Kutzky Park and Slatterly Park Neighborhoods
Pilot Infiltration/Inflow (I/I) Study
City Council Update

City of Rochester, MN
May 23, 2011

Introduction of Presenters

- Richard Freese, P.E. - Director of Public Works
- Rick Nelson, P.E. - CH2M HILL
- Bill Angerman, P.E. - WHKS

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Meeting Objectives

- Present findings, conclusions and recommendations of the Pilot Infiltration/Inflow (I/I) Investigation Study
  - Results of sanitary sewer system analysis
    - Sources of infiltration and inflow (I/I) – private and public sectors
    - Maintenance and structural evaluation
    - Hydraulic evaluation
    - Causes of sewer backups
  - Recommendations

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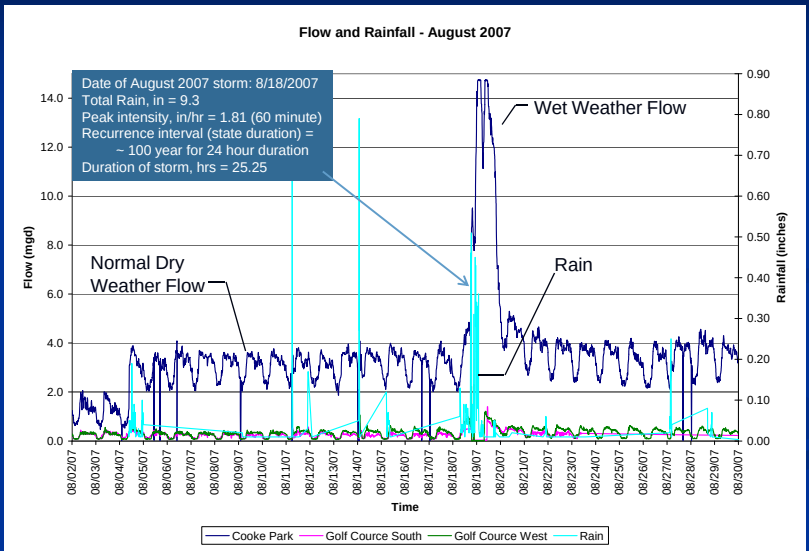
The August 2007 Intense Rainfall Overloaded the Sanitary Sewer System



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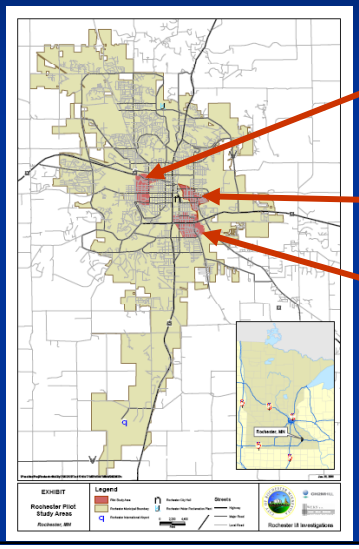
Three Sewersheds Experienced A High Number of Sewer Backups During the August 2007 Storm and Were Thoroughly Investigated



Kutzky Park – 303 Acres, 45,762 ft

Slatterly East – 249 Acres, 38,572 ft

Slatterly West – 400 Acres, 52,966 ft

Sewersheds primarily single family residential with home ages 40 – 80 years old. Some major commercial, St. Mary's in Kutzky and Seneca in SW. Total public main is 137,300 ft.

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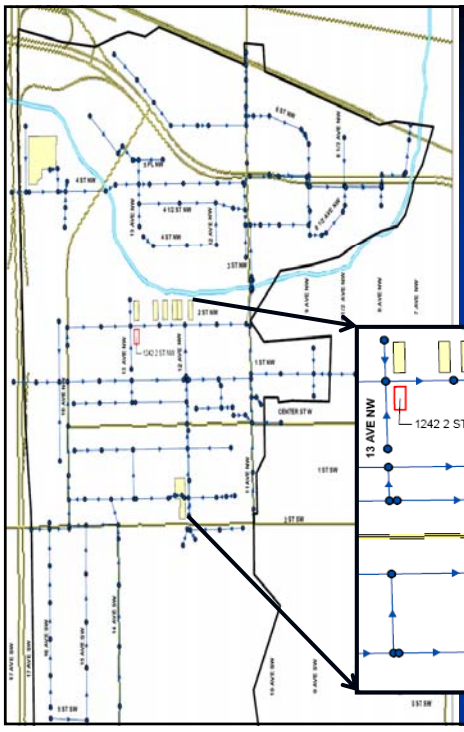

