvement through historic data
  - Routine CCTV schedule and subsequent repairs
- Identified basin with highest I/I
  - Subsequently, narrowed down worst sub-basin and largest contributors in sub-basin
- Developed list of priority improvements
- Suggested flow monitoring program similar to CCTV program
- Continue CCTV program and repairs

Case Study: Ashland, OR

Initial considerations:

- Older pipes (clay and concrete)
- New construction



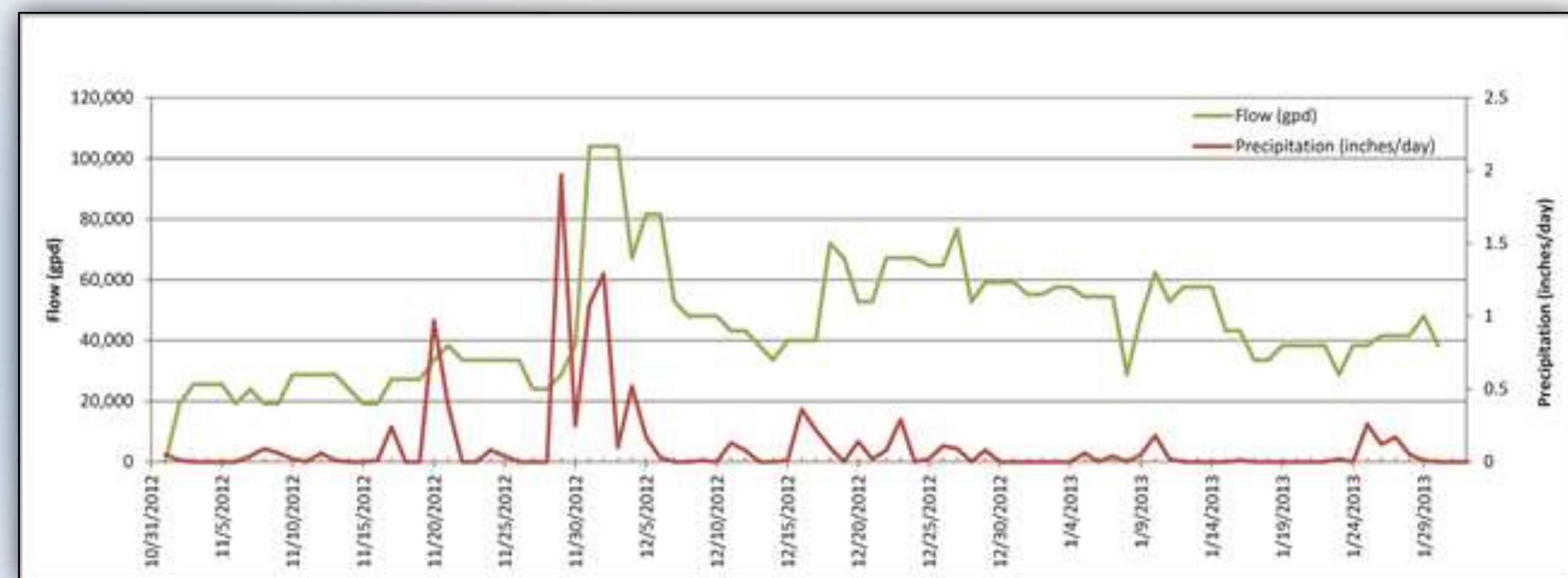
Case Study: Ashland, OR

- Pump run time analysis
- Flow monitoring
- Night-time monitoring
- Smoke testing

Table 2 – Peaking Factors for Selected Pump Stations

Pump Station	Peak Day Factor*
Grandview P.S.	2.32
North Main P.S.	1.95
North Mountain P.S.	1.93
Ashland Creek P.S.	1.52

*Peak day divided by average day for Nov. 2012-Jan 2013 period.



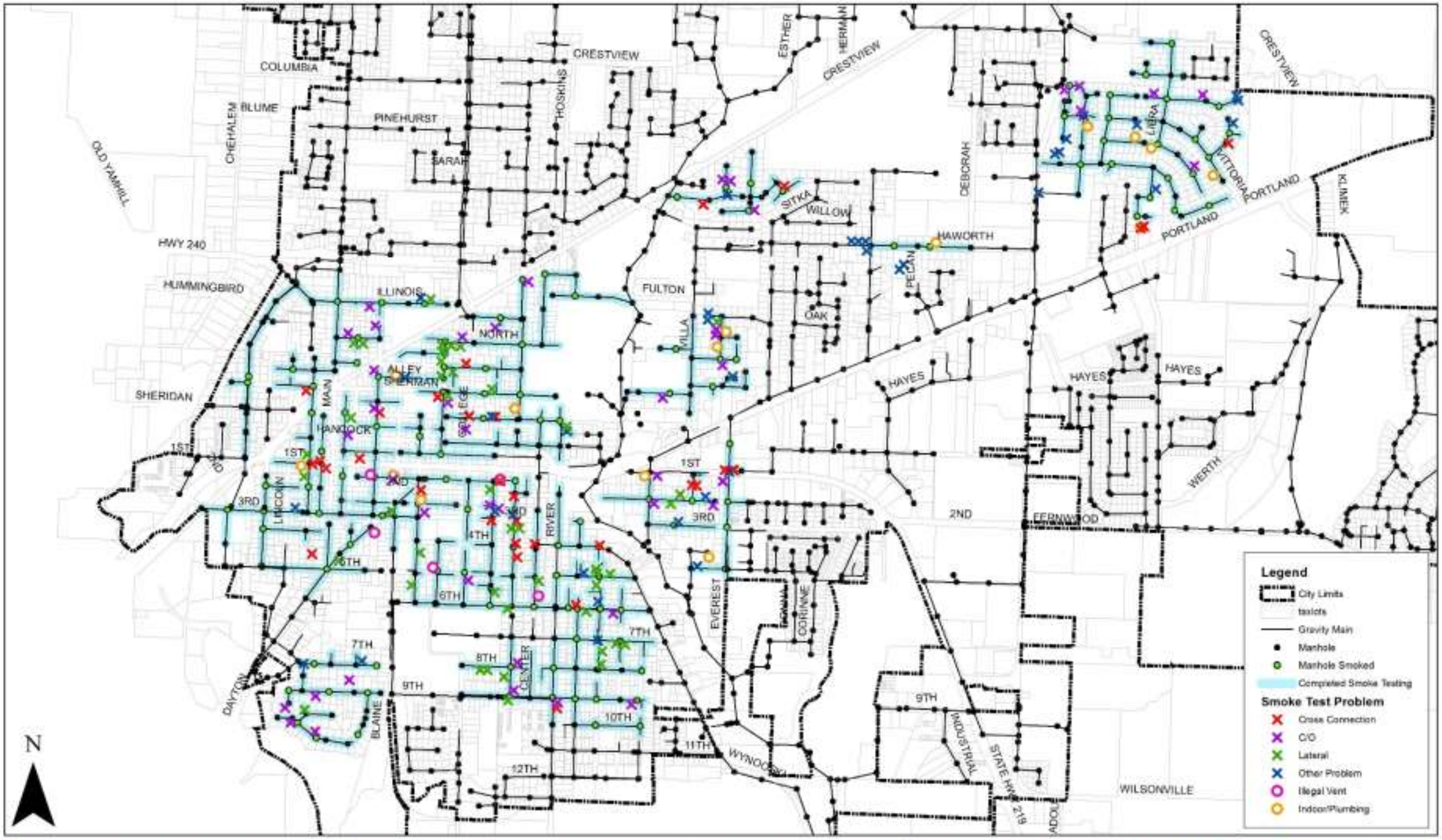
Case Study: Ashland, OR

- Focused on basin with highest I/I
- Narrowed down sub-basin with highest contributions

Smoke testing from this stormwater catch basin near 645 Glenwood Drive revealed a cross connection to the City's sanitary sewer system.

