Using a Model to Assess I&I Reductions

February 10, 2022

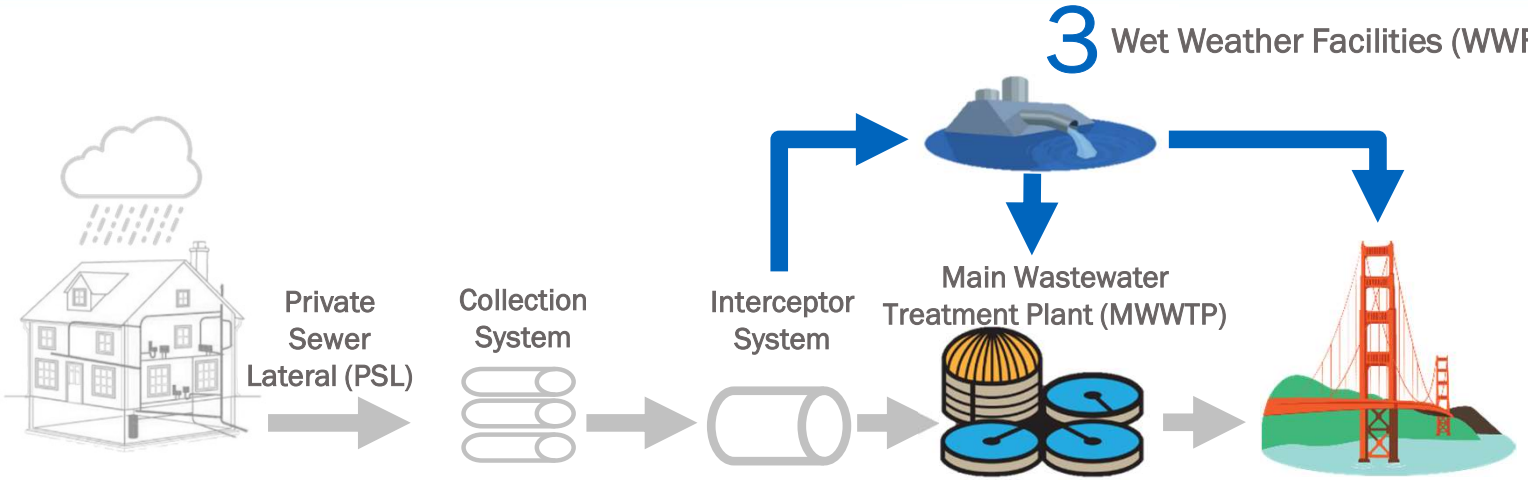
Agenda

1 Background

2 Benefits of Using a Model

3 Assessing I&I Reductions

Background


3 Wet Weather Facilities (WWFs)
Private Sewer Lateral (PSL)
Collection System
Interceptor System
Main Wastewater Treatment Plant (MWWTP)


