



Northeast Ohio Regional Sewer District

# Westerly Storage Tunnel & Dewatering Pump Station



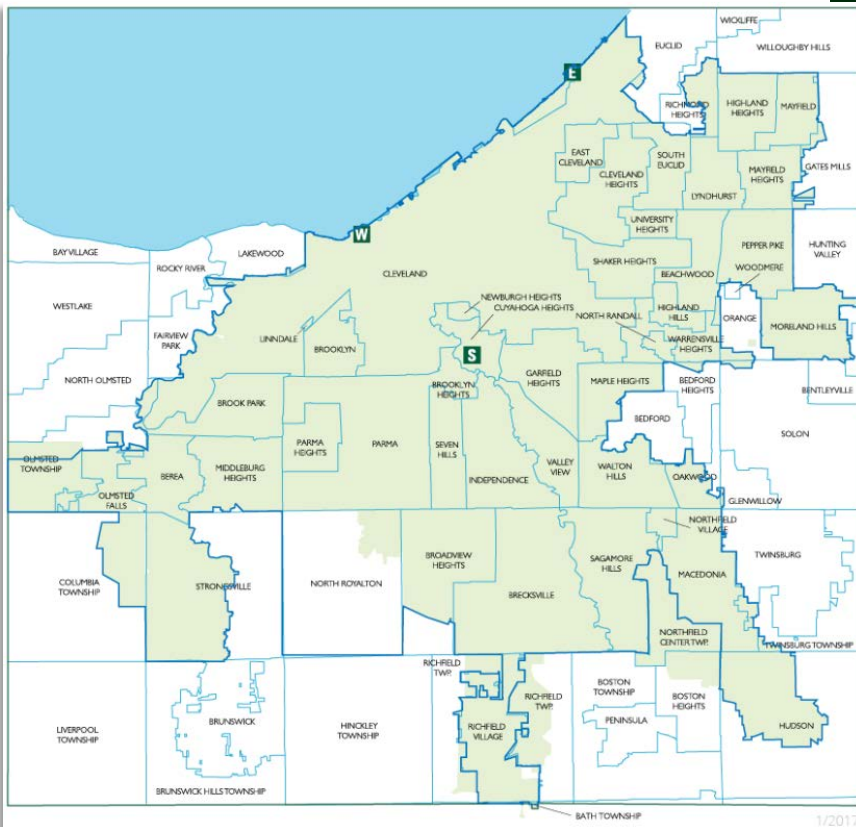
## The Westerly Storage Tunnel and Dewatering Pump Station:

*How to Hit a Moving Target*

June 28, 2017

# NEORSD Introduction

- 355 square mile service area
- 61 member communities



## PROJECTS

A map of the NEORSD service area highlighting several major infrastructure projects. Each project is detailed in a callout bubble:

- WESTERLY CSO STORAGE TUNNEL**: 24' DIAMETER, 12,300' LONG. 2020 ADVERTISE FOR BID.
- SHORELINE STORAGE TUNNEL**: 21' DIAMETER, 16,100' LONG. 2021 ADVERTISE FOR BID.
- TUNNEL DEWATERING PUMP STATION**: 200' DEEP | 160 MGD. 2011 ADVERTISE FOR BID.
- EUCLID CREEK & DUGWAY STORAGE TUNNELS**: 24' DIAMETER, 33,000+ TOTAL FT. 2010/2014 ADVERTISE FOR BID.
- DOAN VALLEY STORAGE TUNNEL**: 17' DIAMETER, 9,700 FT. LONG. 2017 ADVERTISE FOR BID.
- BIG CREEK STORAGE TUNNEL**: 20' DIAMETER, 19,500' LONG. 2026 ADVERTISE FOR BID.
- SOUTHERLY STORAGE TUNNEL**: 23' DIAMETER, 17,600' LONG. 2024 ADVERTISE FOR BID.

