Lehigh County Authority

Kline's Island Sewer System

1. Overview
2. Inflow & Infiltration (I&I) Projects

LCA Board of Directors – February 27, 2023

Abbreviations & Definitions

KIWWTP *– Kline's Island Wastewater Treatment Plant (Allentown)*

KISS *– Kline's Island Sewer System – all municipal systems and facilities that connect to the KIWWTP*

AO *– Administrative Order – issued by EPA in 2007 and 2009 related to sewer overflows and plant bypasses during wet-weather events*

SSO *– Sanitary sewer overflow*

EPA *– U.S. Environmental Protection Agency*

DEP *– Pa. Department of Environmental Protection*

MGD *– Million Gallons per Day*

RFMS *– Regional Flow Management Strategy – a plan submitted in 2018 to DEP & EPA, which resulted in the AO being lifted*

CMP *– Connection Management Plan – a DEP-approved plan to manager new sewer connections while corrective actions are being taken*

Act 537 Plan *– Sewage facilities plan outlining current system requirements and detailed alternatives for meeting future needs*

I&I *– Inflow & Infiltration – refers to clear water entering the sewer system through leaks, unauthorized connections, etc.*

RDII *– Rainfall-Derived I&I, which is a major driver for wet-weather overflows and hydraulic overloads at the KIWWTP*

PTP *– LCA Industrial Pretreatment Plant (Fogelsville)*

WLI *– Western Lehigh Interceptor, owned by LCA and transporting sewage from western Lehigh County to the KIWWTP*

WLSP *– Western Lehigh Sewerage Partnership – the communities served by the WLI*

SBM *– Sewage Billing Meters – permanent sewer flow meters used for calculating bills to municipalities*

Kline's Island Sewer System (KISS)

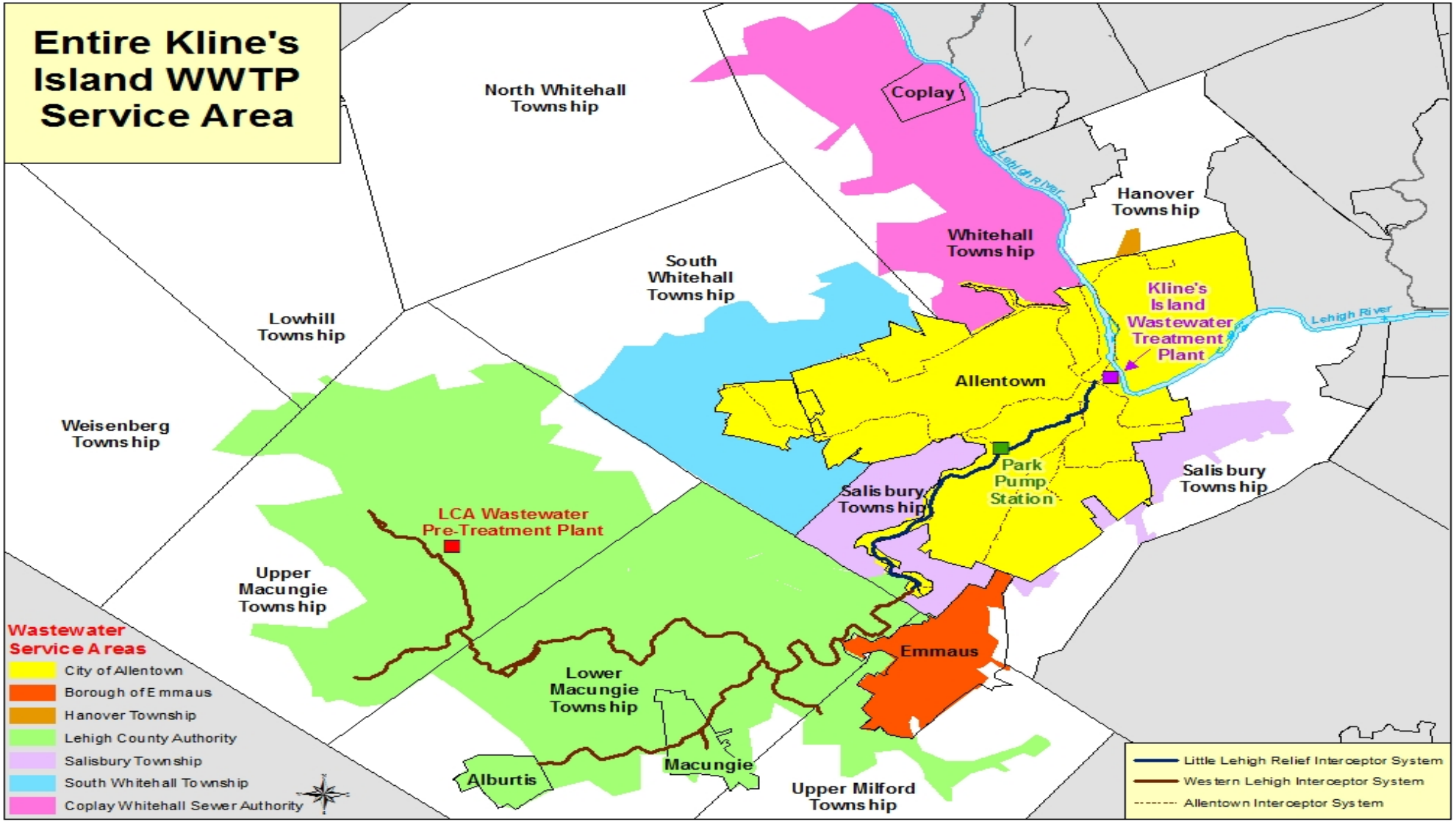
LCA / Western Lehigh Sewerage Partnership