Kutzky Park Sewershed and 2007 Backup Locations

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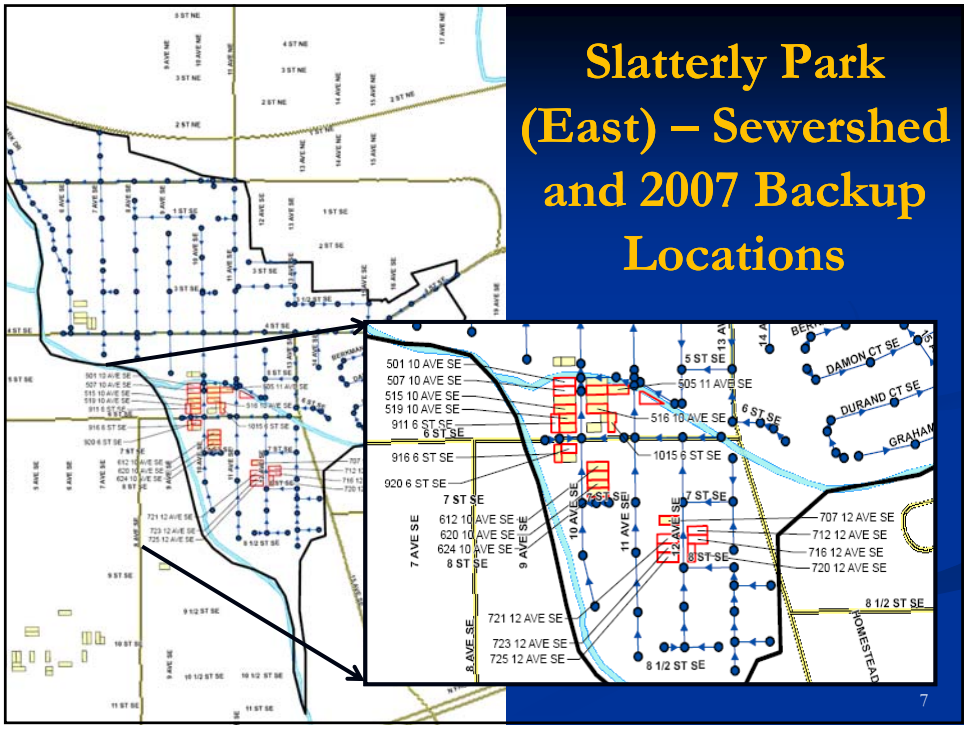
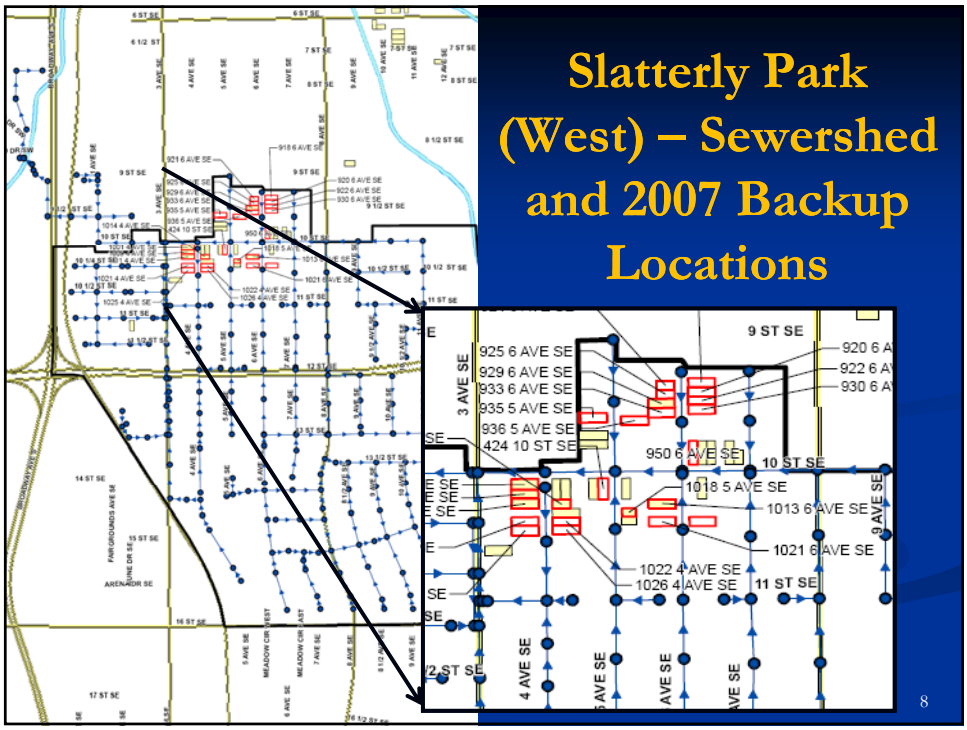
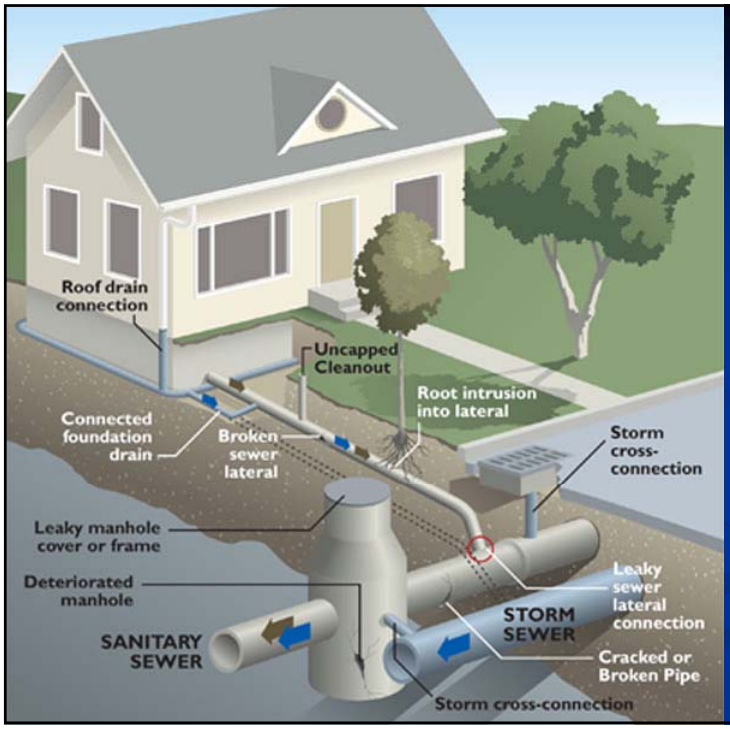

Slatterly Park (East) – Sewershed and 2007 Backup Locations
501 10 AVE SE
507 10 AVE SE
515 10 AVE SE
519 10 AVE SE
911 6 ST SE
916 6 ST SE
920 6 ST SE
612 10 AVE SE
620 10 AVE SE
624 10 AVE SE
721 12 AVE SE
723 12 AVE SE
725 12 AVE SE
505 11 AVE SE
516 10 AVE SE
1015 6 ST SE
707 12 AVE SE
712 12 AVE SE
716 12 AVE SE
720 12 AVE SE
DAMON CT SE
DURAND CT SE
7 ST SE
8 ST SE
8 1/2 ST SE
HOMESTEAD
7 AVE SE
9 AVE SE
10 AVE SE
11 AVE SE
12 AVE SE
8 AVE SE
7


Slatterly Park (West) – Sewershed and 2007 Backup Locations
925 6 AVE SE
929 6 AVE SE
933 6 AVE SE
935 5 AVE SE
936 5 AVE SE
424 10 ST SE
950 6 AVE SE
1018 5 AVE SE
1013 6 AVE SE
1021 6 AVE SE
1022 4 AVE SE
1026 4 AVE SE
9 ST SE
10 ST SE
11 ST SE
3 AVE SE
4 AVE SE
9 AVE SE
8

Typical Inflow & Infiltration (I/I) Sources



- Manhole
- Sanitary Sewers
- Private Laterals
- Private Buildings

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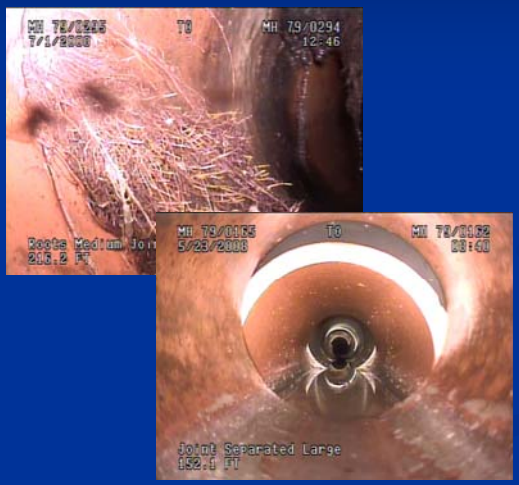
Performance Problems can be Caused by Excessive Infiltration and Inflow (I/I) and Structural Defects, Roots and Grease



- Sewer backups - low customer satisfaction
- Operating costs greater than needed
- Potential health risks
- Property damage
- Regulatory actions

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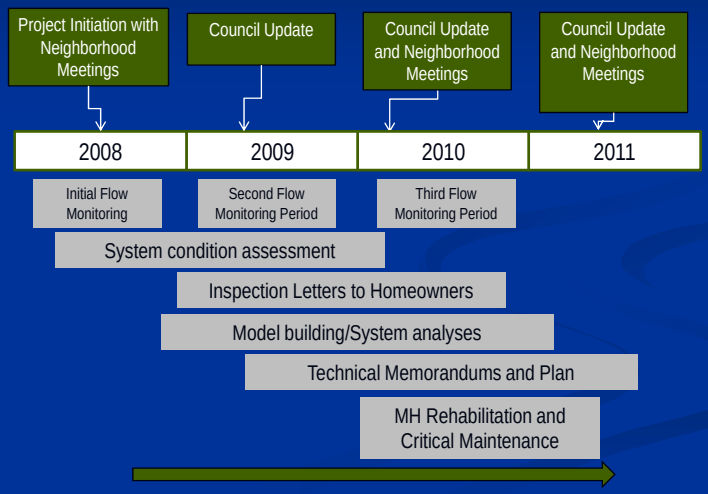
Pilot I/I Project Timeline