**PROJECT CLEAN LAKE**  
GREAT LAKE • GREAT FUTURE

Northeast Ohio Regional Sewer District

# Presentation Outline

- Walworth Run's History
- Westerly Storage Tunnel & Dewatering Pump Station: project background and prior studies
- Design-phase flow monitoring
- H+H model recalibration
- Resulting adjustments to tunnel and pump station designs



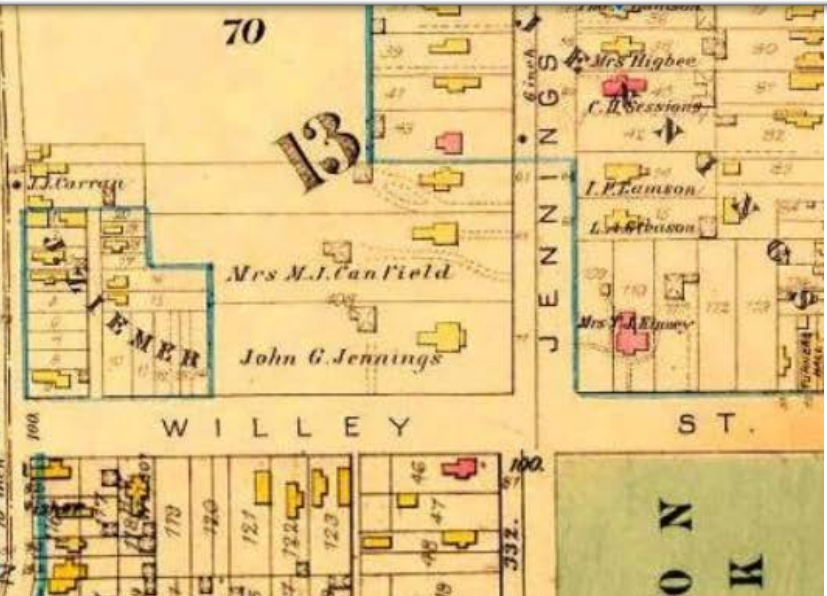
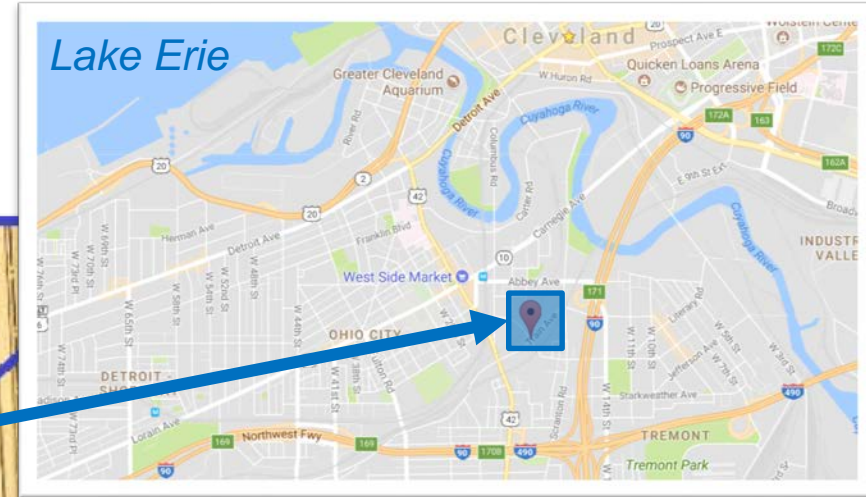
# Project History: Walworth Run

(main CSO location)



0.25 mi to  
Lake Erie

# Industrialization along Walworth Run



# Flooding and Pollution Problems

While normally a small and slow-moving stream, Walworth Run would flood quickly in storms even during the 1850s.