- Upper Macungie
- Lower Macungie
- Macungie
- Alburtis
- Upper Milford
- Weisenberg
- Lowhill

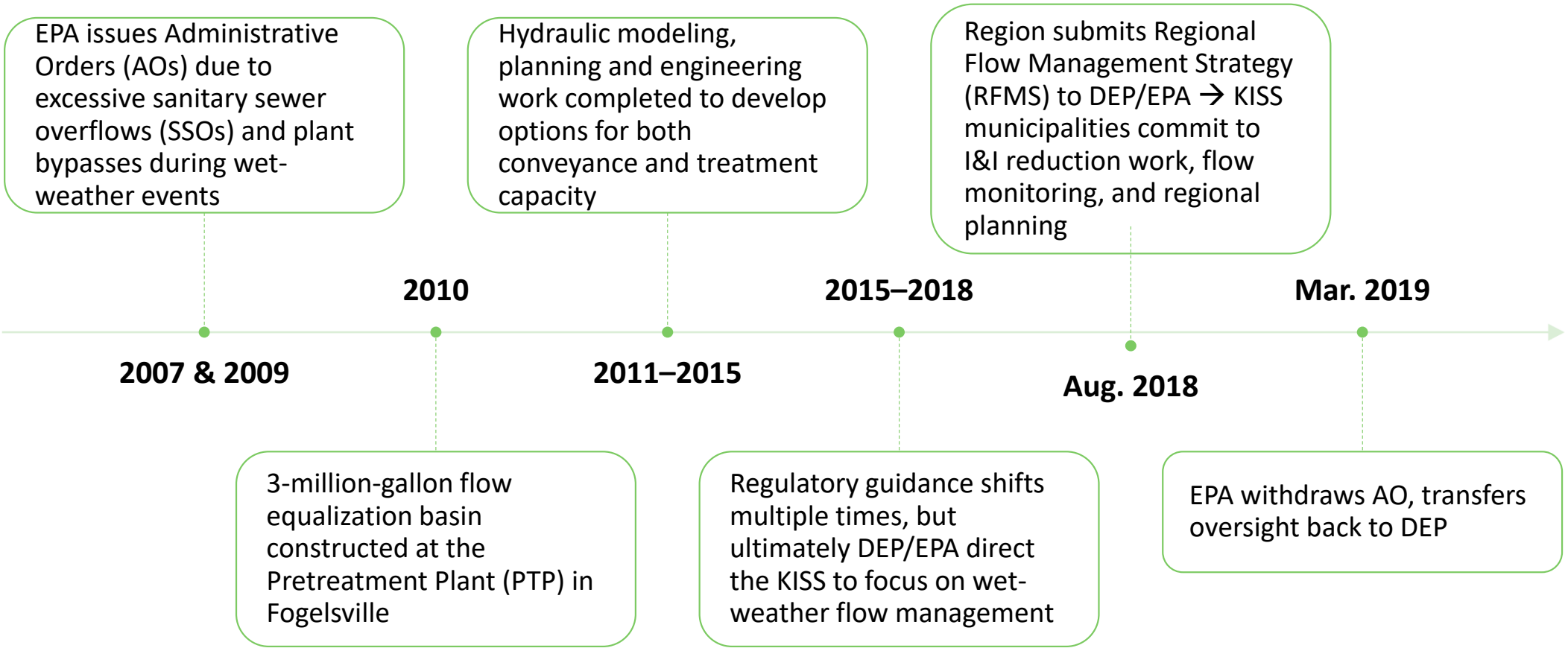
LCA-owned systems

Allentown / City Signatories

- LCA / WLSP
- South Whitehall
- Salisbury
- Coplay-Whitehall Sewer Authority
  - North Whitehall
  - Whitehall
  - Coplay
- Emmaus
- Hanover