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This Project Investigated the Condition and Flow Capacity of the Sanitary Sewer System

- Flow and rainfall monitoring
- Piezometers and Stream Gauge Readings
- Hydraulic Modeling
- Inspection activities
  - Manhole
  - Closed Circuit Televising (CCTV)
  - Smoke / Dye Testing
  - Building and lateral inspections
  - Industry/commercial area investigations
  - Survey of sanitary sewer inverts
- System Alternative Evaluation – relief/rehabilitation/maintenance

Smoke Testing

Hydraulic Modeling

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The Investigation Performed Was Comprehensive and Addressed All Aspects of the Sanitary Sewer System

Asset	Quantity	Percent of the Study Area
Manholes	605	100%
Public Sewer Mains	140,900 feet	100%
Private Lateral Sewers	1,213	45%
Private Lateral Sewers	60,650 feet	45%
Buildings – Residential	1,081	53%
Buildings – Commercial	132	75%

Note: Lateral length based on estimated 50 ft per lateral

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Flow and Rainfall Monitoring Was Performed to Understand the System Flow Response to Rainfall

Kutzky Park – Meter Location Map

- 21 Flow Monitoring Locations
  - Kutzky (11)
  - Slatterly East (2)
  - Slatterly West (8)
- 3 Rainfall Gauges
- 5 Piezometers

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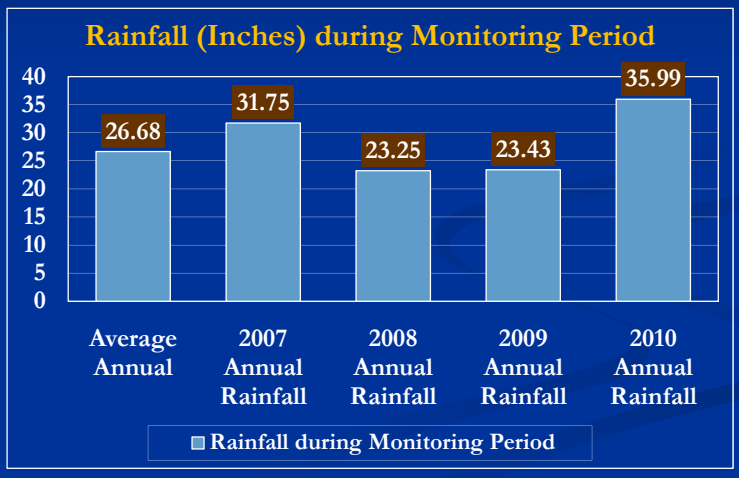
2010 Rainfall was Conducive to Evaluating the Wet Weather Response of the Sanitary Sewers



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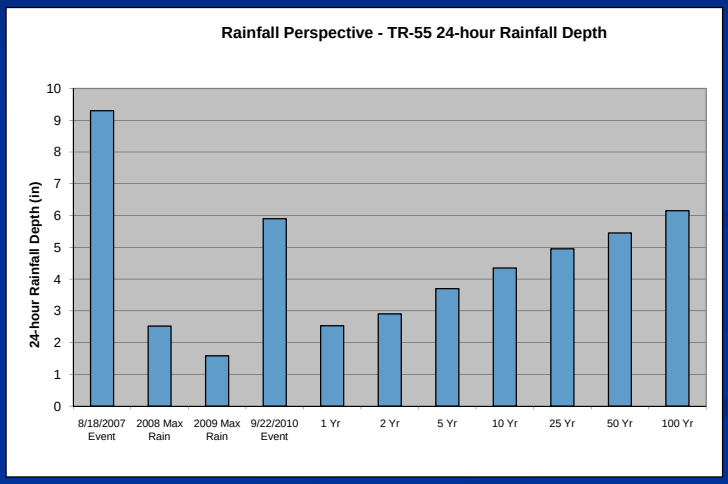
Proper System Evaluation Depends on Measuring Flows During Significant Rainfall Events



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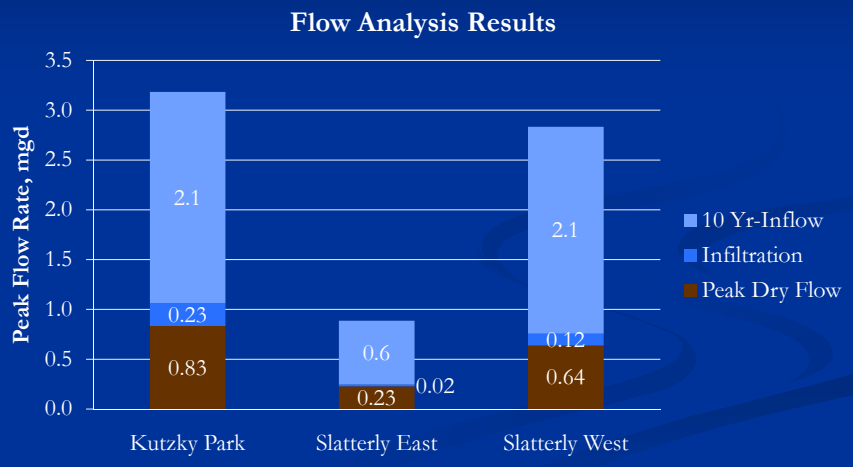
Flow Monitoring Was Used to Project Peak Flows During a 10 Year Storm Event



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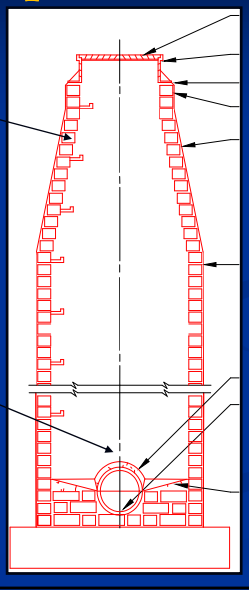
Manholes Were Inspected From Top to Bottom

Poor Step

Leaking Pipe Seal



Cover leaking
Broken frame
Leaking frame seal
Leaking-cone
Leaking-wall
Leaking Pipe Seal
Poor Channel
Poor bench

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Key Manhole Findings

- I/I defects were common in the upper part of the manhole
  - Cover, frame seal, chimney
- Confirmed/updated system configuration
  - Location, depth, pipe size

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CCTV: Documenting and Assessing Public Sewer Main Condition

- Defect Types
  - Crack/Fracture
  - Roots
  - Joint Offset
  - Missing Mortar/Brick
  - Broken/Hole
  - Collapsed
  - Tap Defective/Intruding

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CCTV Typical Findings Public Sewer Main

Crack Circumferential

Crack Longitudinal

Joint Offset Medium

Roots Fine Barrel

Roots at Joints

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Smoke Testing Was Used to Find Direct and Indirect Sources of I/I

- Notification Process
  - Property owners and Fire Department
- Located direct and indirect connections to the sanitary sewer system

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Example Smoke Test Findings

Inlet Inflow - 7Th and 10th Ave SE

Manhole Inflow

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The Study Included a Detailed Evaluation of St. Mary's Hospital

- St. Mary's Hospital – Kutzky Park
  - Regular coordination with St. Mary's – Excellent cooperation
  - Enhanced flow metering conducted in 2009 and 2010 to determine I/I contribution and building water usage
  - Identified unmetered water sources as part of this study
    - These sources are now metered
  - Subsequent flow monitoring matched water meter records
  - Field investigations including field reconnaissance and dyed water testing did not locate specific sources of I/I that can be removed from the sanitary sewer system.
  - St. Mary's will continue to search for sources of I/I that originate from their property.