## WALWORTH RUN.

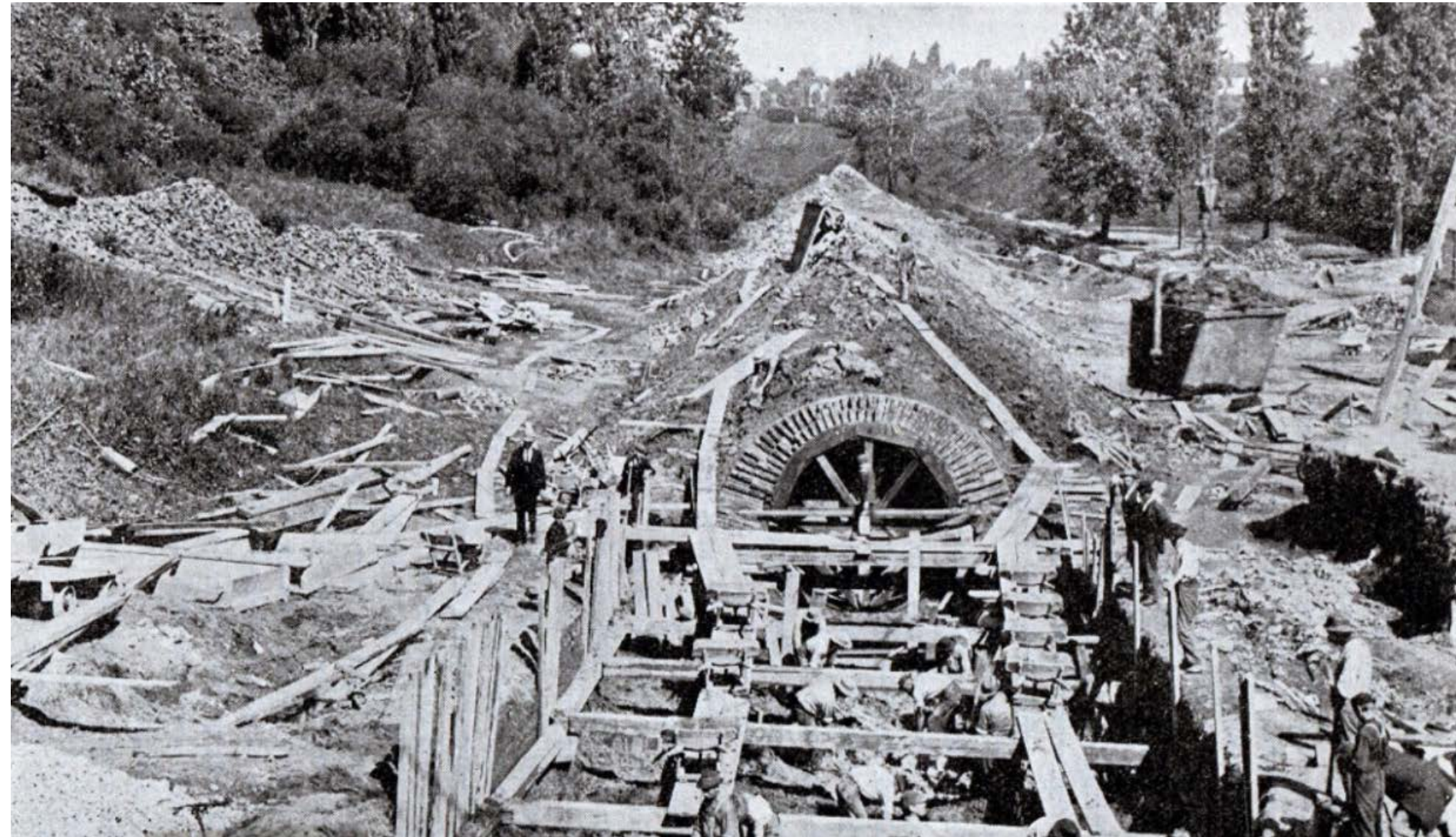
**The Twelfth Ward Aroused—Meeting Last Evening—The Council to be Petitioned in Regard to Slaughter Houses—A Vigilance Committee Appointed**

The meeting held in the Twelfth Ward last Saturday evening to express the opinion of the people in regard to slaughter houses and the use of Walworth run as a general public sewer, was adjourned to last evening, and in pursuance of said adjournment a fair sized assemblage convened in Becker's Hall, at the corner of Columbus and Queen streets.