- Cost/benefit analysis
- Compiled list of cross connection inflows
  - Estimated rehabilitation costs
- Proposed areas for CCTV inspections and ongoing flow monitoring

Case Study: Newberg, OR



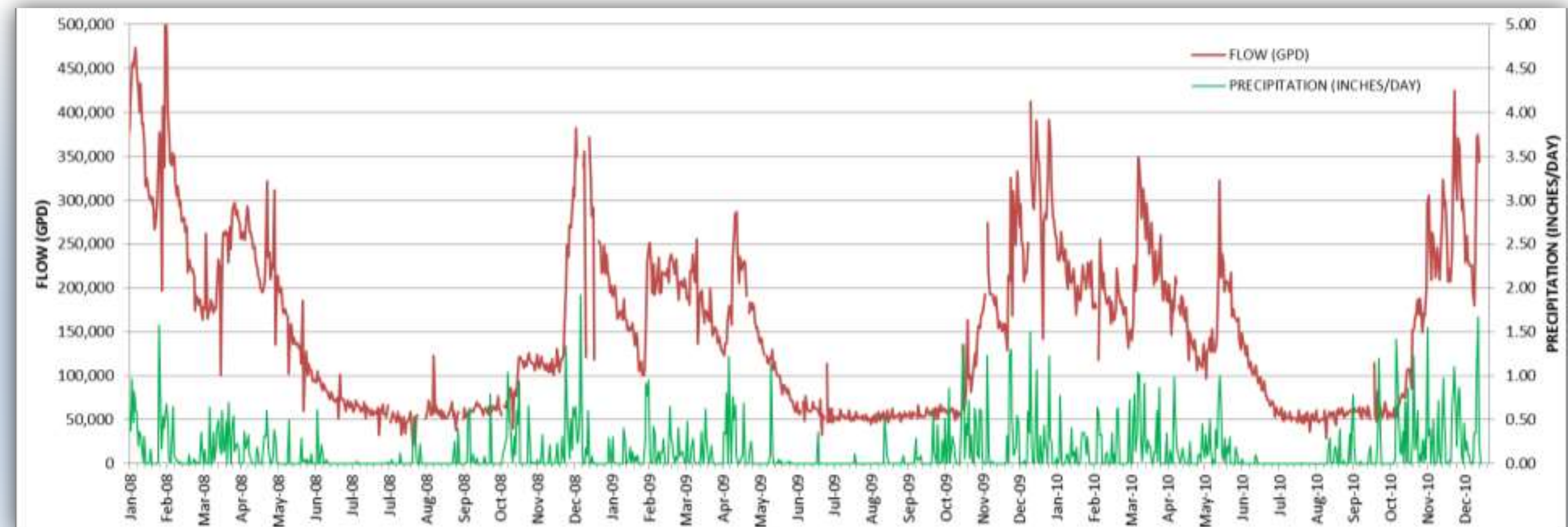
Title:	Project:	Prepared for:			Figure:
Smoke Testing Results	INFILTRATION AND INFLOW STUDY	CITY OF NEWBERG, OR	City of Newberg OREGON	KELLER associates	05

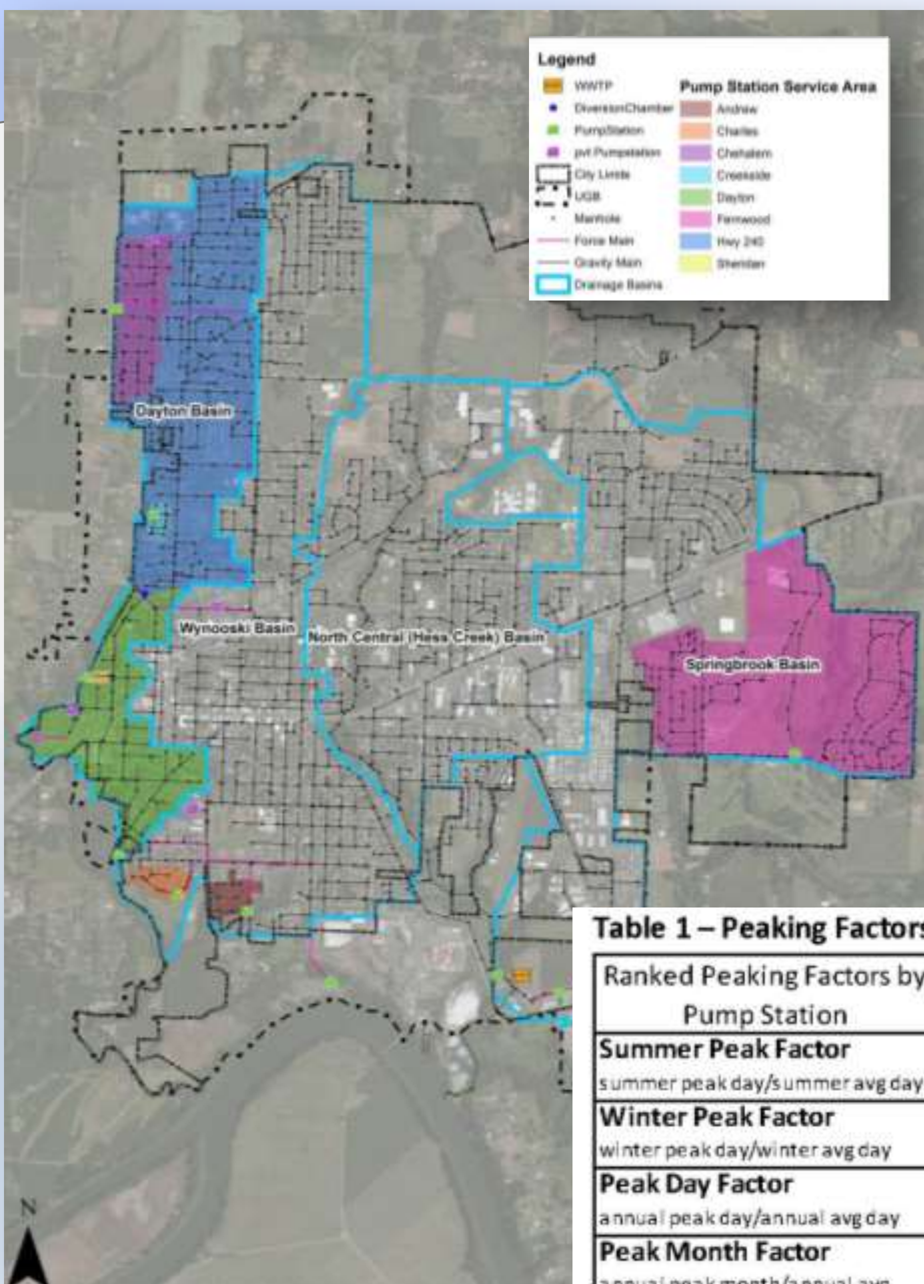
Determining Newberg's Sources of I/I

- WWTP influent data
- Pump run time analysis
  - Narrows down worst basins**
- Flow monitoring
  - Narrows down worst areas
- Nighttime monitoring
  - Narrows down worst segments
- Smoke testing
  - Smoking guns
- Video inspection
  - Pipe conditions and indicators