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The Study Included a Detailed Evaluation of Seneca Foods

- Seneca Foods – Slatterly West Sewershed
  - Regular coordination with Seneca – excellent cooperation
  - Identified outside product storage area tributary to sanitary sewer system during rainfall and documented operation of storage area during wet and dry weather
  - The City is currently working with Seneca to evaluate and modify, if necessary, their discharge permit.
  - Continued coordination is needed to minimize wet weather discharge to City sanitary sewer system and enhance Company operations
  - Storm water study conducted as inadequate storm capability can contribute to I/I.

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Private I/I Sources – Internal Connections and Building Lateral CCTV

Information Regarding Sump Pump and Service Lateral Inspection Program

March 19, 2008

(City Resident)
(Address 1)
(Address 2)

Dear Resident:

The City of Rochester will soon be implementing field inspection activities as part of the City's Kutzky Neighborhood Sewer Rehabilitation and Capacity Assurance Program. The program has a goal of reducing groundwater and rainwater (clear water) entry into the sanitary sewer collection system and achieving a significant reduction in basement sewage backups. Two engineering firms, CH2M HILL and WHKS & Co., are coordinating this program. These field inspections will lead to improvements to the sanitary sewer system.

The field inspection activities will include a physical inspection of each building in the study area to identify connections to the sewer system and to collect information on any past flooding or sewer back-up problems. Building inspection teams will generally be comprised of two people. The inspectors will be evaluating outside drains, such as roof downspouts, yard and foundation drains. They will also be evaluating sump pumps, floor drains, and sewer cleanouts on the inside of buildings. A portion of the homes in the study area will also have their sewer service televised from inside the building. The City will pay for any plumbing repairs needed to gain access to the service lateral. Each inspector will be wearing an identification badge. All inspections will be scheduled and will take approximately 15-20 minutes. Inspection activities will be kept as short as possible in order to obtain all needed information.

In addition to the building inspections, other inspection activities including manhole inspections, sewer line inspections, and smoke testing will be conducted. You will receive additional notification prior to the initiation of smoke testing. The purpose of these important inspections is to further document system conditions and defects in the City's sanitary sewer collection system as well as your service connections to the City's sewer system.

If you have any questions or would like more information, please visit the City's web page: www.rochestermn.gov/departments/publicworks/hottopics or contact Doug Nelson, City of Rochester, 328-2423, or email at dnelson@rochestermn.gov

Your cooperation is greatly appreciated in completing this program. Please contact WHKS & Co., 288-3923, to schedule an appointment.

Sincerely,

XXX, City of Rochester

- Community communications and participation was key to successful program
  - Initial letter
  - Calls
  - 2nd letter
  - Door hanger
  - 3rd letter
  - Additional calls

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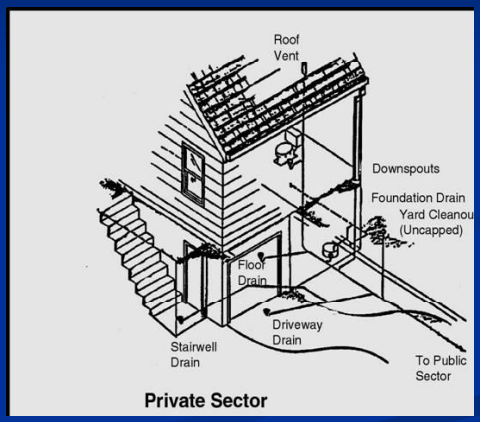
Private Building Connections & Lateral Defects Were Identified

- Defect Types:
  - Area Drain
  - Beaver Drain
  - Downspout
  - Driveway Drain
  - Foundation Drain
  - Stairwell Drain
  - Sump Connections
  - Uncapped Cleanout
  - Defective Lateral



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Building Inspection Findings

Illicit Sump Connection

Illicit Sump/Hose Connection

Beaver Drain

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Building Inspection Findings

Foundation Drain – Floor Drain

Illicit Sump Connection

Inaccessible – Clean Out In Concrete

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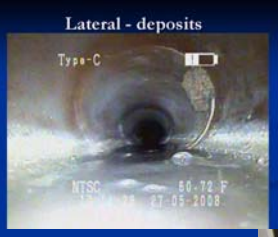
Building Lateral CCTV Findings



Inspector with Push Camera

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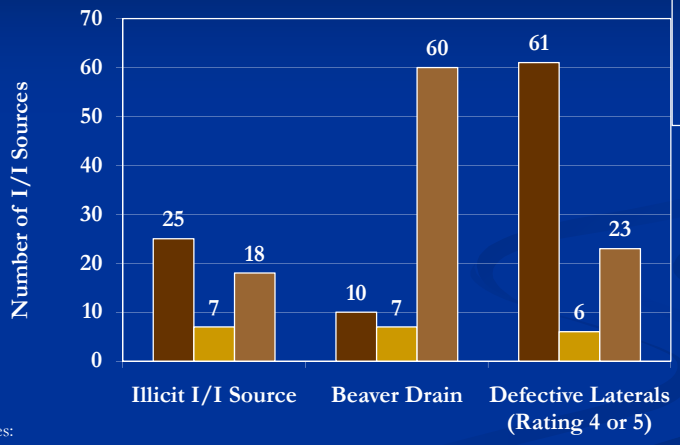
Private Building and Lateral Inspection Findings



Building Inspection Attempts:

Kutzky: 392

Slatterly East: 248

Slatterly West: 573

Kutzky Park

Slatterly East

Slatterly West

Notes:

1) Illicit I/I Source includes sumps, downspout, driveway drain, uncapped cleanout, foundation drain, stairwell drain.

2) Defective Laterals includes laterals with maintenance observations, e.g. grease.