**The Storm and the Freshet---Seldon's Dam and Four Bridges Carried Away on Walworth Run---Narrow Escape of an Omnibus-load of Passengers---Prospect of a Sleighting Carnival.**

Public outrage over the use of Walworth Run as an open sewer grew with the industrialization of the area, peaking during the 1870s and 1880s

# Construction of Walworth Run Sewer



# Outlet of Walworth Run: 1905 (A.K.A. CSO-080)





# Site Conditions at CSO-080: Present Day



An aerial photograph of an industrial facility, likely a wastewater treatment plant, with a semi-transparent text box overlaid. The facility includes several large rectangular buildings, a network of pipes, and a large circular structure. A road runs through the lower right portion of the image. The background shows a city skyline under a hazy sky.

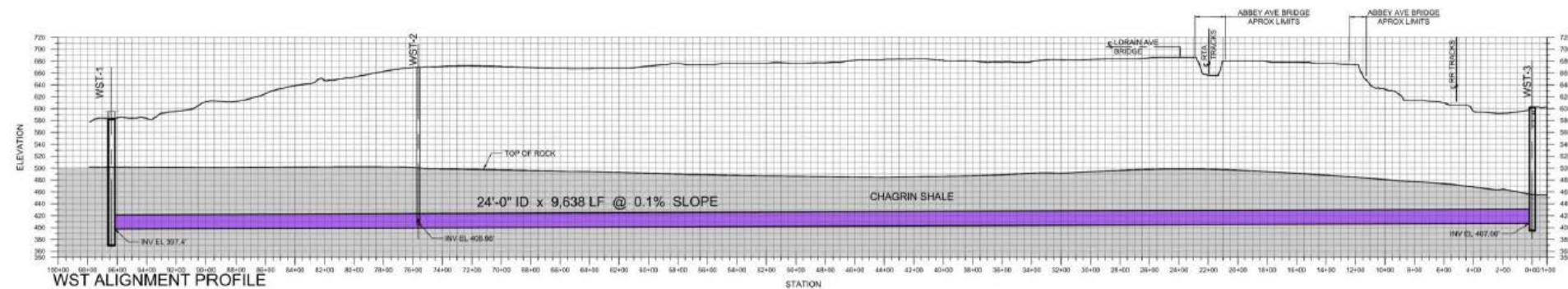
# Combined Sewer Overflows at CSO-080

- Approximately 300 MG of CSO enters the Cuyahoga River from CSO-080 in a Typical Year of Rainfall (TY)
- ~50 activations per TY
- Consent Decree requires reduction to 2 activations/TY
- The Westerly Storage Tunnel (WST) would provide an expected CSO volume reduction to 72 MG/TY in a 2010 estimate