Point Isabel

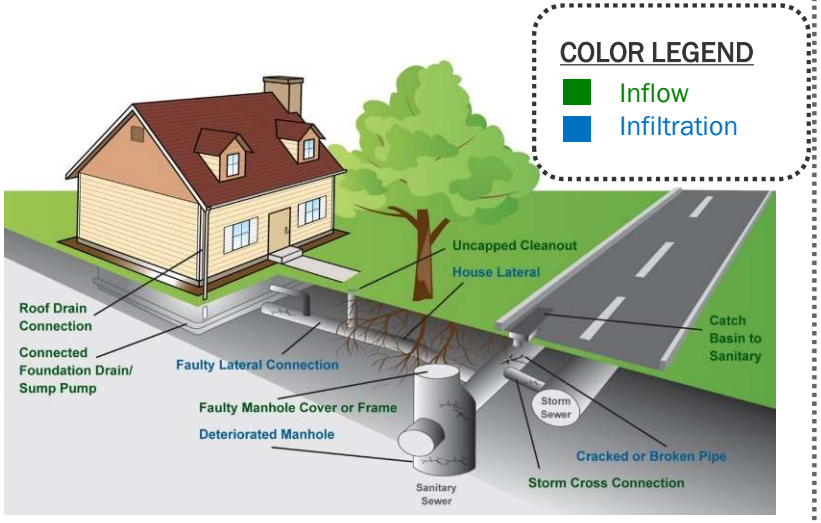

San Antonio Creek

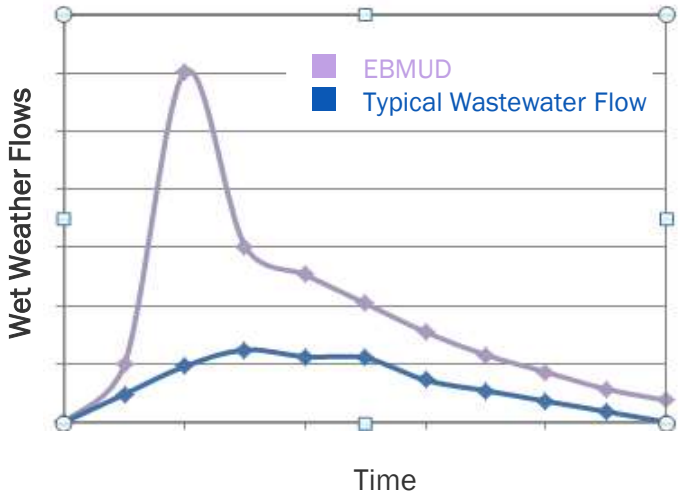

Oakport

Background

INFLOW & INFILTRATION (I&I)

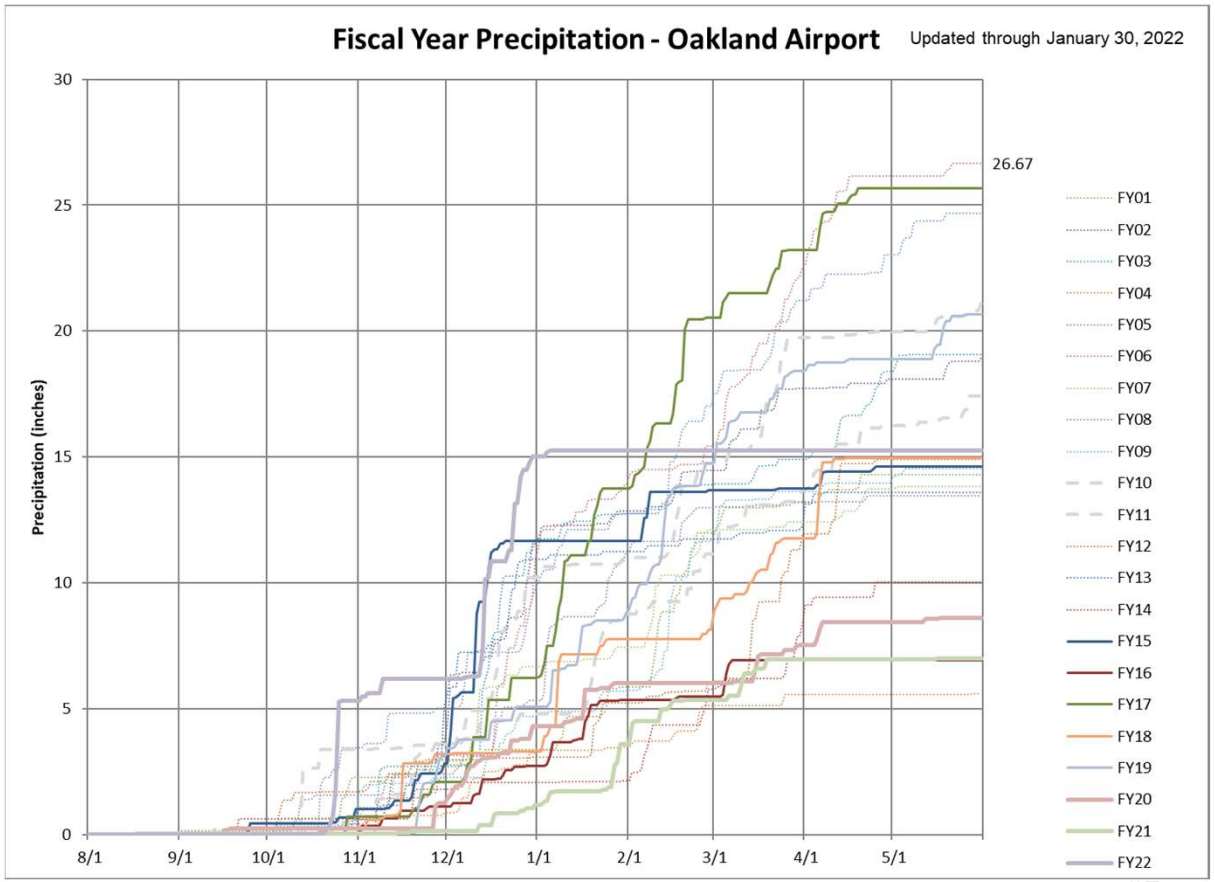
Water that flows into leaky sewer pipes from groundwater and stormwater