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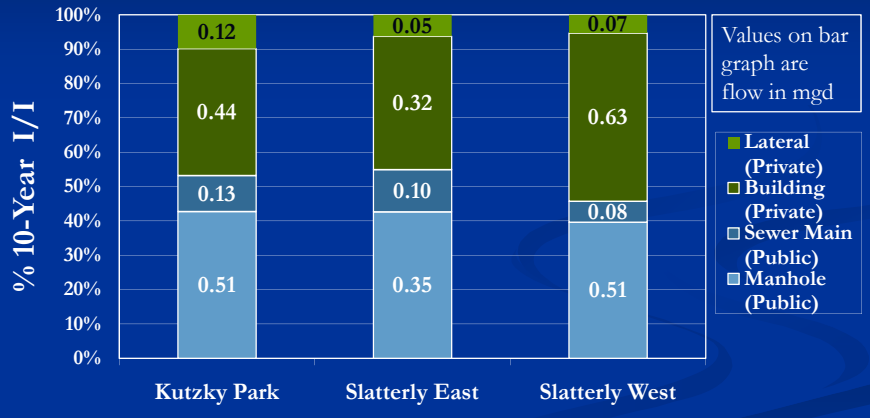
Source Quantification of I/I by Asset Type (10 Yr)



Values on bar graph are flow in mgd

Lateral (Private)

Building (Private)

Sewer Main (Public)

Manhole (Public)

Note: Source quantification includes identified and projected sources in the private sector

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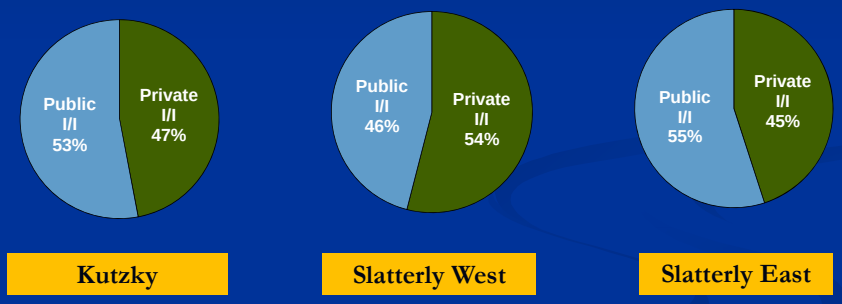
Private vs. Public I/I Contributions



Kutzky | Slatterly West | Slatterly East

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Development of Recommended Plan Included Several Key Considerations

- System Hydraulic Evaluation
  - Evaluate increasing levels of I/I removed to identify the cost-effective level
  - Consideration of key hydraulic structures – 11th Ave. Siphon and Soldiers Field siphon.
  - Coordination with sewers improvements downstream of Slatterly West (PA3 Study)
  - Evaluation of projected surcharge vis-a-vis improvements to eliminate backups

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Development of Recommended Plan Included Several Key Considerations

- Private Sector I/I
  - Removal of I/I sources currently in violation of the sewer use ordinance
  - Recommendations to modify sewer use ordinance
  - Other considerations for implementation

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Development of Recommended Plan Included Several Key Considerations

- Public Sector Improvements
  - Capacity enhancements
  - Maintenance
  - Rehabilitation

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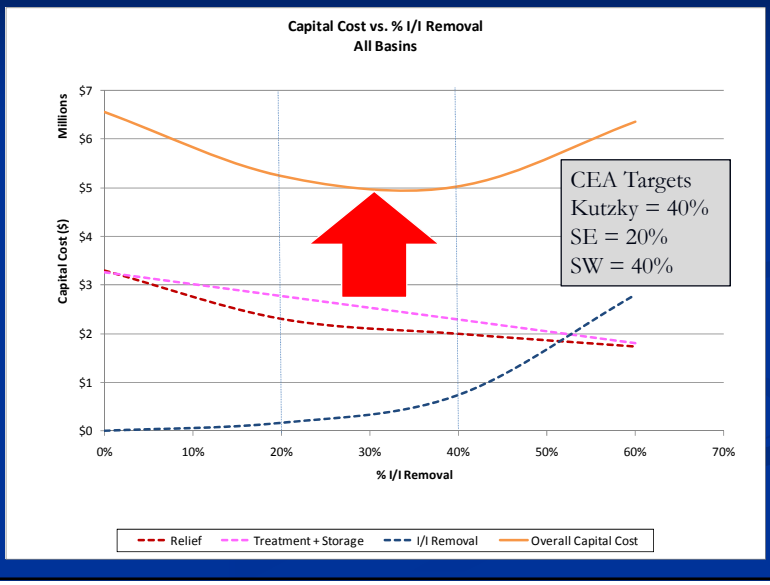
Cost-Effectiveness Analyses Identified Target I/I Removal and Basis for Relief Sizing



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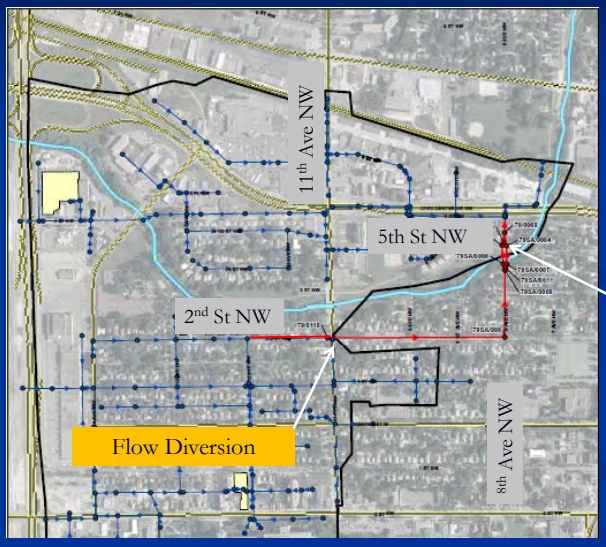
Recommended Relief Sanitary Sewer– Kutzky Park



- 2,935 ft – 21” Dia. & 12”/12” Siphon

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Recommended Relief Sanitary Sewer– Slatterly Park East

- No relief requirements

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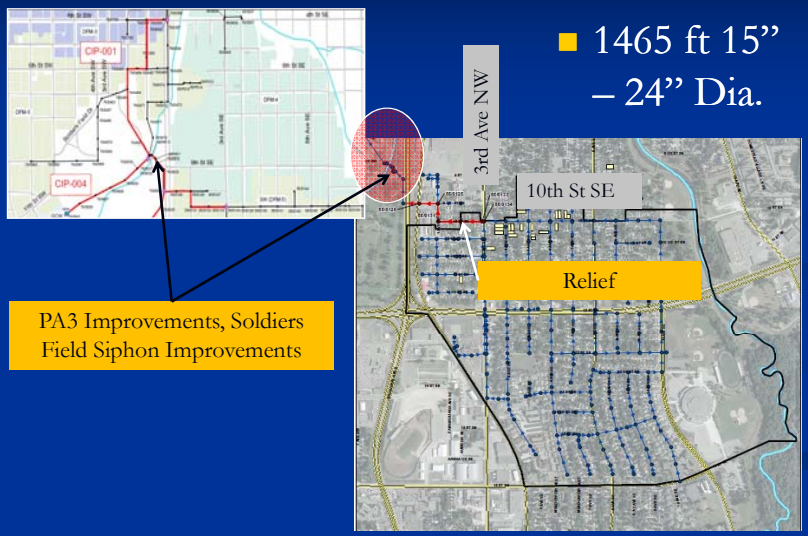
Recommended Relief Sanitary Sewer – Slatterly West



- 1465 ft 15" – 24" Dia.