# Reducing CSO Volumes: Tunnel Alignment and Profile Overview



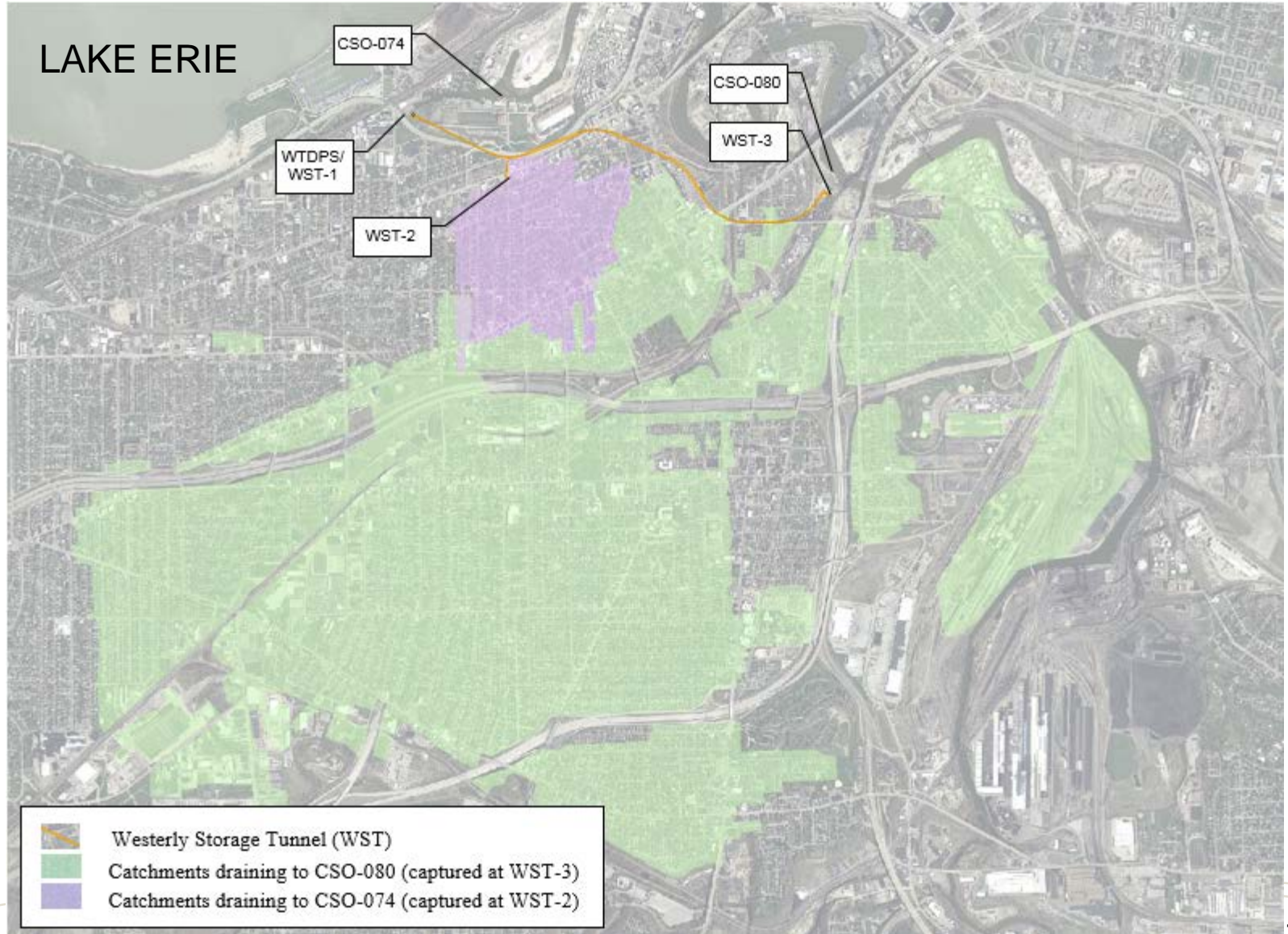