Entire Kline's Island WWTP Service Area
North Whitehall Township
Coplay
Lehigh River
Hanover Township
Whitehall Township
South Whitehall Township
Kline's Island Wastewater Treatment Plant
Lehigh River
Lowhill Township
Allentown
Weisenberg Township
Park Pump Station
Salisbury Township
Salisbury Township
LCA Wastewater Pre-Treatment Plant
Upper Macungie Township
Emmaus
Lower Macungie Township
Macungie
Alburtis
Upper Milford Township
Wastewater Service Areas
City of Allentown
Borough of Emmaus
Hanover Township
Lehigh County Authority
Salisbury Township
South Whitehall Township
Coplay Whitehall Sewer Authority
Little Lehigh Relief Interceptor System
Western Lehigh Interceptor System
Allentown Interceptor System

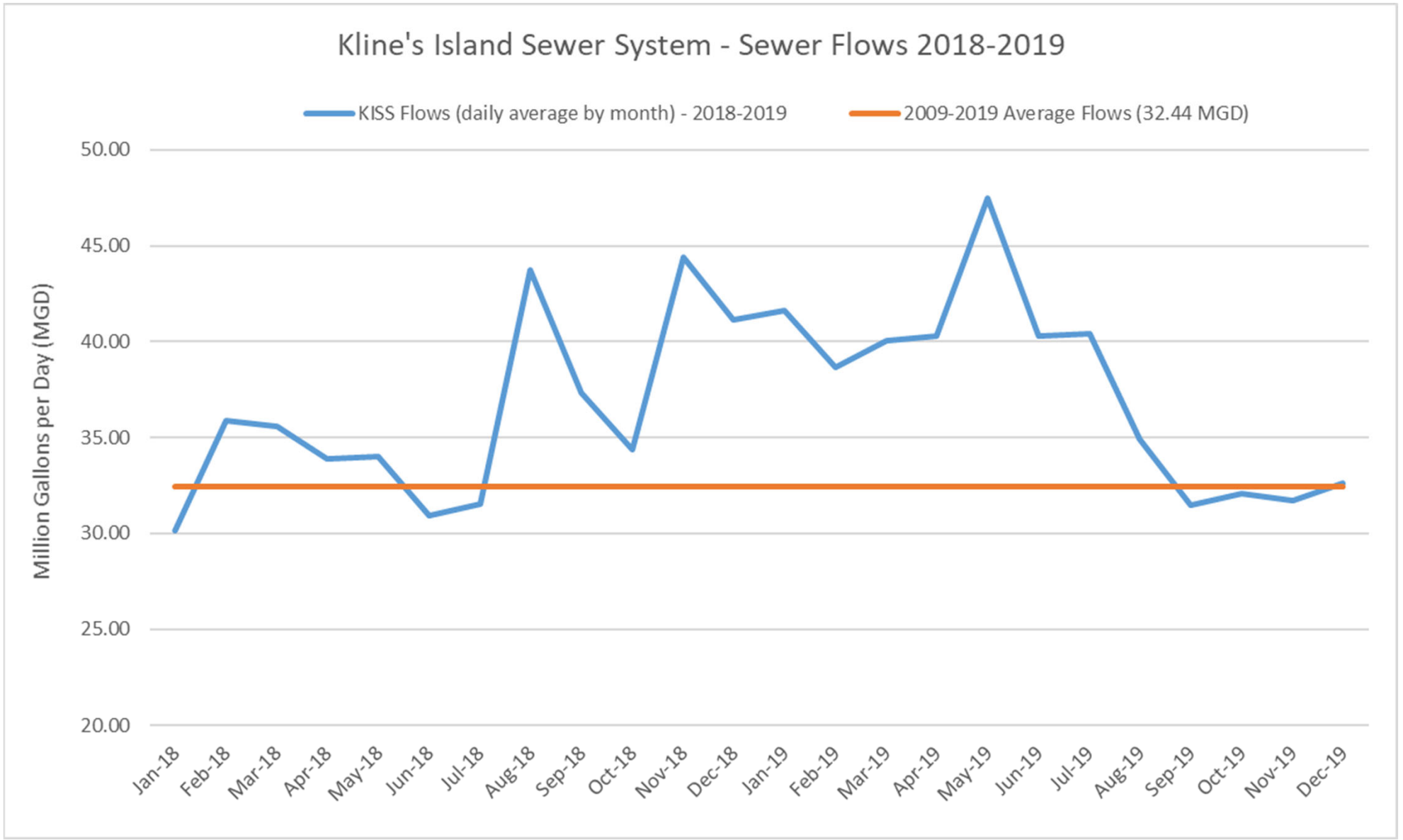
Brief History – "The AO Era" (2009-2019)



2018-2019: “The Wet Years”

August 2018-July 2019: Region receives 80” of rain (compared to 45” normal)

KISS flows >40 MGD over multiple months (officially in “hydraulic overload”)