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Summary of Relief Sanitary Sewer Plan

Sewershed	Length of Pipe (ft)	Capital Cost
Kutzky Park	2,935	$1,411,000
Slatterly Park East	0	$0
Slatterly Park West- 10th	1,465	$650,000
Slatterly Park West – Soldiers Field Siphon	3,928	$3,530,000
Total	**8,328**	**$5,591,000**

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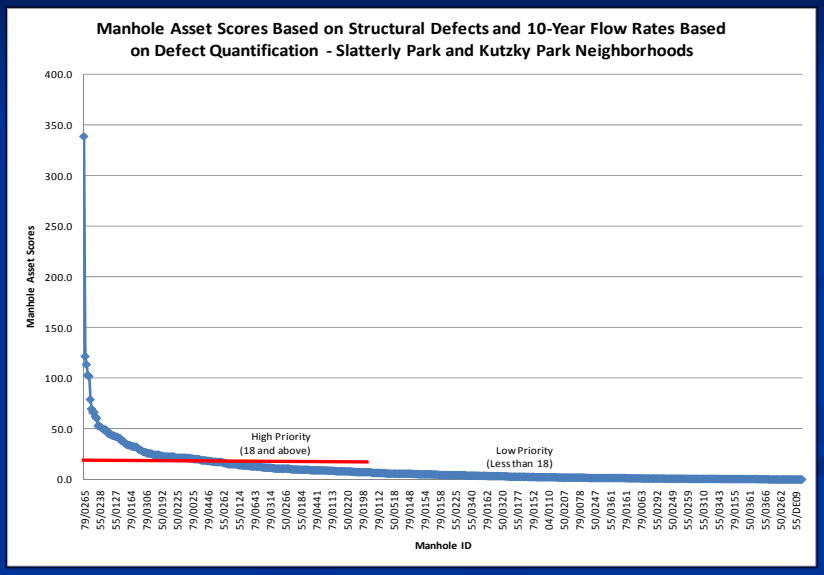
Manhole Ratings Identified 100 Manholes to Rehabilitate



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Manholes to Be Rehabilitated Were Prioritized

		Component Structural Condition				I/I condition								
MANH_NU	Location	RimGrade	CoverCastingCondition	CoverFrameFi	FrameConditio	CoverInflow	ChimInfiltratio	WallInfiltration	ChInfiltration	Structural Score	I/I Sco	10 year - I/I Flowrate (from Defect database)	Asset Score	Asset Rank
79/0265	16 ave & 2 st sw	At Street	Poor	Poor	Fair	Low	Low	Moderat	None	30	3	11.31	339.3	1
55/0219	12 st & 8 ave se	Below	Poor	Fair	Fair	Low	Severe	None	None	16	5	7.61	121.7	2
55/0217	12 st & 7 ave se	Below	Poor	Poor	Good	Low	Severe	None	None	14	5	8.12	113.7	3
50/0327	413 13 ave se	Below	Good	Good	Fair	Low	Moderat	None	None	16	3	6.45	103.2	4
55/0212	5 ave & 12 st se	Below	Poor	Fair	Good	Low	Moderat	None	None	14	3	7.28	102.0	5
50/0190	9 ave & east center st	Below	Good	Good	Good	Moderate	Severe	None	None	11	5	7.19	79.1	6
55/0236	13 st & 4 ave se	At Street	Poor	Poor	Good	Low	Low	Low	None	13	1	5.37	69.8	7
79/0313	1112 6 st sw	At Street	Good	Good	Fair	Low	Moderat	None	None	12	3	5.54	66.5	8
55/0208	1118 4 ave se	At Street	Good	Good	Fair	Low	Low	None	None	12	3	5.54	66.5	8
55/0160	201 10 1/4 st se	At Street	Poor	Poor	Fair	Low	Low	None	None	12	1	5.19	62.2	10
55/0281	14 st & 3 ave se	At Street	Poor	Fair	Good	Low	Low	None	None	15	1	4.03	60.4	11
55/0237	1216 5 ave se	At Street	Fair	Fair	Good	Low	Low	None	None	11	1	4.83	53.1	12
55/0238	1240 5 ave se	At Street	Fair	Fair	Good	Low	Low	None	None	11	1	4.83	53.1	12
55/0280	1322 3 ave se	At Street	Good	Good	Good	Moderate	Low	Low	None	9	3	5.76	51.8	14
79/0045	16 ave & cascade creek	At Street	Good	Poor	Poor	Moderate	Moderat	Moderat	None	9	3	5.67	51.0	15
55/0285	310 14 st se	At Street	Fair	Fair	Good	Low	Moderat	Low	None	12	3	4.12	49.4	16
55/0252	1226 9 ave se	Below	Fair	Fair	Fair	Low	Low	None	None	12	1	4.12	49.4	17
79/0294	214 16 ave sw	At Street	Good	Fair	Fair	Low	Moderat	Low	None	11	3	4.47	49.2	18
79/0297	420 16 ave sw	At Street	Good	Poor	Fair	Low	Moderat	Low	None	11	3	4.38	48.2	19
50/0191	10 ave & east center st	At Street	Good	Fair	Good	Low	Severe	Low	None	11	5	4.11	45.3	20
55/0209	1134 4 ave se	At Street	Good	Good	Fair	Low	Low	Low	None	10	1	4.47	44.7	21
55/0251	12 st & 9 ave se	At Street	Good	Good	Fair	Low	Moderat	None	None	9	3	4.97	44.7	22
50/0253	722 10 ave se	At Street	Fair	Fair	Good	Low	Low	Low	None	12	1	3.62	43.4	23
55/0247	1230 8 ave se	At Street	Poor	Poor	Good	Low	Low	None	None	11	1	3.94	43.3	24
55/0127	212 9 1/2 st se	At Street	Good	Fair	Fair	Low	Low	None	None	10	1	4.29	42.9	25
55/0207	12 st & 3 ave se	At Street	Good	Fair	Good	Severe	Low	None	None	9	5	4.68	42.2	26
50/0326	12 ave 6 st se	At Street	Good	Poor	Fair	None	Moderat	None	None	10	3	4.20	42.0	27
79/0308	6 st & 14 ave sw	Below	Poor	Good	Fair	Moderate	Low	None	None	8	3	5.13	41.0	28
55/0260	11 ave & 12 st se	Below	Good	Poor	Good	Moderate	Moderat	Low	None	7	3	5.85	40.9	29

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Manhole Rehabilitation Plan – Completed in 2010

Sewershed	Number of Manholes	10 Year Flow Rate Reduction (gpm)	Capital Cost*
Kutzky Park	38	148.7	$ 79,000
Slatterly Park East	22	81.2	$45,000
Slatterly Park West	40	161.6	$84,000
Total	**100**	**391.5**	**$ 208,000**

*capped manholes at $5,000 for Rehabilitation/ Construction Cost
** Manhole rehabilitation completed in 2010