Benefits of Using a Model

- Available options?
  - Annual performance
  - Model-approach
  - Others?
- Benefit of an apples-to-apples comparison



How to assess reductions?

Develop a consistent process

- Data collection & review
- Update model (and perform continuous simulations)
- Calibrate the model
- Assess performance

Data Collection & Review

- Reported Work
  - Public rehabilitation
  - PSL certifications
- Potable water consumption
  - Winter consumption
- Gauge Adjusted Radar Rainfall (GARR) data
- Flow and level data
  - ITA-scale flow and level data
  - EBMUD facility flow and level data

KEY TAKEAWAYS

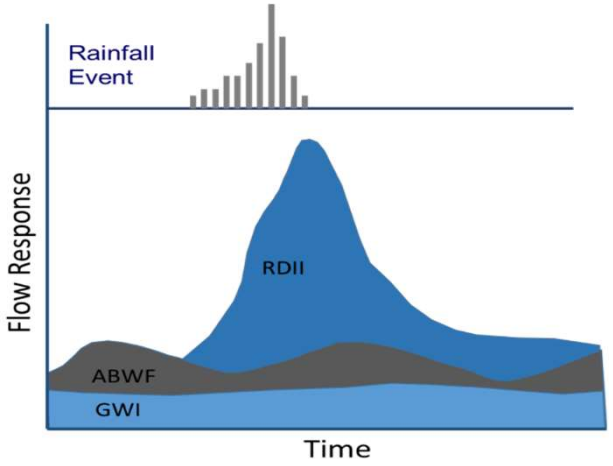
1. Collaborative approach for reported data used in Flow Model Update.

2. Independent data QA process used to validate project data.

Flow Model Update
Hydrologic Model

Simulates generation of all flow components within the Collection Systems

- Average Base Wastewater Flow (ABWF)
- Groundwater Infiltration (GWI)
- Rainfall Derived Inflow & Infiltration (RDII)



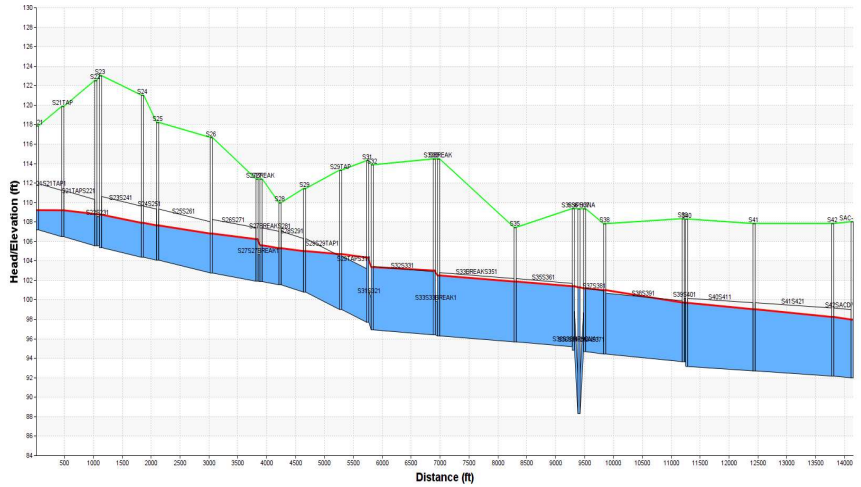
KEY TAKEAWAYS

1. *Hydrologic model generates hydrographs representing all flows generated within sewershed area.*