WST ALIGNMENT PLAN VIEW



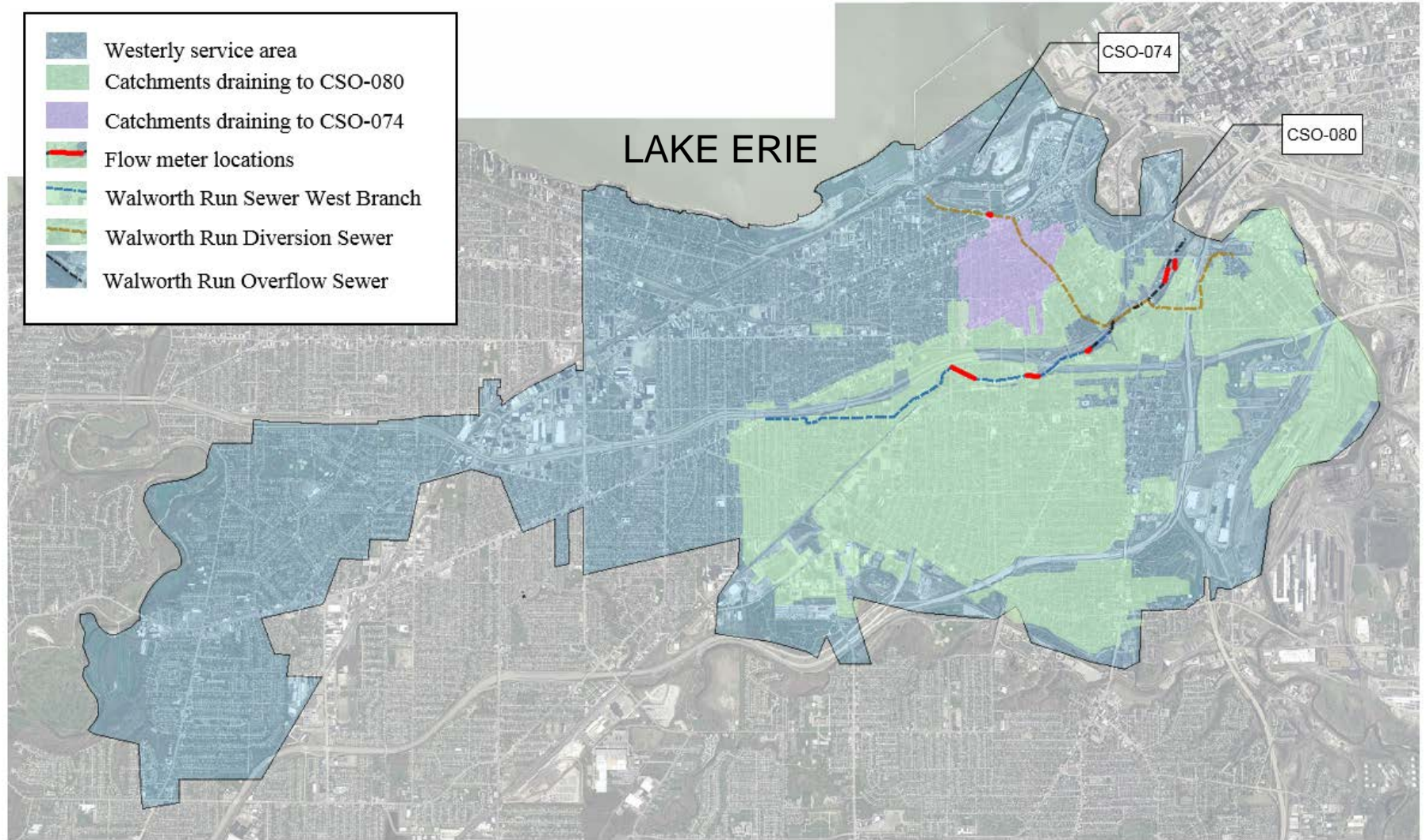
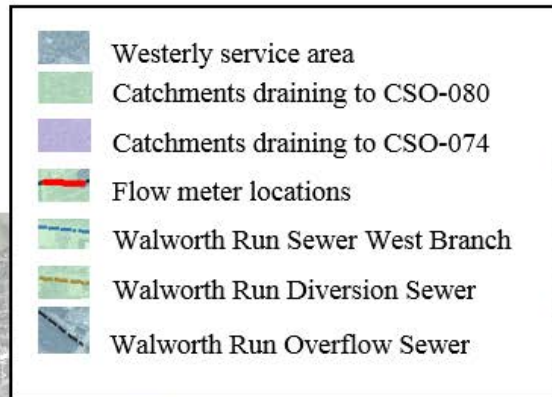
WST ALIGNMENT PROFILE