Kline's Island Sewer System - Sewer Flows 2018-2019
KISS Flows (daily average by month) - 2018-2019
2009-2019 Average Flows (32.44 MGD)
Million Gallons per Day (MGD)
50.00
45.00
40.00
35.00
30.00
25.00
20.00
Jan-18
Feb-18
Mar-18
Apr-18
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Jan-19
Feb-19
Mar-19
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May-19
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Jul-19
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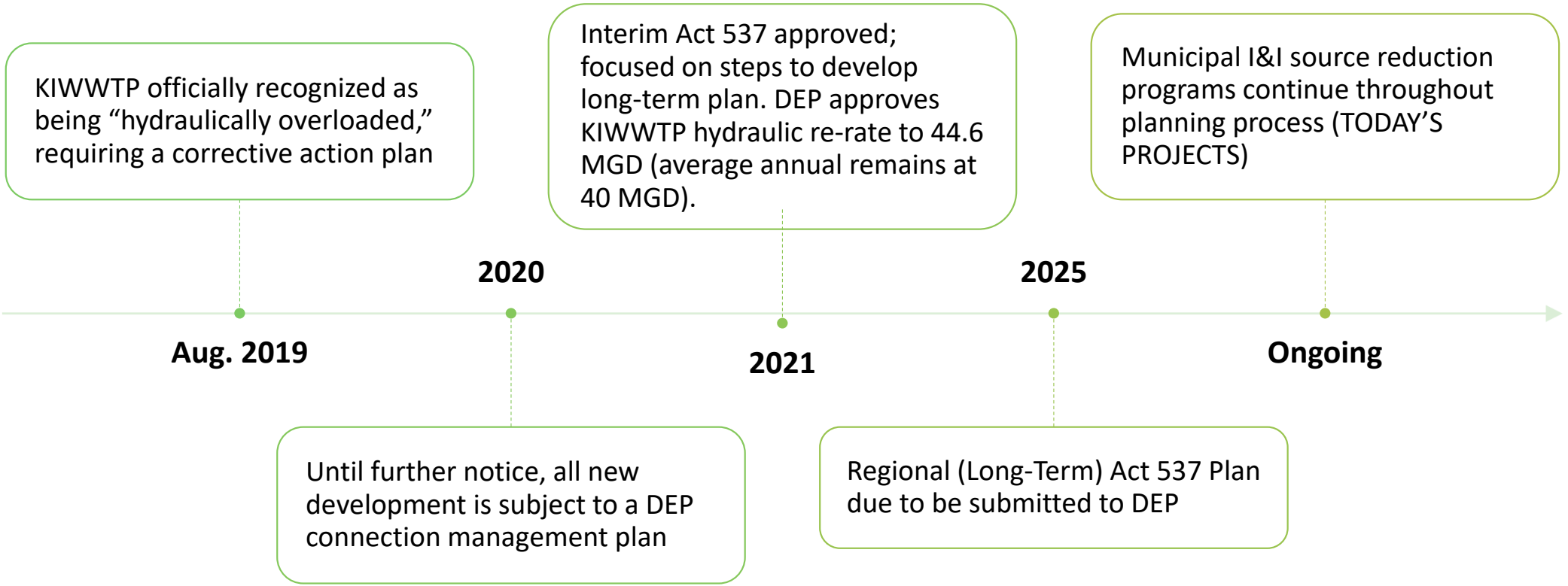
Oct-19
Nov-19
Dec-19

2019 Forward: “The Collaboration Era”



Goals for a Regional Act 537 Plan

- Support environmental and economic goals of the region
- Solutions must be regional and comprehensive
- Ensure existing infrastructure is maintained / rehabilitated – focus first on reducing I&I
- Long term sewer capacity needs quantified through 2050
- Develop plan for new infrastructure to meet region's future needs (project period through 2035)

Keys to Success

- Aggressive schedule requires extensive intermunicipal cooperation
- Continued engagement with DEP
- Regional approaches will be most cost effective
- Significant planning and engineering required between now and 2025
- Public communication to drive understanding and support for projects and rate impact

Break for questions?

Today's Focus:
Inflow & Infiltration Projects

1. Western Lehigh Municipalities, working together
2. City of Allentown – Regional Flow Management Strategy, final phase
3. City of Allentown – NEW I&I Source Reduction Program, kickoff

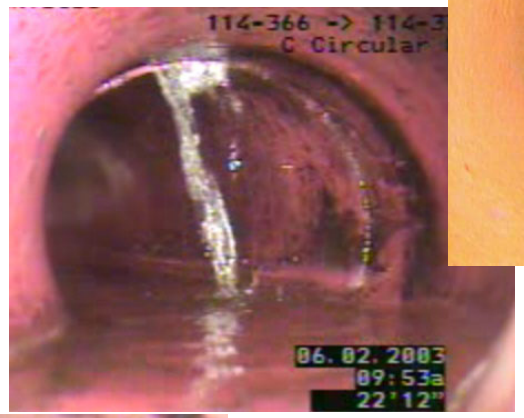
INFILTRATION AND INFLOW (I&I)