Flow Model Update
Hydraulic Model

Simulates flow routing within the model pipe network

- RTC emulates Interceptor System operations
- Model results show discharges and water levels for each model element

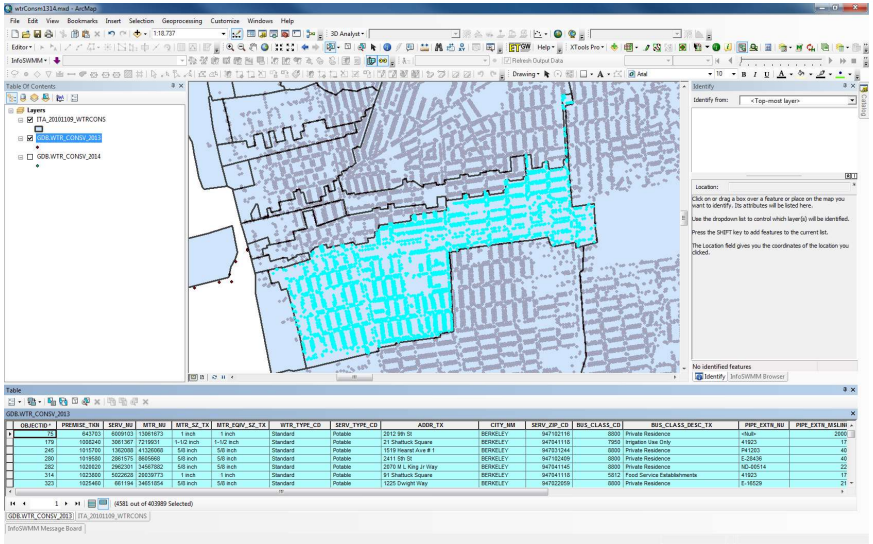


KEY TAKEAWAYS

1. *Hydraulic model represents Interceptor System conveyance and operations.*
2. *Hydraulic model routes hydrographs through sewer network.*

Flow Model Update
Hydrologic Model Updates - ABWF

- FY21 ABWF update based on change in winter water consumption
- 2020 winter water consumption aggregated and summed by ITA
- Ratio of 2019:2020 used as multiplier to update ABWF volume

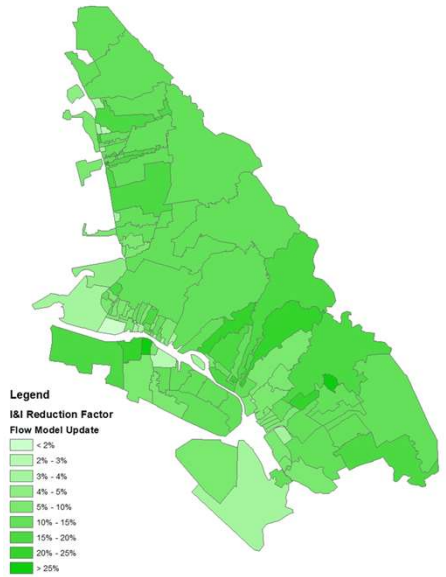


KEY TAKEAWAYS

1. *Updated ABWF values provide first estimate of sanitary wastewater flow volume generated within each ITA.*
2. *ABWF update uses the most recent winter water consumption data available.*

Flow Model Update
Model Updates – I&I Reduction Factor

- Composite ITA I&I Reduction Factor computed from:
  - Satellite reported public sewer rehabilitation
  - PSL certifications reported by Berkeley & EBMUD