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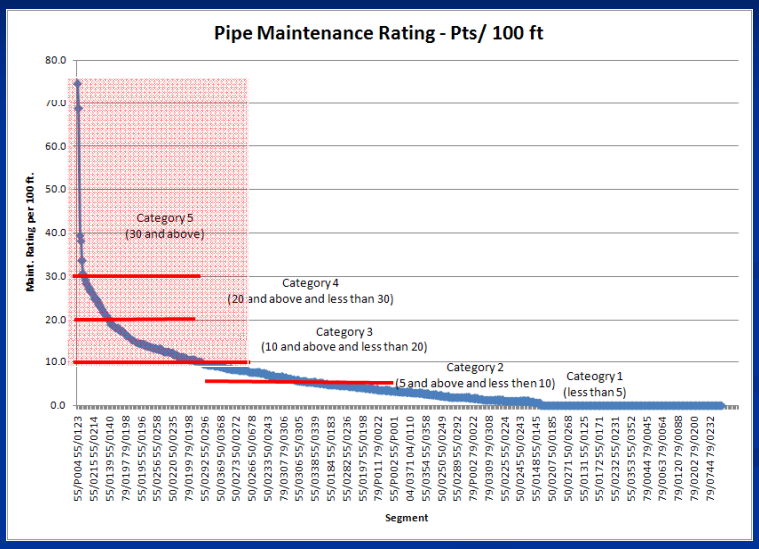
Pipe Maintenance Scoring Curve



Priority Pipes Requiring Additional Maintenance Activity

No.	CIP Name	Basin	Asset ID	UP Manhole	Down Manhole	Asset Type	Length of Pipe (ft)	Existing Pipe Diameter (in)	10-year flow rate (gpm)	Improvement Type	Construction Cost $
1		Slatterly East	50/0189 50/0188	50/0189	50/0188	Pipe	337			Maintenance	$ 674
2		Slatterly East	50/0192 50/0191	50/0192	50/0191	Pipe	93			Maintenance	$ 186
3		Slatterly East	50/0193 50/0192	50/0193	50/0192	Pipe	223			Maintenance	$ 446
4		Slatterly East	50/0218 50/0219	50/0218	50/0219	Pipe	167			Maintenance	$ 334
5		Slatterly East	50/0220 50/0235	50/0220	50/0235	Pipe	417			Maintenance	$ 834
6		Slatterly East	50/0221 50/0219	50/0221	50/0219	Pipe	331			Maintenance	$ 662
7		Slatterly East	50/0223 50/0236	50/0223	50/0236	Pipe	291			Maintenance	$ 582
8		Slatterly East	50/0224 50/0221	50/0224	50/0221	Pipe	249			Maintenance	$ 498
9		Slatterly East	50/0227 50/0228	50/0227	50/0228	Pipe	283			Maintenance	$ 566
10		Slatterly East	50/0228 50/0230	50/0228	50/0230	Pipe	21			Maintenance	$ 42
11		Slatterly East	50/0229 50/0230	50/0229	50/0230	Pipe	50			Maintenance	$ 100
12		Slatterly East	50/0232 50/0233	50/0232	50/0233	Pipe	214			Maintenance	$ 428
13		Slatterly East	50/0236 50/0249	50/0236	50/0249	Pipe	418			Maintenance	$ 836
14		Slatterly East	50/0238 50/0518	50/0238	50/0518	Pipe	127			Maintenance	$ 254
15		Slatterly East	50/0274 50/0273	50/0274	50/0273	Pipe	365			Maintenance	$ 730
16		Slatterly East	50/0275 50/0274	50/0275	50/0274	Pipe	281			Maintenance	$ 562
17		Slatterly East	50/0298 50/0239	50/0298	50/0239	Pipe	55			Maintenance	$ 110
18		Slatterly East	50/0300 50/0299	50/0300	50/0299	Pipe	280			Maintenance	$ 560
19		Slatterly East	50/0320 50/0319	50/0320	50/0319	Pipe	268			Maintenance	$ 536
20		Slatterly East	50/0335 50/0318	50/0335	50/0318	Pipe	236			Maintenance	$ 472
21		Slatterly East	50/0336 50/0335	50/0336	50/0335	Pipe	266			Maintenance	$ 532
22		Slatterly East	50/0337 50/0336	50/0337	50/0336	Pipe	226			Maintenance	$ 452
23		Slatterly East	50/0354 50/0353	50/0354	50/0353	Pipe	57			Maintenance	$ 114
24		Slatterly East	50/0365 50/0362	50/0365	50/0362	Pipe	269			Maintenance	$ 538
25		Slatterly East	50/0518 50/0250	50/0518	50/0250	Pipe	397			Maintenance	$ 794
26		Slatterly West	55/0123 55/0124	55/0123	55/0124	Pipe	117			Maintenance	$ 234

Priority Pipe Maintenance Plan

Sewershed	Number of Segments	Length of Pipe (ft)	Annual Cleaning Cost ($2/ft)
Kutzky Park	12	2,170	$4,340
Slatterly Park East	5	880	$1,760
Slatterly Park West	11	1,565	$3,130
Total	**28**	**4,615**	**$9,230**

Present Worth of Cleaning = $155,000

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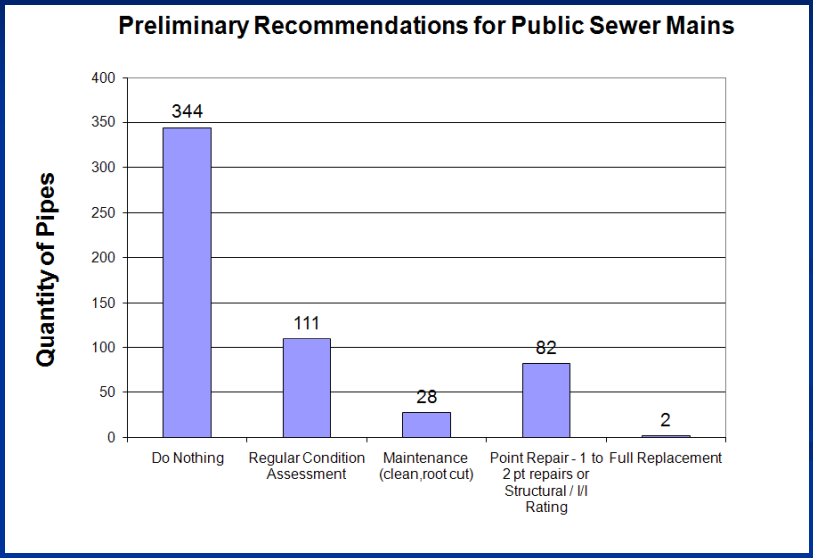
Pipe Risk Analysis Identified Pipe Recommendations



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Summary of Sewer Main Rehabilitation Plan

Sewershed	Quantity	10 Yr. Flow Reduction, mgd	Capital Cost
Kutzky Park	38 point repairs	0.060	$1,123,000
Slatterly Park East	24 point repairs, 2 full pipe replacements	0.024	$723,000
Slatterly Park West	20 point repairs	0.017	$454,000
Total	**82 point repair, 2 full repairs**	**0.101**	**$2,300,000**

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Private Sector – Implement Program for the Cost-Effective Removal of Building I/I Sources

- Remove Illicit Building I/I sources
  - Sump pumps, driveway drains, area drains, uncapped cleanouts, stairwell drains, down spouts/ roof drains
  - Complete remaining inspections and removal of sources found
- Beaver Drains – Modify policy to require disconnection
- Laterals – develop guidelines for evaluation and rehabilitation
- Point-of-Sale certificate of compliance for building and lateral sources
- Future inspections of building and laterals as determined necessary in the future