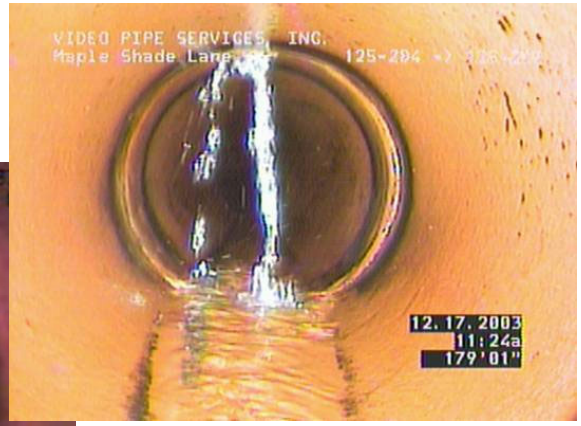
1. Infiltration – Groundwater flow into pipes and/or manholes through defects and failed gaskets

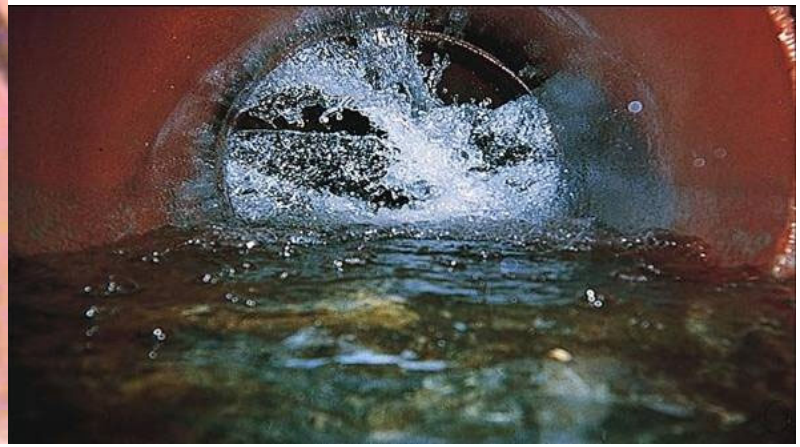
2. Inflow – Stormwater flow directly into manholes and cleanouts

3. Clearwater – Roof drains and sump pumps connected to sanitary sewer pipes.

INFILTRATION

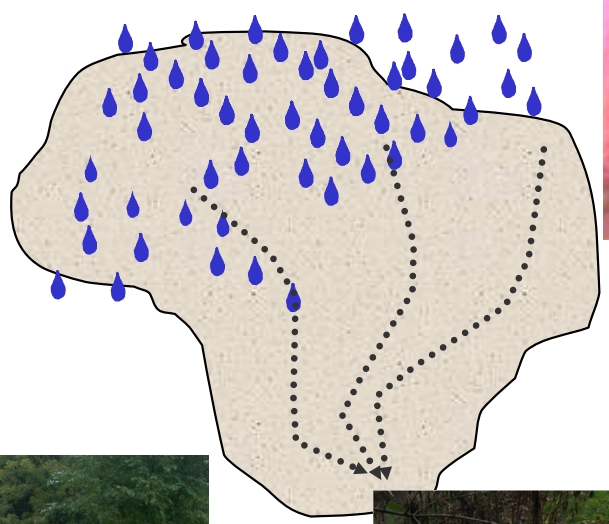


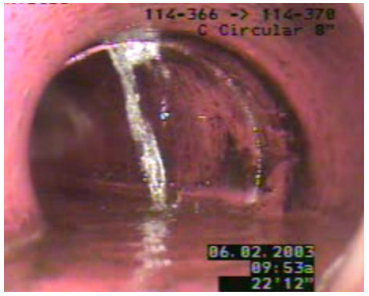




INFLOW

Leakage Originates in the Collection System…
but Overflows in the Interceptor





Where Overflows Occur

"Outfall 003" at the Allentown treatment plant – discharges to Little Lehigh Creek approximately 100 yards upstream of confluence of Lehigh River.

Manholes along the Little Lehigh Creek and other locations in the system.