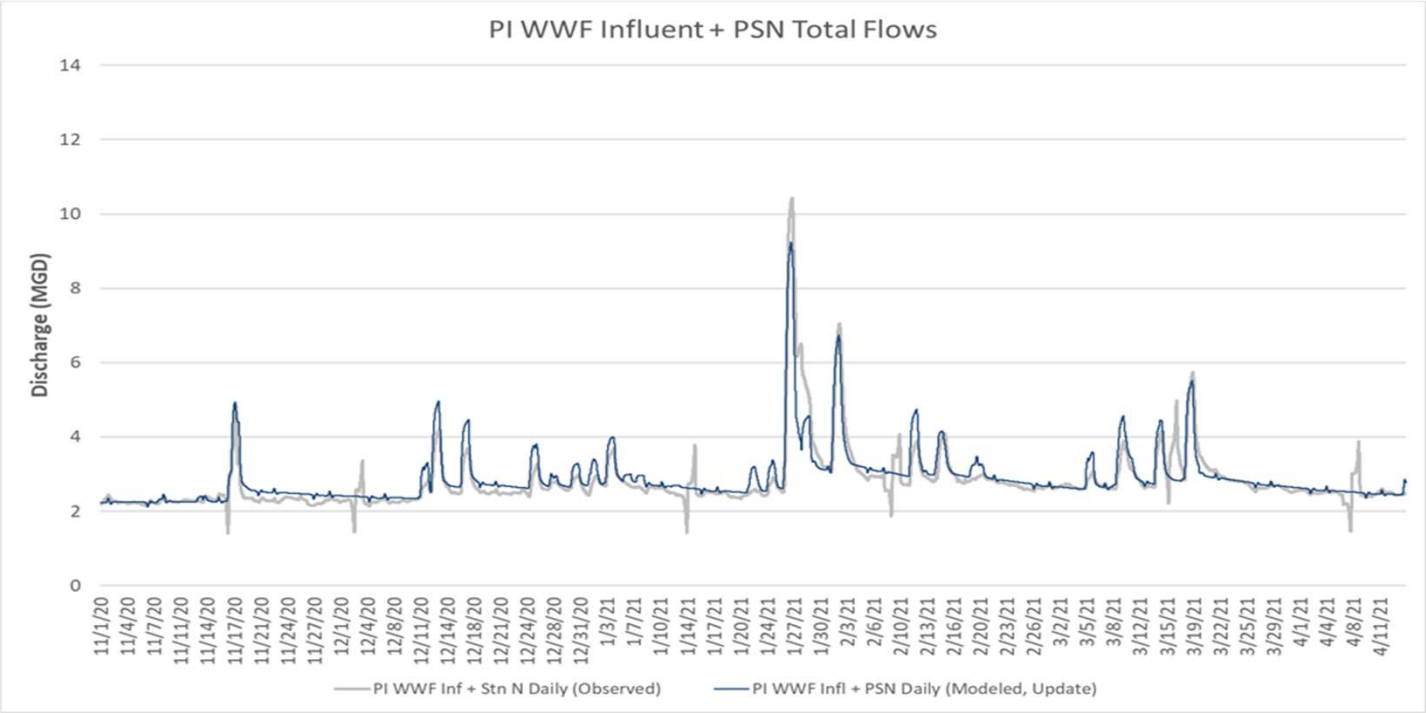


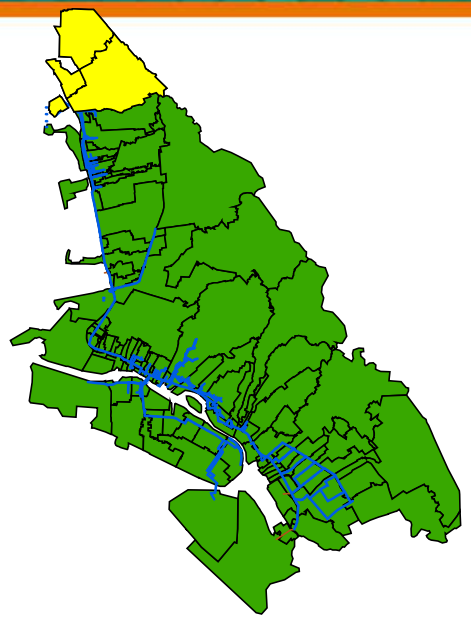
FY21 Updated PICS I&I Reduction Factor

KEY TAKEAWAYS

1. Expected I&I Reduction Factors show significant variation across ITAs. #11

Flow Model Update (Continuous Simulations)