Start with WWTP influent data

- Seasonal groundwater infiltration patterns
- Storm response



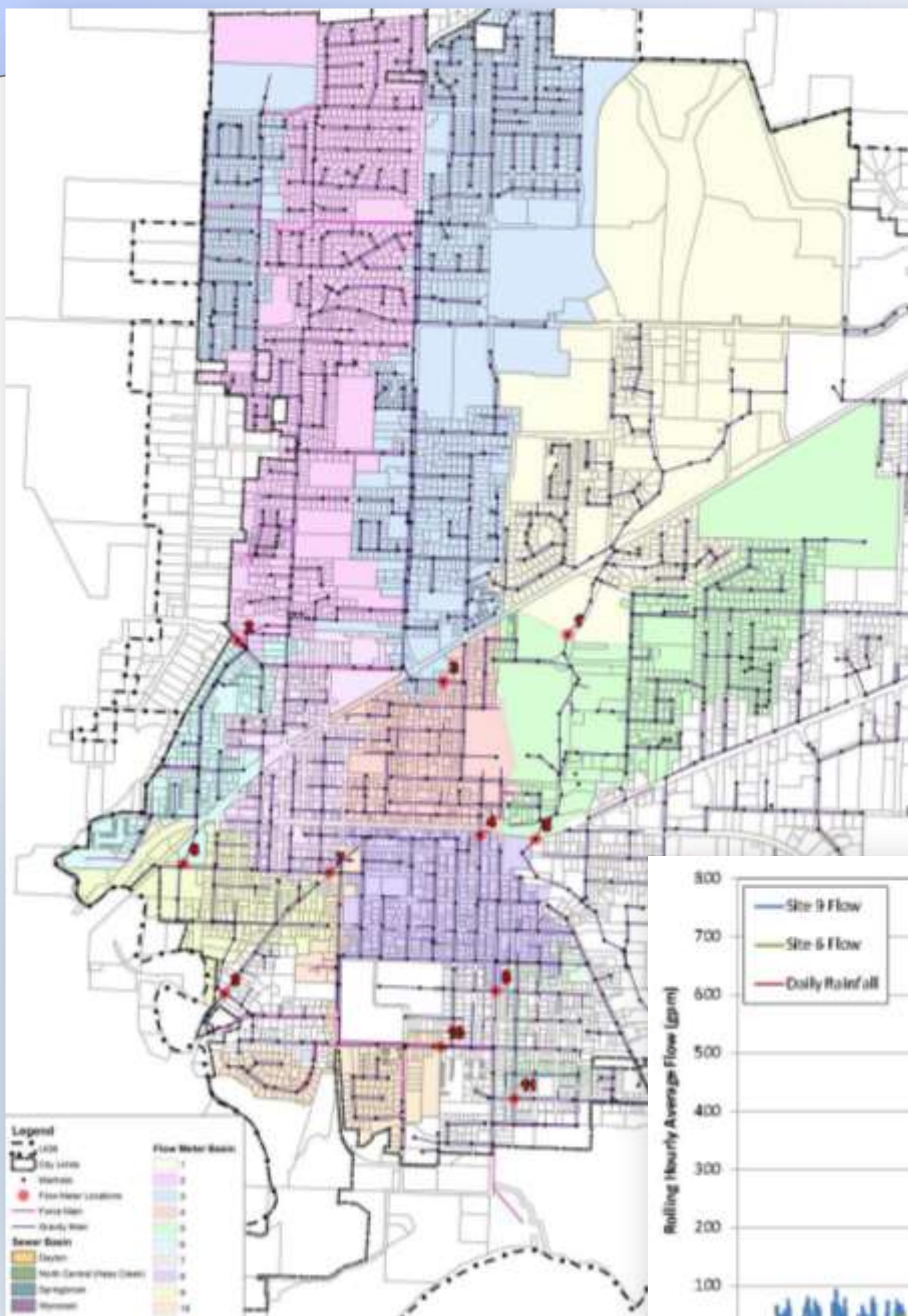


Review other Available Data

- Lift station flow metering and pump run time data

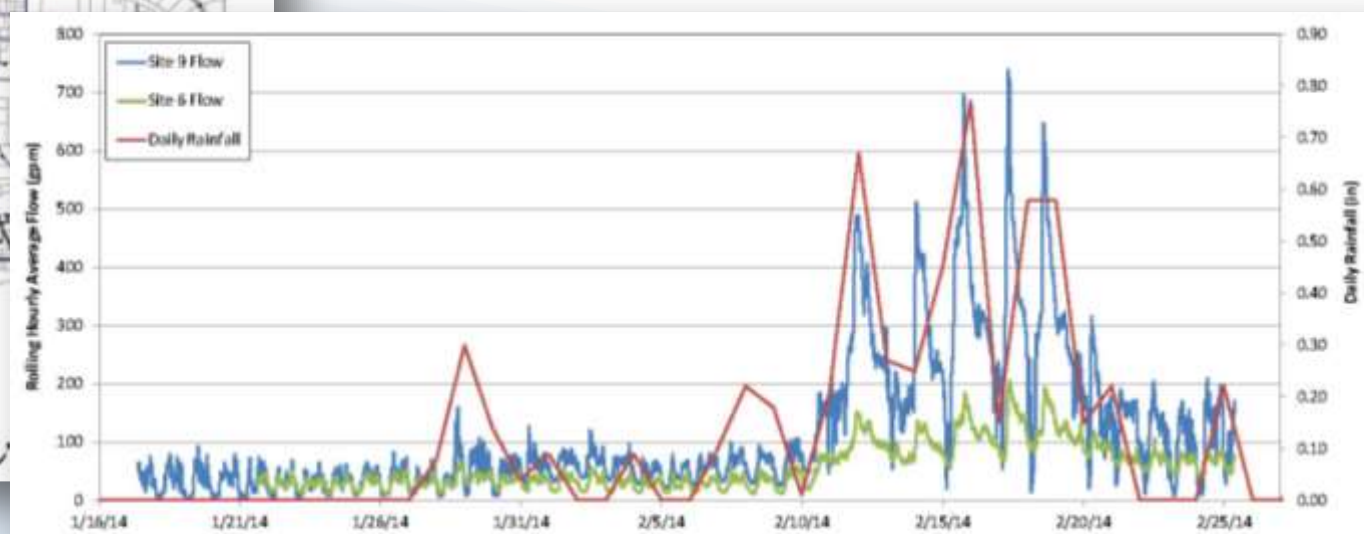
Table 1 – Peaking Factors for Newberg Pump Stations

Ranked Peaking Factors by Pump Station	Andrew	Charles	Chehalem	Creekside	Dayton	Sheridan	Fernwood	Highway 240
Summer Peak Factor summer peak day/summer avg day	1.7	2.8	1.4	1.7	3.5	4.0	1.4	1.8
Winter Peak Factor winter peak day/winter avg day	3.1	4.2	4.7	2.7	4.1	17.5	1.8	2.6
Peak Day Factor annual peak day/annual avg day	3.9	6.4	5.0	3.3	6.3	17.2	3.1	3.3
Peak Month Factor annual peak month/annual avg	1.7	2.0	1.6	1.7	2.1	2.4	1.3	1.8
Winter-Summer Avg Factor winter avg day/summer avg day	1.8	2.5	1.5	1.8	2.7	2.1	1.3	2.4
Winter-Summer Peak Factor winter peak day/summer	5.4	10.2	7.0	4.9	11.5	42.4	2.4	6.0