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Recommended Building I/I Source Removal Plan

Table 5-7 Recommended Building I/I Source Removal Plan					
Sewershed	Number of Sources in Violation of Current Sewer Use Ordinance	Number of Beaver Drains	10 Yr. I/I Removed, mgd	Estimated Construction Cost	Estimated Capital Cost
Kutzky	25	10	0.211	$60,000	$96,000
Slatterly East	7	7	0.074	$33,000	$53,000
Slatterly West	18	60	0.267	$179,000	$287,000
Total	**50**	**77**	**0.552**	**$273,000**	**$436,000**

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Private Sector – Lateral Defects

- A total of 93 laterals were ranked as being in poor condition (rating 4 or 5) and would cost $1,190,000 capital to repair and remove 0.053 mgd. The $/gpd is over $14 and therefore not cost-effective. Review lateral repair only as part of a broader main sewer improvement unless individual lateral conditions dictate that it would be cost-effective to repair.
- Laterals in Poor Condition –
  - Notify home owners of Maintenance, Structural and I/I issues that could impact on lateral functioning properly.
- Laterals – Review and update current policies to address laterals in terms of inspections and fixing of defects. Consider requirement for point of sale certificate of compliance.

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Recommended I/I Removal Plan

	Kutzky	Slatterly East	Slatterly West	Total Flow
Manhole Rehabilitation	0.214	0.117	0.233	0.563
Pipe Rehabilitation	0.060	0.024	0.017	0.101
Building Source Removal	0.211	0.074	0.267	0.551
Total I/I Removed	**0.485**	**0.215**	**0.517**	**1.215**
Total I/I	1.087 (w/o SM)	0.660	1.397 (w/o Sen)	3.144
% I/I Removal	45%	33%	37%	39 %

Note: Flow in mgd

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Recommended Plan Capital Costs

	Kutzky	Slatterly East	Slatterly West	Total, $
Relief Sewers	$ 1.411	$ 0	$ 0.650	$ 2.061
Maintenance	$ 0.054	$ 0.022	$ 0.039	$ 0.115
Manhole Rehabilitation	$ 0.079	$ 0.045	$ 0.084	$ 0.208
Pipe Rehabilitation	$ 1.123	$ 0.723	$ 0.454	$ 2.300
Building Source Removal	$ 0.096	$ 0.053	$ 0.287	$ 0.436
Total	**$ 2.684**	**$ 0.843**	**$1.430**	**$ 5.120**
$ / ft	*$ 58.65*	*$ 21.86*	*$ 27.00*	*$ 37.29*
Relief Soldiers Field Siphon	-	-	-	$3.530
Broader City-Wide Program Planning & Complete Bldg.	-	-	-	$0.4 - $1.4
Implementation	-	-	-	TBD

Note: Cost in $ million

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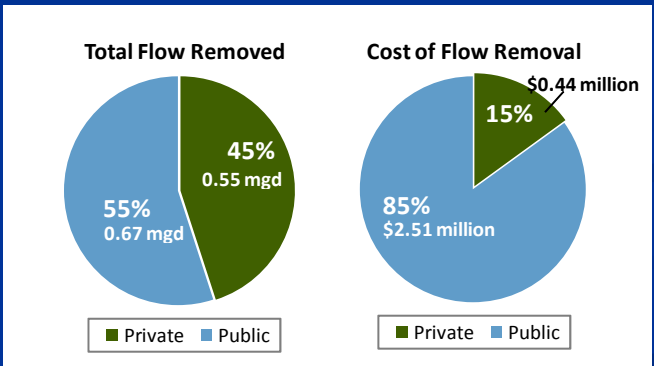
Summary of I/I Removal Cost and I/I Flow Removed by Public vs Private Sources



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Findings and Conclusions

- I/I is occurring in all three pilot areas but is most significant in Kutzky Park and Slatterly West.
  - The levels of I/I can overload parts of the system during severe storm events.
- I/I was found in both the private and public sectors of the system.
  - To effectively reduce I/I will require both public and private sectors of the system to be addressed.
- Manholes and building sources account for the majority of the I/I although some laterals and some sewer pipes do have I/I that should be removed.
  - All system sources will need to be addressed to reduce I/I, recover capacity, and improve overall system performance.

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Findings and Conclusions

- Public main sewers have roots, grease, structural issues and obstructions .
  - Installed capacity is being reduced due to maintenance and structural conditions.
- Even after removal of cost-effective I/I and sewer pipe cleaning, some lines are overloaded during wet weather. The 11th Ave. siphon and the Soldiers Field siphon were identified as being key hydraulic structures that are a significant contributing factor to sewer backups.
  - Relief sewers will be required
- Current City sewer use policies do not adequately address removal of private sector I/I sources such as beaver drains or lateral defects that are cost-effective to remove.
  - Review and update City sewer use policies to include private sector sources that are cost-effective to remove

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Findings and Conclusions

- Seneca can contribute peak flows during rain event which are a contributing factor to system peak wet weather flows.
  - Controlling Seneca runoff during wet weather will improve system performance during peak flow events.
- St. Mary's water use was not being accurately accounted for and no significant I/I source was identified from St. Mary's.
  - St. Mary's is not a contributor of excessive I/I in the system
- Pilot I/I Program protocols from field inspection through modeling were effective but should be optimized for future similar work.
  - Optimize future I/I investigations (see recommendations)

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Recommendations: The Initial Improvement Plan

- Manhole Rehabilitation Program Initiated
  - 100 manholes were rehabilitated in 2010
- Slatterly Park West - Replace Siphon Under Zumbro River in Soldiers Field Golf Course in 2012
- Kutzky Park - Replace Siphon on 11th Ave NW Under Cascade Creek in 2012
- Implement Intensive Maintenance Program
- Root control program
- Fats, oils and grease (FOG) program

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Overall Recommendations

- Implement the rehabilitation plan for manholes and public mains.
- Implement relief sewer improvements.
- Implement private sector improvement including addressing policy considerations for beaver drains, laterals, and funding.
- Implementation of a broader City-wide program to address system maintenance and asset management is recommended
  - Continue long term flow and rainfall monitoring program in balance of the system
  - Implement Capacity Maintenance Operations & Management (CMOM) protocols and Utility Assessment program to evaluate maintenance procedure, staffing, processes and tools
  - Upgrade maintenance tools to effectively handle condition assessment and maintenance data
  - Strategic program to manage I/I and system capacity
  - Private Sector Plan
- Optimize process used in the pilot study for future similar work.

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Schedule to Implement Study Recommendations

Item	Schedule – to Be Complete Within Stated Time
Relief Sewers	3 yrs.
Maintenance	1 yr.
Manhole Rehabilitation	1 yr.
Pipe Rehabilitation	10 yrs.
Building Source Removal (Currently in Violation)	2 yrs.
Building Source – Beaver Drain Policy	1 yrs.
Lateral Rehabilitation	As part of main sewer repairs
System Wide Recommendation	5 yrs.

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Questions ??

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