KEY TAKEAWAYS

1. *Updated Flow Model shows good agreement with totalized flows from PSN and to PI WWF.*

Flow Model Calibration

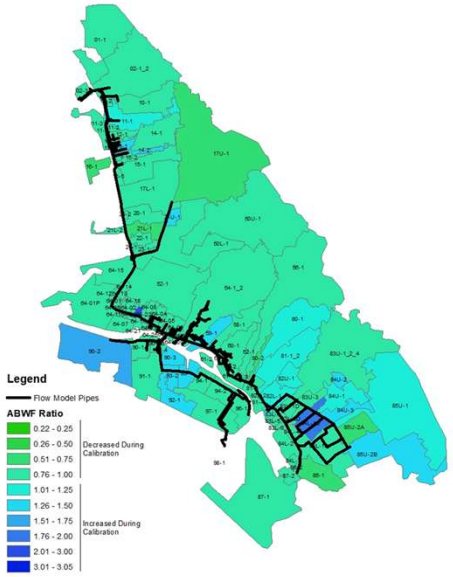
- Latest Simulation Period: Nov. 1, 2020 – April 15, 2021
- Sanitary and I&I Flow Components
  - Hydrologic model calibration
- Interceptor System Hydraulics
  - Flows to and from WWFs
  - Flows from pumping stations
  - MWWTP IPS Flow

KEY TAKEAWAYS

1. *Flow Model calibration considers both flow generation (hydrologic model) and flow routing (hydraulic model).*

Flow Model Calibration
ABWF Volume Adjustment

- ABWF volume calibrated to ITA-scale flow data
- Calibrated ABWF Ratio demonstrate adjustments required for calibration
  - Ratio < 1, ABWF volumes reduced in calibration
  - Ratio > 1, ABWF volumes increased in calibration



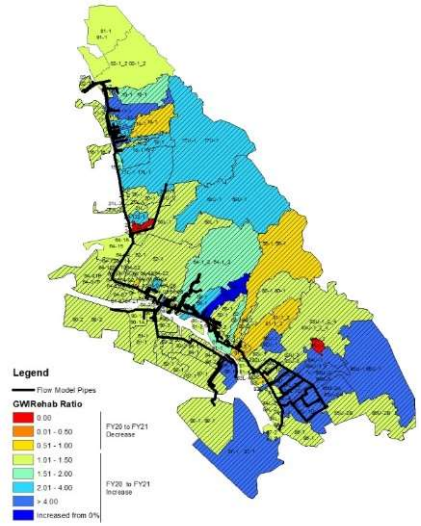
- Calibrated ABWF Factor Ratios

KEY TAKEAWAYS

1. *ABWF calibration to ITA-scale flow data resulted in good agreement between modeled and observed dry weather flows.*

Flow Model Calibration
GWI Volume Adjustment

- Calibrated GWI Rehabilitation Ratio demonstrate adjustments required for calibration
  - Ratio < 1, calibrated GWI Rehabilitation value less than expected
  - Ratio > 1, calibrated GWI Rehabilitation value more than expected



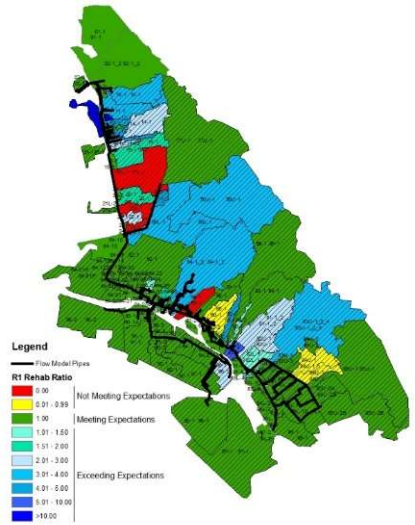
Calibrated ITA GWI Rehabilitation Ratios

KEY TAKEAWAYS

1. *GWI Rehabilitation factor calibration to ITA-scale flow data resulted in good agreement between modeled and observed long-term infiltration flow recession.*