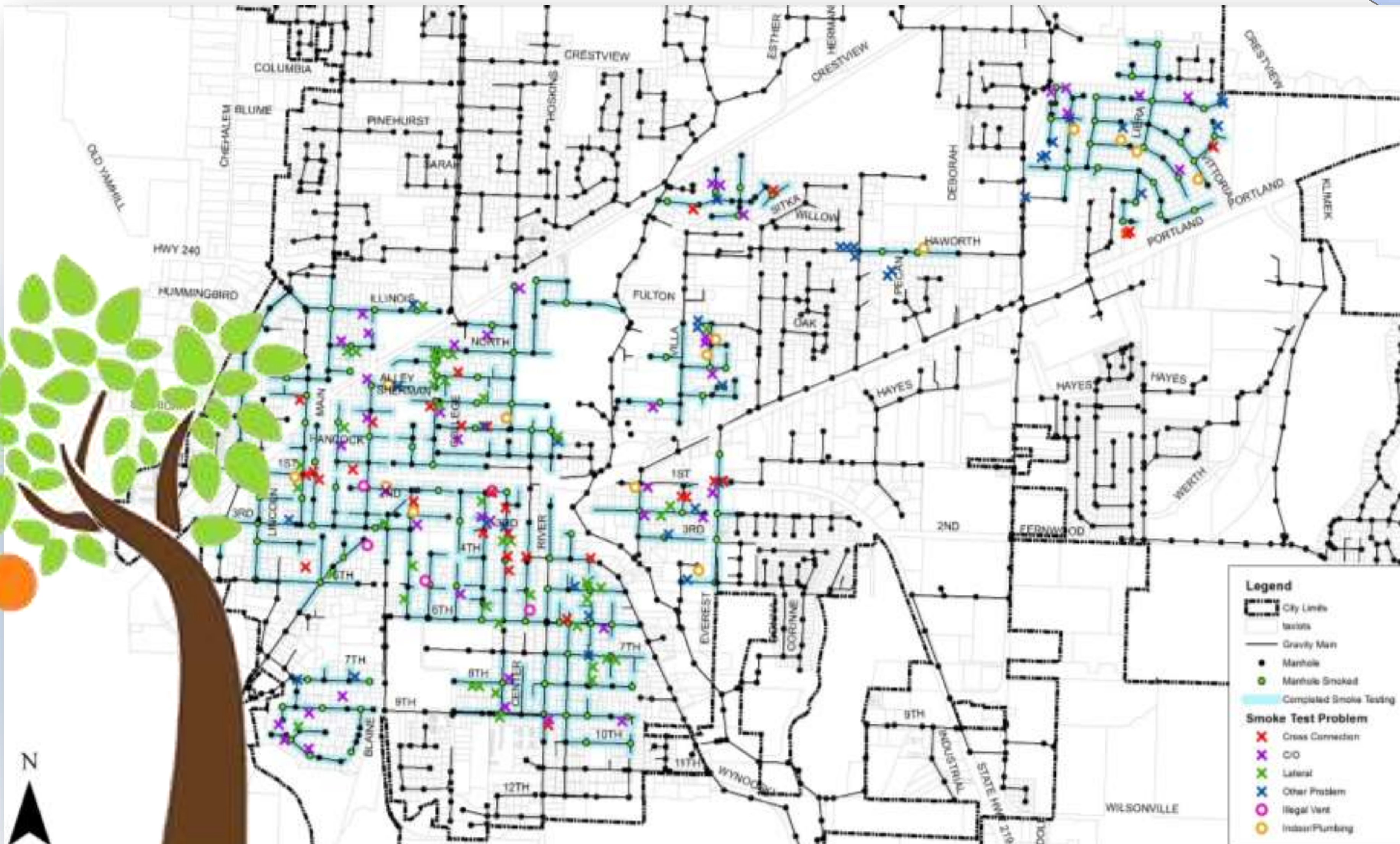


Target Flow Monitoring Sites

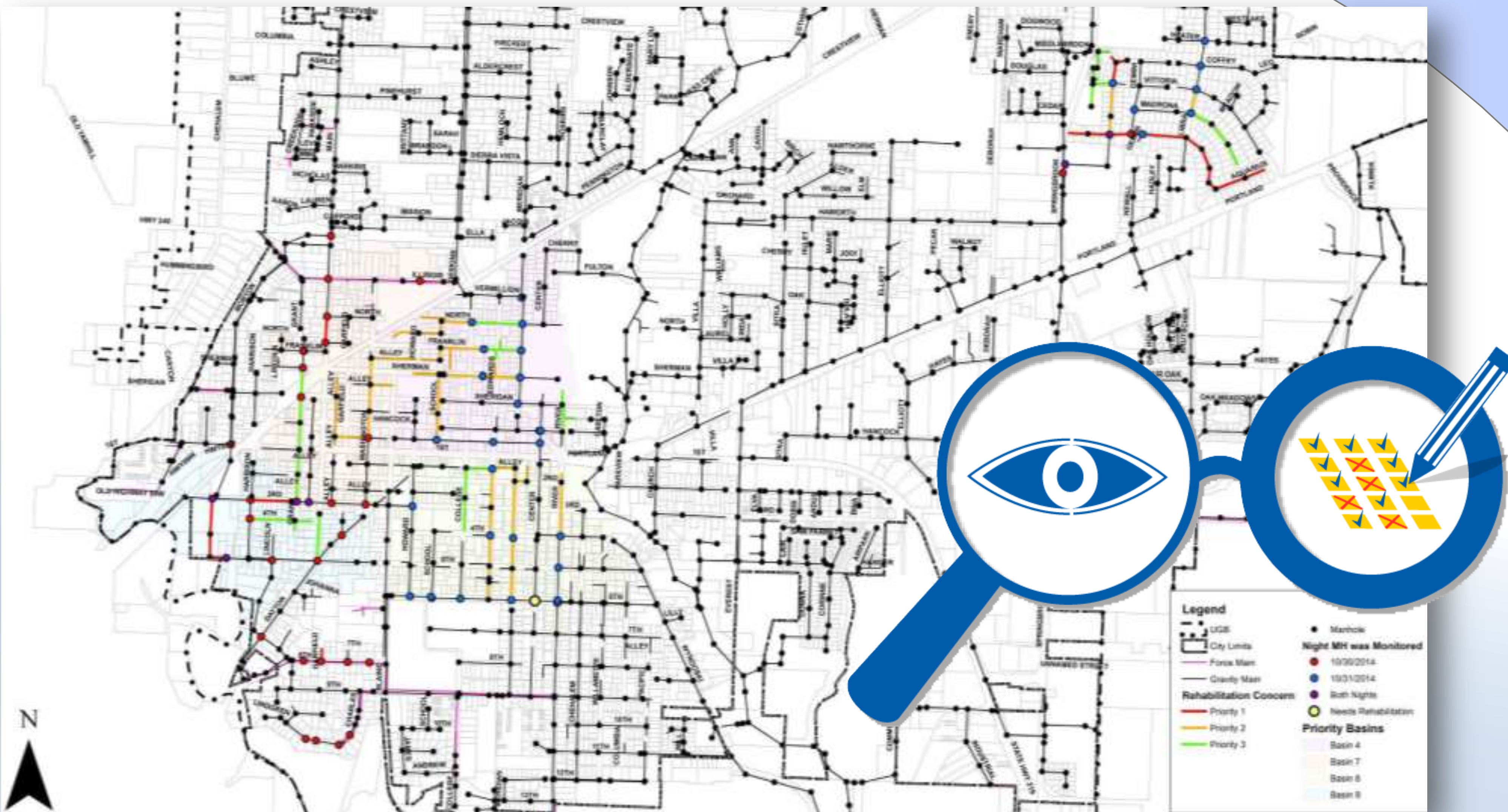
- Consider best time of year to capture high flow events