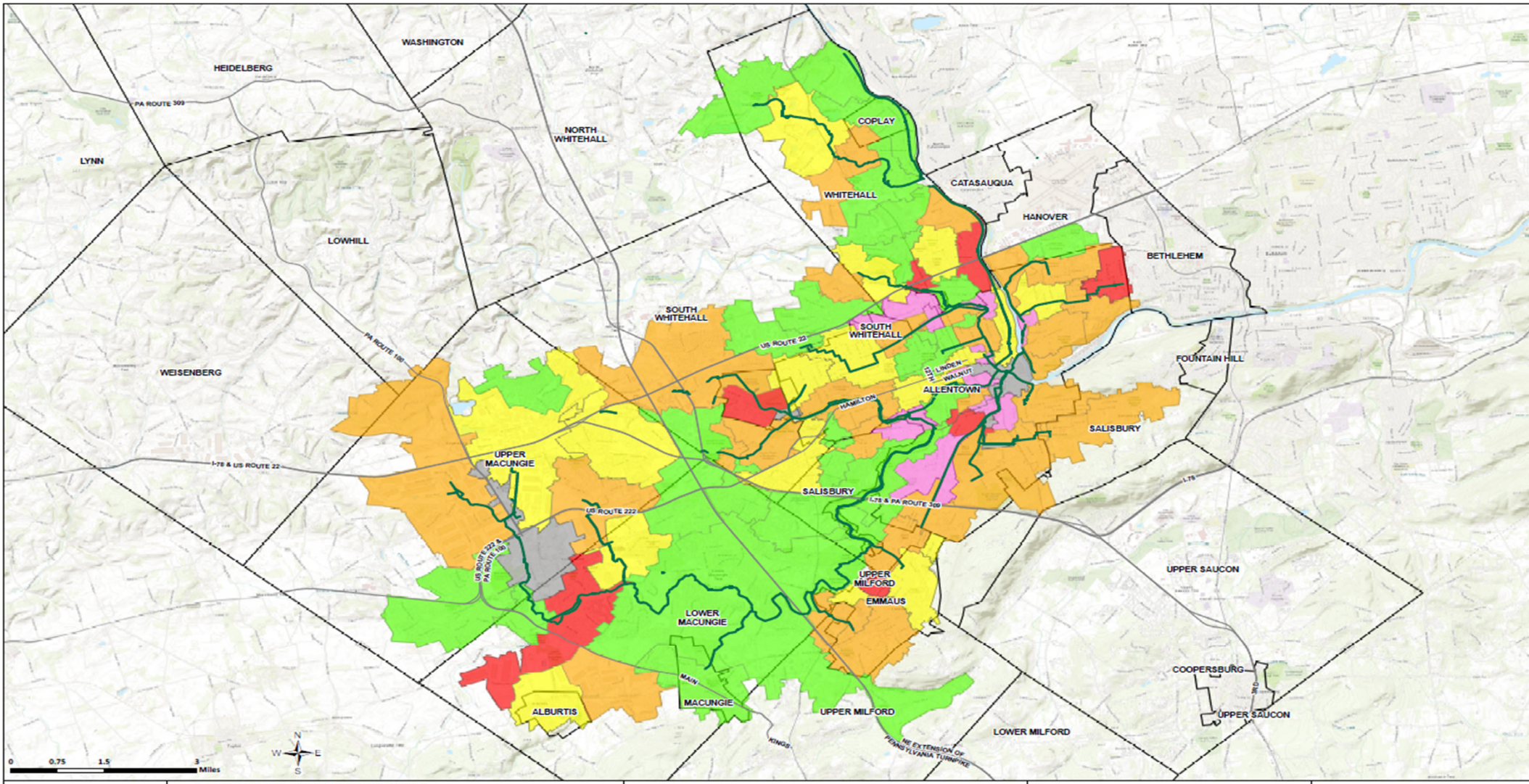
Basement backups when smaller lines are full or bottlenecks occur.

Interim Act 537 Plan: Work Schedule

Work Categories & Description	Start	Finish
Immediate: ■ Sewage Billing Meter (SBM) Upgrades & data validation / capture method ■ Defined scope and meter placement for Flow Characterization Study ■ Agreement on Cost-Sharing for Planning work ■ Municipal Flow Projections → 2050 ■ Part 2 Permit Resubmission for the KIWWTP hydraulic rerate	As soon as possible	December 2020 ** Timing required to design flow metering program*
Preliminary: ■ Preliminary Treatment Alternatives Evaluation –Resolve concepts with preliminary regulatory and engineering evaluation so signatories can review impacts to inter-municipal agreements, cost-sharing, etc.	As soon as possible	September 2021 ** Timing required to have inputs available for flow modeling work*
Flow Monitoring & Model Calibration: ■ Flow Monitoring ■ Rainfall Monitoring ■ RDII Characterization ■ KISS Model Calibration ■ Preliminary modeling of alternatives ■ Update treatment alternatives analysis	January 2021	June 2022
Trexlertown Special Planning Study: ■ Develop Alternatives ■ Select Alternative ■ Pre-Planning Meeting with PADEP ■ Develop Special Planning Study ■ Submit Special Planning Study ■ Prepare Part II Permit Application	January 2021	January 2023

Interim Act 537 Plan: Work Schedule

Administrative Issues: ■ Inter-Municipal Agreements ■ Discuss Regional Approach ■ Develop Cost Sharing Agreement	September 2021	June 2024
Alternatives Analysis: ■ KIWWTP vs. Pretreatment Plant ■ Storage vs. conveyance/pumping alternatives ■ Peak flow capacity alternatives ■ I&I removal impacts on alternatives ■ Preliminary cost estimates	June 2022	June 2023
Selection of Preferred Alternative: ■ Detailed cost estimates ■ Address impact to inter-municipal agreements ■ Develop implementation schedule ■ Stakeholder input	June 2023	June 2024
Act 537 Plan Development (Write the plan)	June 2024	September 2024
Public Notice & Municipal Adoptions	September 2024	February 2025
Final Submission		March 2025