Flow Model Calibration
RDII Rehabilitation Parameters

- Calibrated RDII Rehabilitation Ratios demonstrate adjustments required for calibration
  - Ratio < 1, RDII Rehabilitation value less than expected
  - Ratio > 1, RDII Rehabilitation value greater than expected

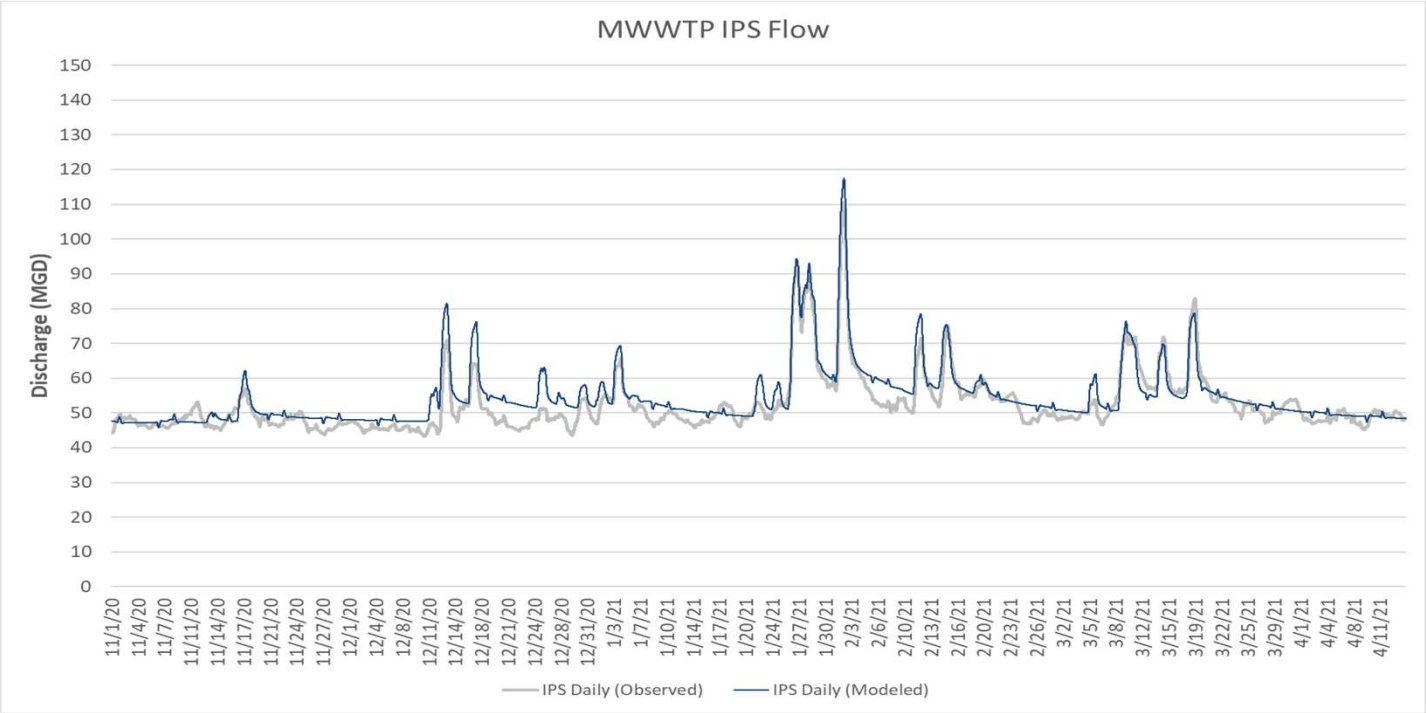


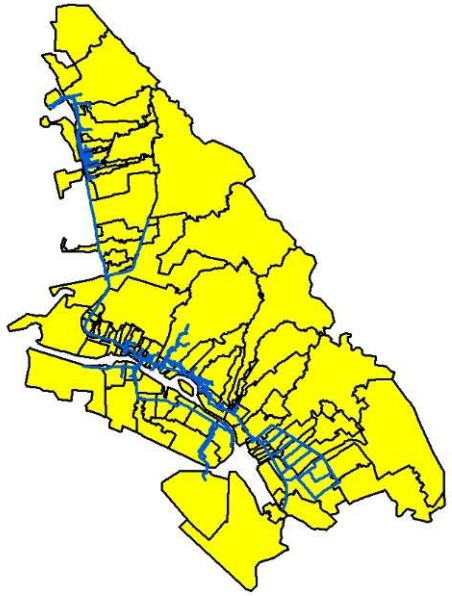
Calibrated ITA R1 Rehabilitation Parameter Ratios