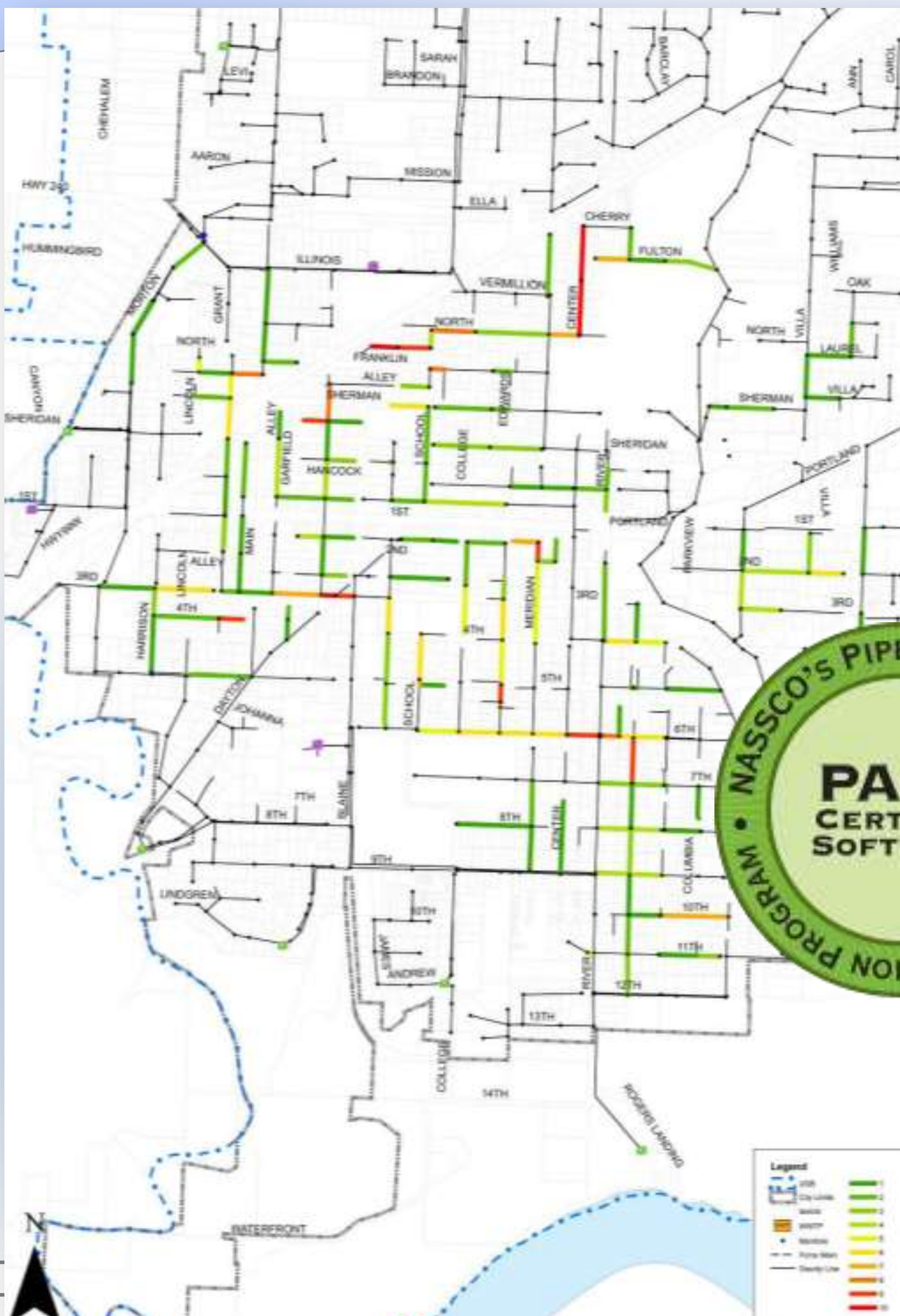


Use Smoke Testing to Find Low Hanging Fruit



Nighttime Flow Monitoring





CCTV Inspection

- Use standardized PACP rating criteria

Risk Considerations

- Risk = likelihood of failure (x) consequence of failure
- Consequence considerations

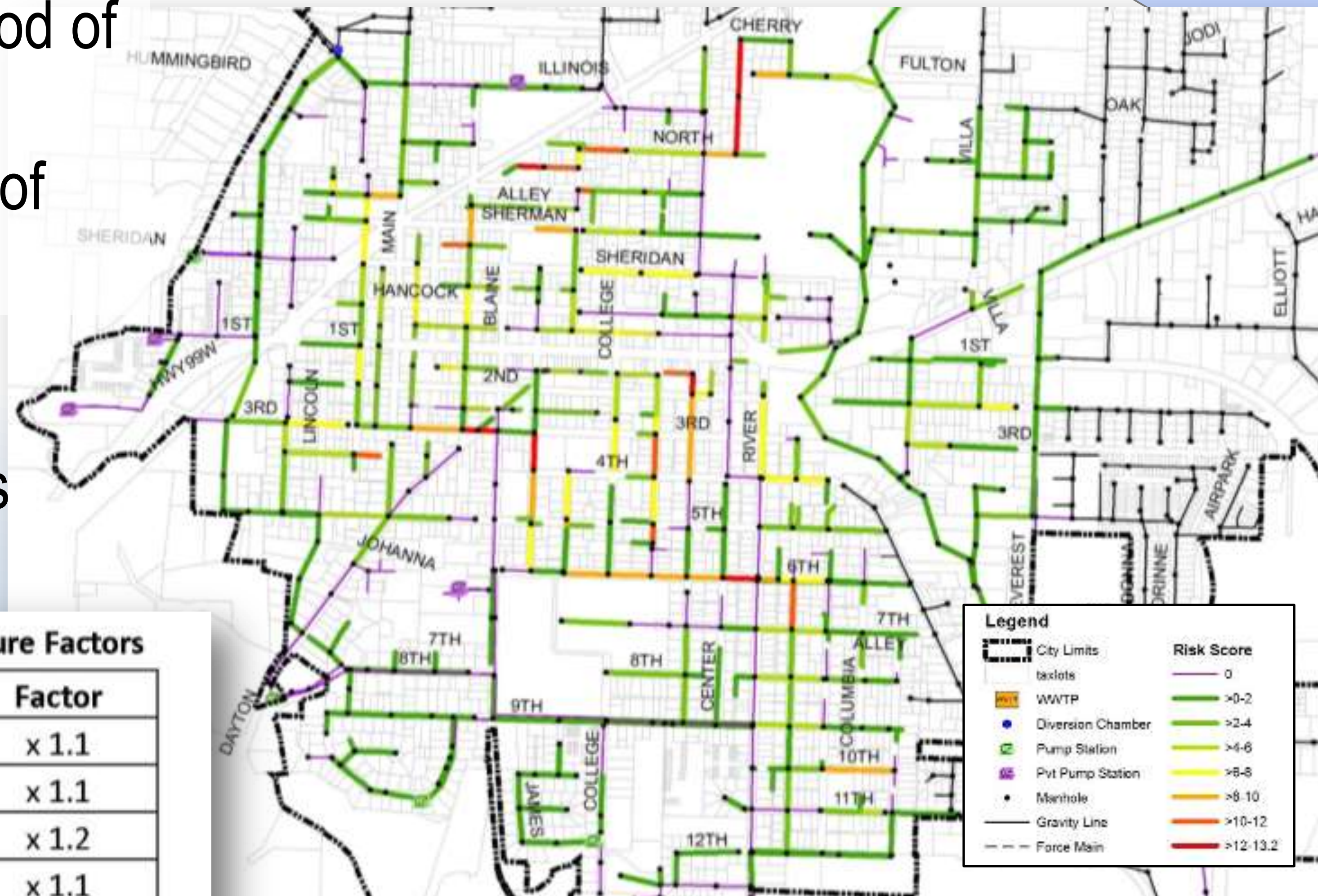


Table 9 –Consequence of Failure Factors

Parameter	Factor
If commercial zone	x 1.1
If next to school or creek	x 1.1
If interceptor ≥18"	x 1.2
If interceptor ≥12"	x 1.1

Prioritization

- Pipe Condition
  - CCTV reports
  - Structural and O&M defects
  - Pipe age and material
  - Night-time monitoring
- Risk
  - Risk = Consequence of failure x Likelihood of failure
  - Location: service to school, hospital, etc.
- Separate list of cross connections
- Separate list for spot repairs
  - Grade 4 or 5 structural defect in PACP report