Lehigh County Authority

Length Normalized RDII (GPD/LF)

- < 2
- 2 - 4
- 4 - 8
- 8 - 15
- > 15
- No Study Conducted
- Interceptor Main 18" and Over

LEHIGH COUNTY AUTHORITY

KISS I&I SUMMARY

LEHIGH COUNTY, PENNSYLVANIA

Remarks:

I&I studies were not able to be conducted in gray boundary areas

LEHIGH COUNTY AUTHORITY GIS

DATE: 4/6/2022 *SCALE: 1:44,000*

CREATED: *CHECKED:*

Statistics by Basin

Meter																																		
Signatory	City	City	City	City	City	City	City	City	City	City	City	City	City	City	City	City	City	City	City	City	City	City+ST	City	City	City	City	City	City	City	City	City+ST	City+ST	City	City	City
Parcels	426	1,223	584	627	263	582	1,707	832	3,154	329	1,935	516	412	443	752	432	57,915	447	1,876	630	204	1,365	825	227	3,108	780	849	388	1,095	287	1,241	462	157	1,978	426	353
Basin Length (LF)	48,683	59,725	25,186	36,318	9,059	11,651	64,042	41,990	124,566	14,633	48,091	10,369	23,509	12,585	19,914	18,509	57,915	10,851	49,094	27,721	11,428	63,689	55,875	26,815	141,700	32,229	39,222	40,306	75,410	15,894	83,039	35,573	20,987	59,512	30,066	8,685
Dry Weather GPD/EDU	347	268	299	296	440	548	260	235	205	322	177	232	641	501	170	377	242	412	127	241	378	310	218	273	364	603	676	1598	201	488	338	303	4346	278	1408	227
Average Dry Weather Flow, DWF (MGD)	0.772	0.328	0.175	0.72	0.116	0.319	0.443	0.195	0.647	0.106	0.343	0.12	0.264	0.222	0.128	0.163	0.63	0.184	0.239	0.304	0.077	0.424	0.327	0.88	1.293	0.47	0.676	0.62	0.22	0.14	0.42	0.14	0.682	0.55	0.6	0.08
Baseline Infiltration % adjusted for data issues	65%	36%	65%	44%	65%	51%	30%	35%	40%	40%	61%	38%	38%	60%	57%	55%	39%	33%	33%	31%	31%	46%	19%	40%	58%	51%	53%	76%	18%	47%	47%	47%	30%	31%	25%	13%
Baseline Infiltration (MGD)	0.502	0.118	0.114	0.317	0.075	0.163	0.133	0.068	0.259	0.042	0.209	0.046	0.100	0.133	0.073	0.090	0.246	0.061	0.079	0.094	0.024	0.195	0.062	0.352	0.750	0.240	0.358	0.471	0.040	0.066	0.197	0.066	0.205	0.171	0.150	0.010
Average Peaking Factor adjusted for data issues	5.0	12.7	6.0	7.5	27.6	3.0	6.8	6.0	4.1	3.4	2.3	2.3	6.7	7.0	5.1	7.7	2.4	2.2	7.5	3.2	8.0	5.5	5.1	2.9	4.0	3.4	4.6	6.0	4.5	4.0	6.0	13.4	5.8	3.4	5.0	5.2
Length Normalized RDII (GPD/LF)	4.3	8.7	5.3	2.8	53.4	7.1	5.2	2.3	2.6	6.6	1.3	1.9	4.8	28.3	6.2	18.4	1.6	1.6	5.1	2.5	52	5.4	5.6	15.8	4.7	8.5	19.8	10.1	2.1		4.7	7.3	36	3.8		7.9