KEY TAKEAWAYS

1. *RDII Rehabilitation factor calibration to ITA-scale flow data resulted in good agreement between modeled and observed wet weather flows.*

Flow Model Calibration





KEY TAKEAWAYS

1.Calibrated Flow Model improved agreement with flows at the MWWTP IPS.

Assessing I&I Reductions

- Simulate design storm
  - Baseline Flow Model
  - FY21 Calibrated Flow Model
- Volumetric comparison between model results

Assessing I&I Reductions

FY21 Calibrated Facilities Flow Volumes

Facility	Baseline Flow Model Accumulated Effluent Volume (MG)	FY21 Calibrated Flow Model Accumulated Effluent Volume (MG)
PI WWF	23.3	10.0
OAK WWF	53.7	28.9
SAC WWF	13.2	4.6
MWWTP IPS	355.9	293.2
System-wide Total	446.1	336.7

KEY TAKEAWAYS

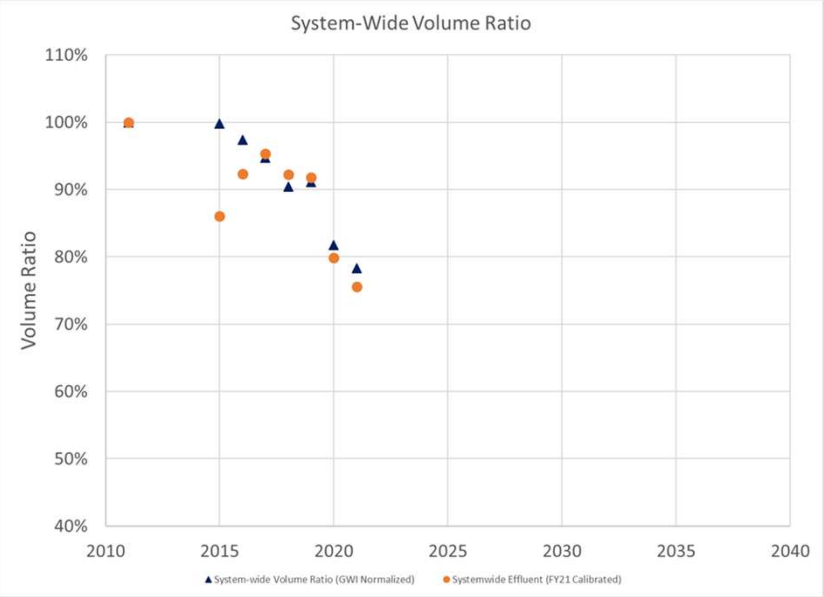
1. *FY21 model results show decreased discharge volumes at all WWFs and at the MWWTP.*

Assessing I&I Reductions

Year	System-wide Volume Discharged with FY Groundwater Conditions	System-wide Volume Discharged with FY11 Groundwater Conditions
FY11 (Baseline)	100%	100%
FY15	86%	100%
FY16	92%	97%
FY17	95%	95%
FY18	92%	90%
FY19	92%	91%
FY20	80%	82%
FY21	76%	78%

Assessing I&I Reductions

- Evidence that collection system rehabilitation is effective in reducing discharge volumes
- GWI normalized volume ratio analysis demonstrates year-over-year discharge reductions



KEY TAKEAWAYS

1. *GWI normalized system-wide volume ratio analysis demonstrates collection system rehabilitation is effective in reducing discharge volumes*


Thank you!
Questions?
EAST BAY
MUNICIPAL UTILITY DISTRICT