Cost / Benefit

- Cross connections (smoking guns)
  - Rational method: estimated $/gpm removed
- Estimated cost of rehabilitation
- Estimated cost to convey and treat wastewater
- Calculated annual replacement budgets

Picture ID	Address	Inflow Source	Area of Inflow, A (ac)	Runoff Coefficient, C	Rainfall Intensity, i (in/hr)	Inflow, Q (cfs)	Inflow, Q (gpm)	Estimated Improvement City Cost	Cost per GPM
9	3813 Coffey Ln	driveway drain	0.02	0.75	1.85	0.03	12	$500	$40
26	1205 Hawthorne Loop	roof drain	0.07	0.90	1.85	0.12	52	$300	$6
31	1300 Villa Rd	roof drain	0.04	0.90	1.85	0.07	30	$300	$10
48	1542 E 1st St	roof drain	0.06	0.90	1.85	0.10	45	$300	$7
49	1544 E 1st St	roof drain	0.06	0.90	1.85	0.10	45	$300	$7
75	503 N College St	roof drain	0.04	0.90	1.85	0.07	30	$300	$10
107	417 & 419 S Main St	roof drain, driveway drain	0.19	0.84	1.85	0.30	133	$800	$6
115	112 S Edwards St Dormer's Embroidery	roof drain	0.24	0.90	1.85	0.40	179	$300	$2
128	406 S Meridian St	roof drain	0.06	0.90	1.85	0.10	45	$300	$7
153	904 S River St	roof drain	0.03	0.90	1.85	0.05	22	$300	$13
42	E 1st St and Everest Rd	roadside swale	0.8	0.75	1.85	1.11	498	$500	$1
43	E 1st St and Everest Rd	roadside swale	0.8	0.75	1.85	1.11	498	$500	$1
45	E 1st St and Everest Rd	catch basin (3x)	0.55	0.59	1.85	0.60	271	$14,500	$54
66	300 N Lincoln St (K V Mini Storage)	catch basin (1x)	0.6	0.59	1.85	0.66	295	$9,500	$32
86	E Sheridan St and N College St	catch basin (2x)	0.63	0.59	1.85	0.69	310	$33,500	$108
87	E Sheridan St and N Edwards St	catch basin (2x)	0.65	0.59	1.85	0.71	320	$34,000	$106
93	E Sheridan St and N Washington St	catch basin (2x)	0.65	0.59	1.85	0.71	320	$35,000	$109
97	W 1st St and S Grant St	catch basin (4x)	0.48	0.59	1.85	0.53	236	$20,000	$85
99	W 1st St between Grant St and Main St	catch basin (1x)	0.15	0.59	1.85	0.16	74	$14,500	$196
111	E 2nd St and S Howard St	catch basin (4x)	0.7	0.59	1.85	0.77	345	$20,000	$58
117	E 2nd St and S Meridian St	catch basin (2x)	0.6	0.59	1.85	0.66	295	$9,000	$30
121	E 3rd St and S Edwards St	catch basin (3x)	0.7	0.59	1.85	0.77	345	$14,500	$42
123	E 3rd St and S Meridian St	catch basin (4x)	0.63	0.59	1.85	0.69	310	$20,000	$64
126	E [illegible]ian St	catch basin (2x)	0.8	0.59	1.85	0.88	394	$30,000	$76
127	[illegible]	catch basin (4x)	0.8	0.59	1.85	0.88	394	$20,000	$51
137	[illegible]	catch basin (2x)	0.76	0.59	1.85	0.83	374	$42,000	$112
14[illegible]	[illegible]	catch basin (4x)	0.85	0.59	1.85	0.93	419	$20,000	$48
						Totals:	6000	$342,000	$57

Sample Cost / Benefit Analysis

- Cross Connections
  - Cost to remove
  - GPM benefit
  - Relative cost per GPM comparison

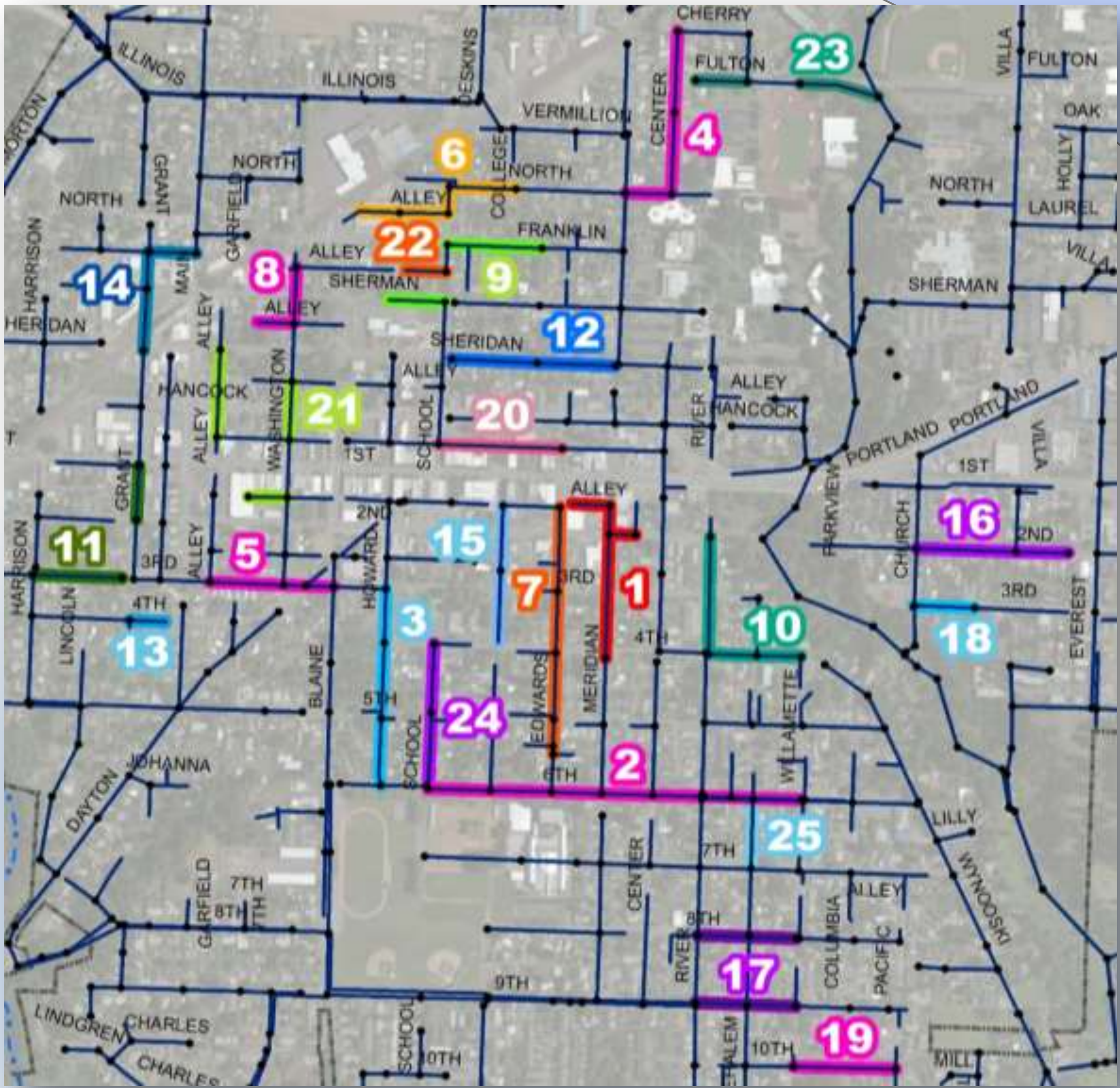
Sample Cost / Benefit Analysis

- Cost to convey and treat
  - Fixed and variable costs
- I/I inconsistent flow, based on rainfall and groundwater
  - Variable intensity of rainfall
  - Variable duration of rainfall