Meter																																				
Signatory	City	City	SWT	SWT	SWT	SWT	SWT	SWT	SWT	SWT	SWT	HT	ST	ST	ST	ST	ST	CWSA	CSWA	CSWA	CSWA	CSWA	CSWA	CSWA	CSWA	CSWA	CSWA	CSWA	CSWA	CSWA	CSWA	CSWA	EB	EB	EB	EB	EB
Parcels	1,055	251	-	1,043	667	1,025	1,311	2,418	800	487	237	1,687	566	390	1,001	1,055	1,535	1,454	623	831	672	701	745	757	708	646	647	864	87	966	633	253	337	1,310	227	1,937
Basin Length (LF)	44,778	20,278	15,526	22,964	44,592	65,448	72,963	168,942	71,764	31,158	20,384	104,982	32,860	40,862	34,414	48,511	73,780	83,665	42,100	56,778	46,901	40,493	53,472	47,775	43,946	32,089	29,896	40,047	8,191	47,742	49,937	11,444	17,737	68,562	15,447	99,644
Dry Weather GPD/EDU		1673	4350	268	281	165	188	298	338	381	277	539	264	649	258		148	128	431	339	199	168	327	126	179	239	298	204	1006	273	217	268	327	280	220	253
Average Dry Weather Flow, DWF (MGD)		0.42	0.065	0.28	0.19	0.17	0.246	0.72	0.27	0.442	0.066	0.637	0.15	0.253	0.661		0.228	0.186	0.262	0.282	0.134	0.118	0.243	0.096	0.127	0.154	0.193	0.176	0.088	0.264	0.138	0.068	0.107	0.367	0.05	0.5
Baseline Infiltration % adjusted for data issues	35%	35%	100%	50%	46%	29%	30%	25%	26%	44%	17%	51%	47%	36%	32%	35%	35%	18%	43%	41%	41%	27%	27%	27%	27%	31%	46%	18%	40%	18%	45%	30%	29%	21%	20%	48%
Baseline Infiltration (MGD)	-	0.147	0.065	0.140	0.087	0.049	0.074	0.180	0.070	0.194	0.011	0.325	0.071	0.091	0.212	-	0.080	0.033	0.113	0.116	0.055	0.032	0.066	0.026	0.034	0.048	0.089	0.032	0.035	0.048	0.062	0.020	0.031	0.077	0.010	0.240
Average Peaking Factor adjusted for data issues	5.0	7.7	5.0	4.5	8.0	4.3	4.0	16.0	4.3	5.2	3.8	10.0	2.1	4.0	10.0	5.0	6.3	2.9	2.2	4.6	10.0	3.8	2.9	10.0	9.0	2.8	2.4	4.7	5.0	3.4	5.0	6.0	15.1	4.0	8.0	5.4
Length Normalized RDII (GPD/LF)		49.4		4.9	6.7	1.4	1.9	6.2	2.7	7.2	1.2	4.8	1	1.4	4.5		1.5	0.7	2.2	4.1	1.3	1.2	1.3	4.4	9.7	1.3	2.2	2.2	11.5	15.6	1.2	2.5	8.5	3.6	3.3	4.3

Meter																
Signatory	EB	UMT	UMT	UMT	UMT	UMT	UMT	UMT	UMT	Alburtis	Macungie	LMT	LMT	LMT	LMT	LMT	LMT
Parcels	367	1,751	945	1,375	521	4,362	9,513	2,325	995	1,311	778	973	663	503	1,547	5,070

City Stats	CWSA Stats	Salisbury Stats	Emmaus Stats	South Whitehall Stats	Hanover	Upper Macungie	Alburtis	Macungie	Lower Macungie	WLSP Stats
90,136	11,869	4,699	4,431	7,751	237	20,792	995	1,311	9,534	32,632
288	132	50	49	93	3.9	137	9	17	151	314

Conclusions

- Older systems (City, Salisbury, and Emmaus) are generally leakiest sewers, but all Signatories have bad areas
- Western Lehigh municipalities have made good progress in I&I reductions, especially Macungie and Alburtis
- There is ~11 MGD of baseline infiltration that, if removed, can be turned into dry weather capacity
- Wet weather flow issues are driven by leaking sewers
- Wet weather overflows are driven by manhole cover inflows

No amount of I&I removal will eliminate need to expand the conveyance system, but it can reduce it considerably.

1. WLSP – *Working Together*

- *Since 2009, the WLSP municipalities have been sharing strategies to reduce I&I, with good results!*

- *2023 project will take collaboration to a new level:*
  - LCA overall project management
  - Shared resources to address sewer laterals
  - Upper Macungie and Lower Macungie townships, plus LCA's Upper Milford system

2. City of Allentown – *RFMS Commitments*

- 2018 Regional Flow Management Strategy (RFMS) included City's commitment to complete specific projects to remove I&I from the City system
- RFMS submission resulted in Administrative Order (AO) being lifted by EPA
- Allentown Water & Sewer Lease holds the City responsible for AO expenses
- 2023 project is final phase of I&I projects outlined in the RFMS

Roles & responsibilities:

- City defines project
- LCA implements project
- City pays for project
- LCA collects project cost from customers through an "AO Fee"
- City pays debt service on AO bonds using revenues from LCA "AO Fee"

3. City of Allentown – *NEW Source Reduction Program*

- Using data from RDII analysis completed in 2022, new 10-year program developed
- I&I Source Reduction Program will be incorporated into Act 537 Plan
- Program goal is to reduce overall size/cost of large capital improvements
- Water & Sewer Lease (2020 Amendment) covers how I&I work will be handled after City's AO commitments are satisfied
- 2023 kickoff; Year 1 to be completed in 2024

Roles & responsibilities:

- City & LCA collaborate on project scope; City has final say on scope
- LCA implements and pays for project
- LCA contributes first $650,000
- LCA collects remaining project cost through Capital Cost Recovery Charge applied to customer bills

Note 1: 10-Year Source Reduction Program cost estimate is $50 million

Note 2: LCA and City collaborated on a $10.4 million grant application to support Years 1-3 of this program. Decision on grant expected this summer.

Lehigh County Authority

Questions? Discussion

Next Up: Project Details

THANK YOU!