	COST		VARIABLE COSTS	
Operations (WWTP)				
Operating supplies	$	144,580	10%	$ 14,458
Utilities	$	282,655	40%	$ 113,062
Equipment Repair and Maintenance	$	147,680	25%	$ 36,920
Pump Station Maintenance	$	6,531	50%	$ 3,266
WW Collection				
Supplies & Tools	$	15,867	25%	$ 3,967
Inflow/Infiltration	$	4,105	100%	$ 4,105
Wastewater Rehabilitation	$	58,000	75%	$ 43,500
Wastewater System Replacement	$	6,417	50%	$ 3,209
Manhole Rehabilitation	$	-	50%	$ -
Lateral Replacement	$	16,012	70%	$ 11,208
Equipment Repair and Maintenance	$	4,510	25%	$ 1,128
Pipe and Materials	$	20,541	25%	$ 5,135
				$ 239,957
		average daily flow		3.4 mgd
		average daily flow		2361 gpm
		O&M Savings		**$102 / gpm**

Priority Improvements

- Prioritize based on multiple criteria
  - CCTV reports
  - Pipe age and material
  - Observed infiltration
  - Consequence of failure
- Grouped projects
  - Separate lists for cross connections and spot repairs, organized by $/gpm



Case Study: Newberg, OR

Deliverables

- Prioritized list of rehabilitation projects
- List of spot repairs – major pipe defects
- List of cross connections

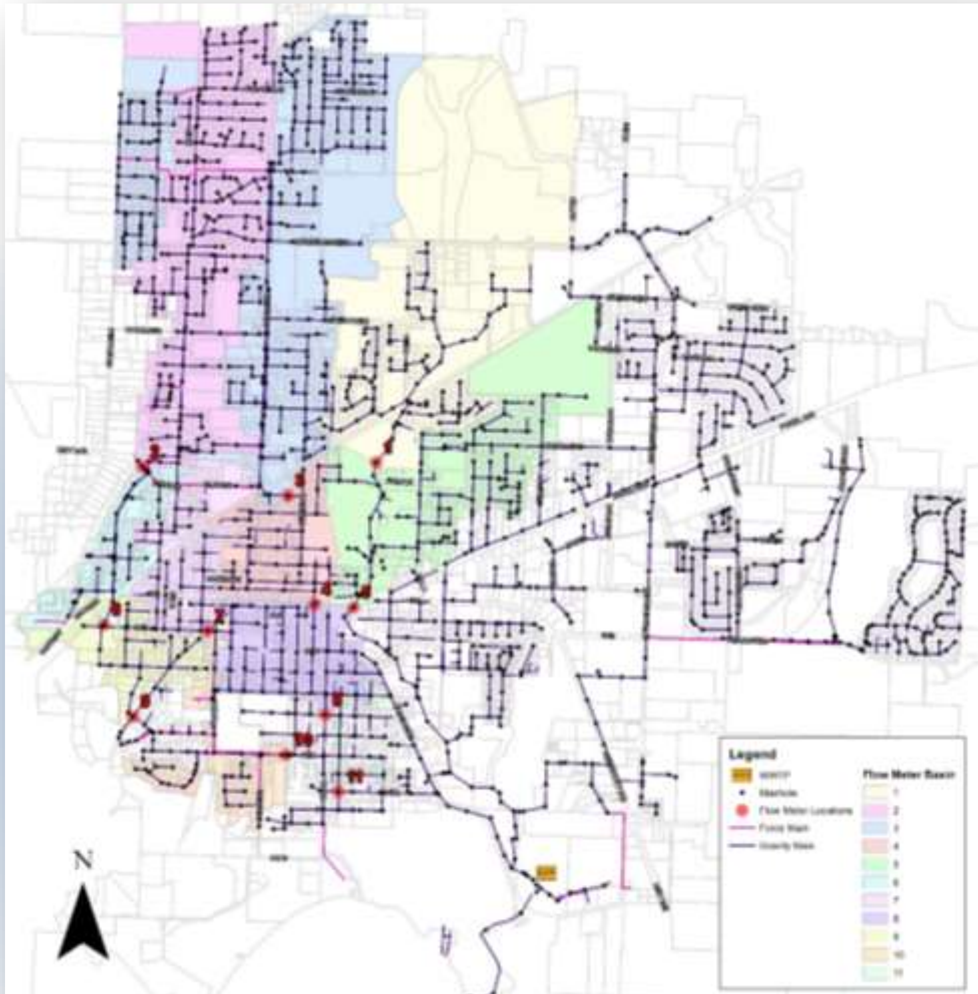
Utilization

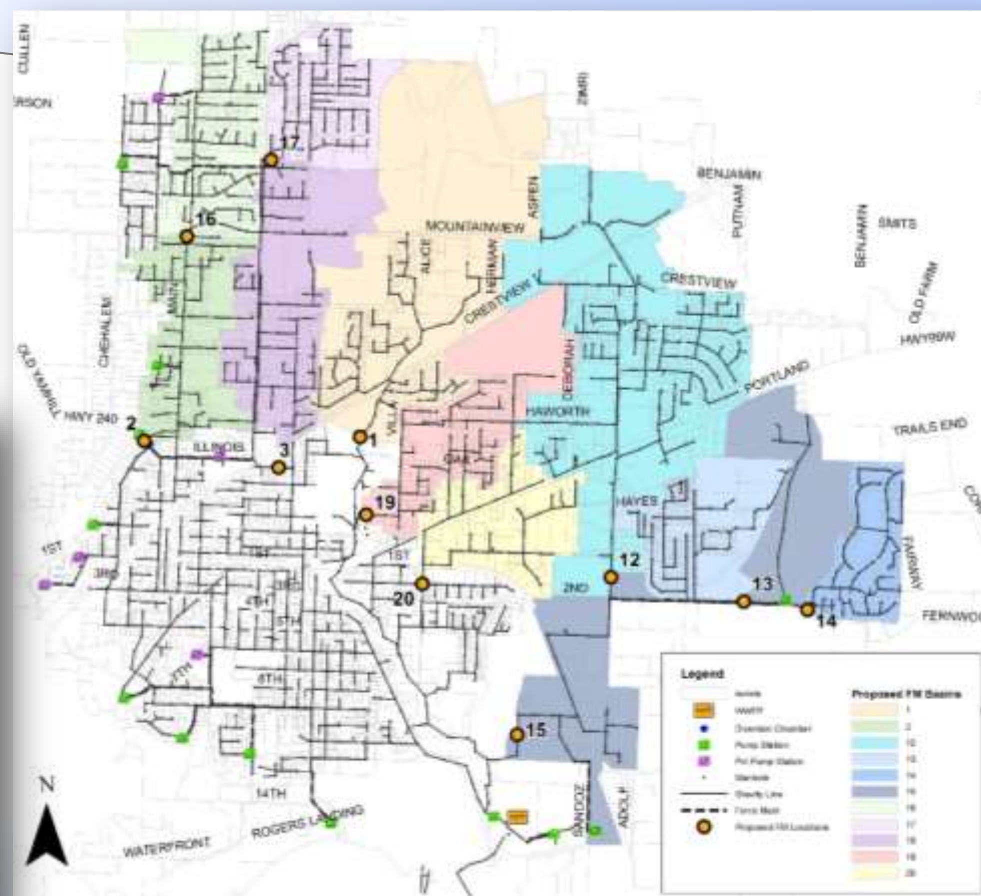
- Allows “smart” planning of rehabilitation projects
  - Can group with other utility work
- Can budget rehab work annually
- Update and re-prioritize list as additional data is collected (living document)
- Prioritized projects if extra money is awarded or surplus budget

Round 2 / Lessons Learned

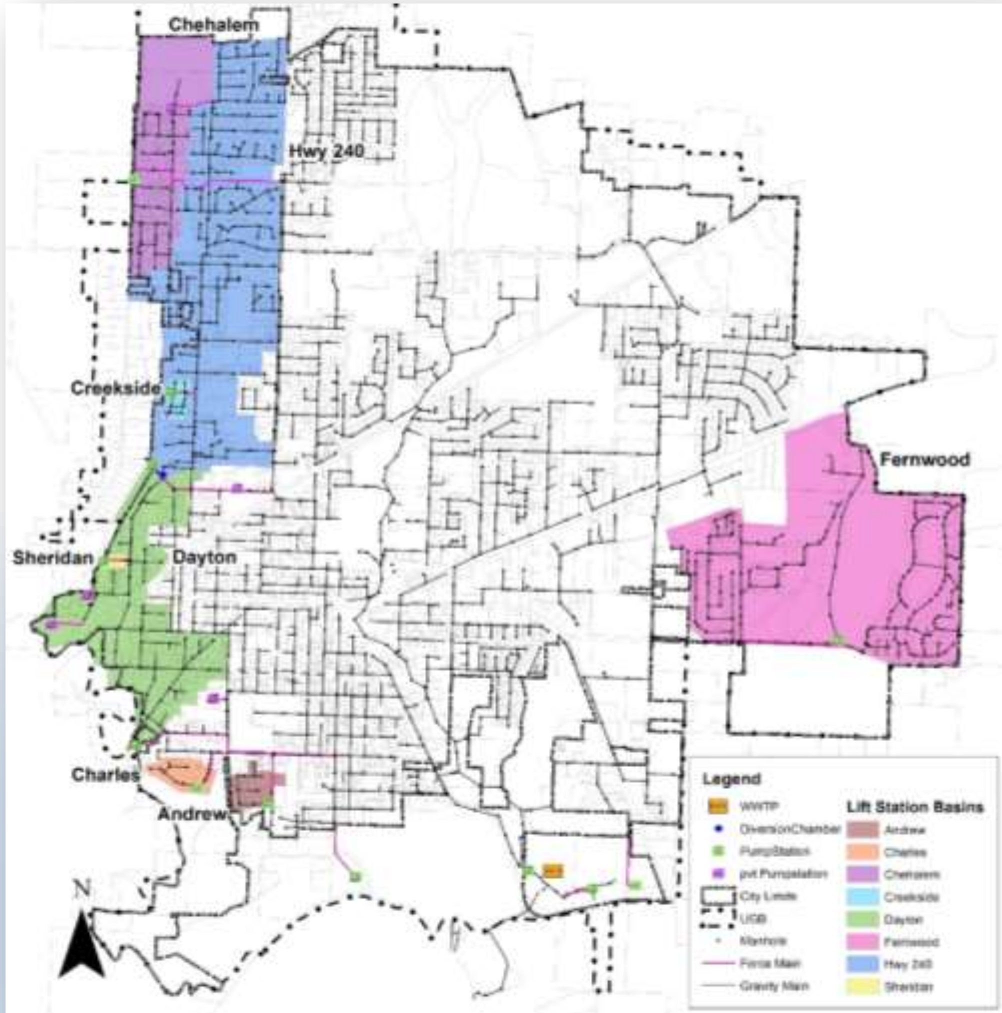
- Newberg Wastewater Master Plan
  - Building on previously completed I/I Study
  - Incorporating collected data from then to now
    - Standardize methods of data collection
  - Collecting new data in different areas
    - Extents of data are important
  - Updating prioritized projects and lists

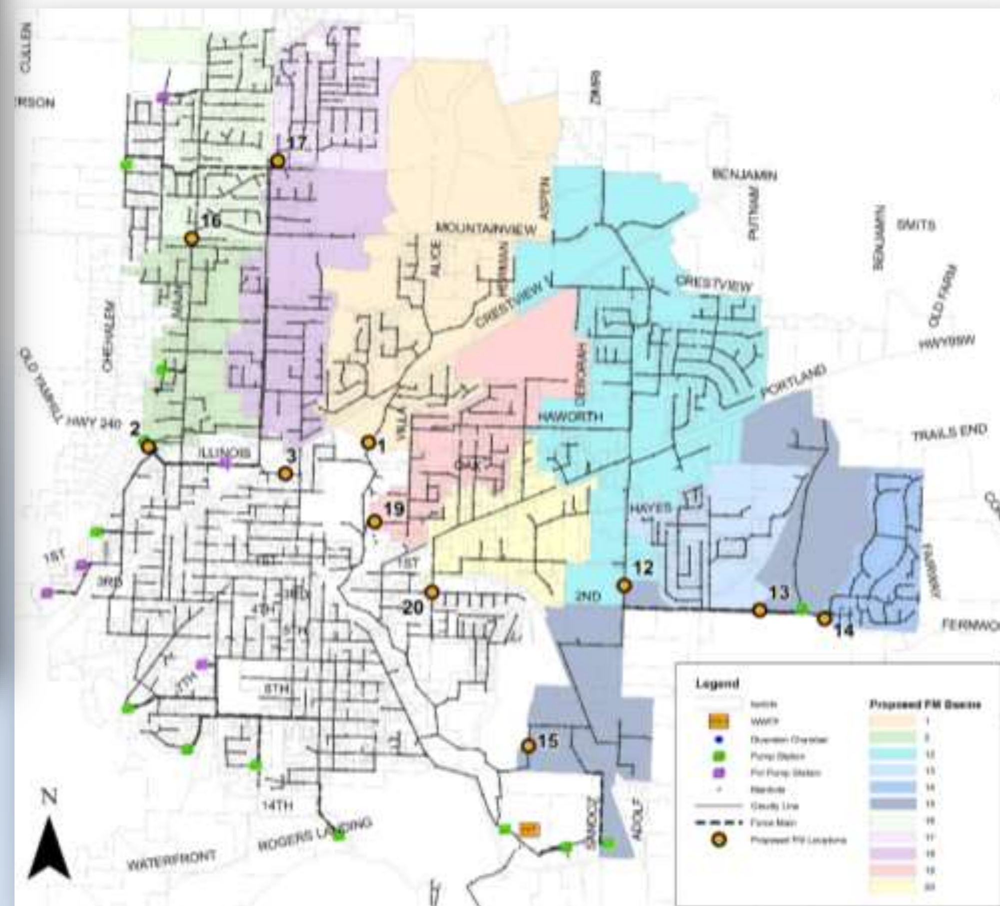
Building on Initial Study





Data Extents





Keep Records & Standardize Process

- Highlights trends over time
- Facilitates ability to track condition changes

I/I Flow (MGD)	Andrew	Charles	Chehalem	Creekside	Dayton	Sheridan	Fernwood	Highway 240
2009	0.07	0.11	0.10	0.06	3.2	0.02	0.13	N/A
2010	0.06	0.09	0.17	0.05	1.8	0.01	0.12	0.35
2011	0.05	0.11	0.48	0.05	1.0	0.02	0.21	0.35
2012	0.06	0.09	0.25	0.07	1.3	0.01	0.16	0.37
2013	0.04	0.06	0.06	0.01	0.48	0.00	0.16	0.50
2014	0.07	0.14	0.08	0.01	1.03	0.01	0.18	0.70
2015	0.12	0.25	0.13	0.02	1.81	0.01	0.44	1.03
2016	0.08	0.13	0.13	0.01	0.86	0.01	0.54	1.04
Average	0.07	0.12	0.18	0.04	1.5	0.01	0.24	0.62

What can you do about I/I?

- Start with what you have
  - Collect data (daily pump run times, CCTV reports, etc.)
- Educate political leaders & commit to an I/I program appropriate for your community
- Identify & correct the low hanging fruit (and share your success!)
  - Cost/benefit
  - Prioritized plan
- Don’t be afraid to ask for help to jump start or enhance your program

QUESTIONS?

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