# The Westerly Storage Tunnel

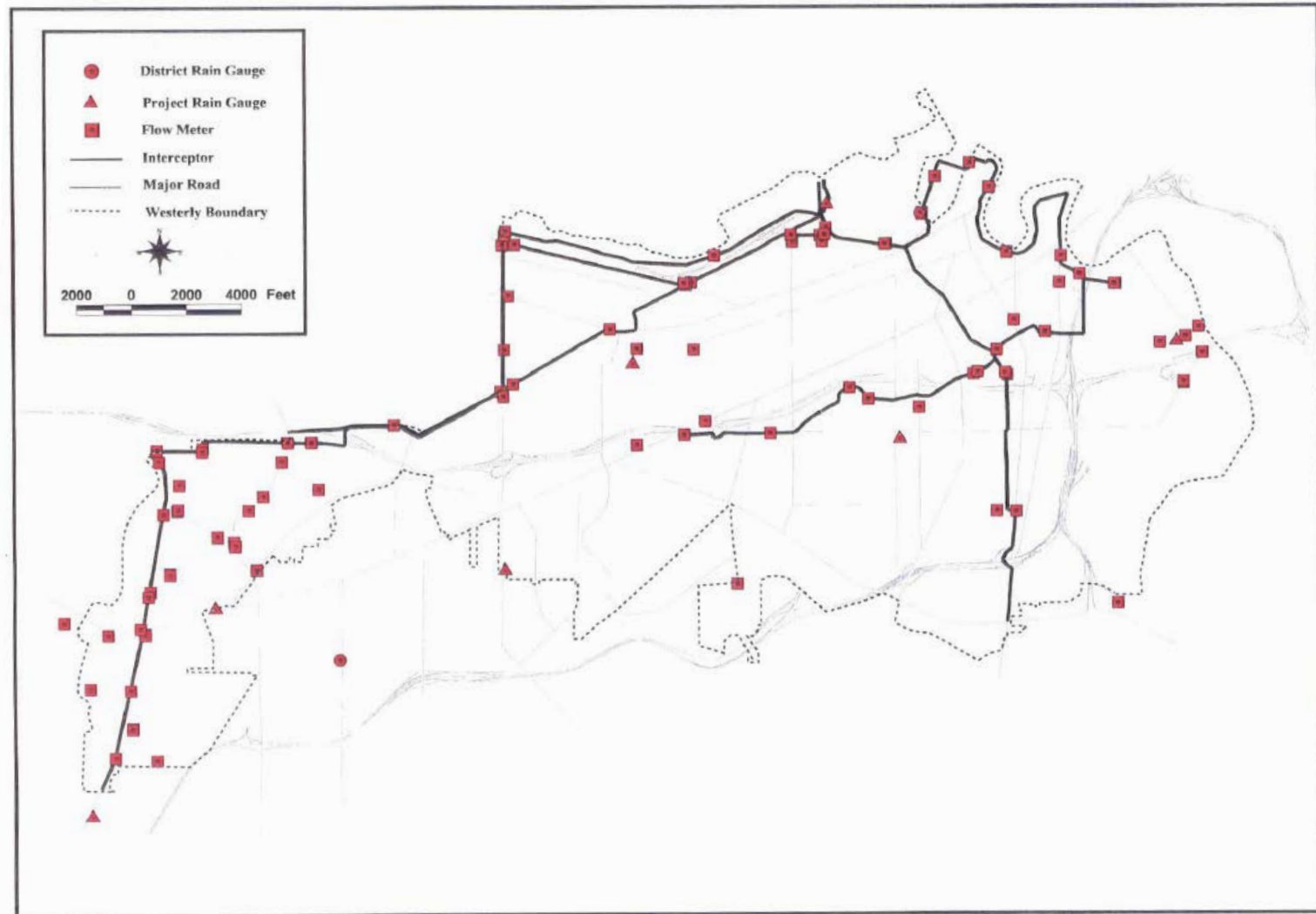
## Alignment (in Orange) and Diversion Structure Locations



# Capture Areas (shown in green and pink)



# Original Hydraulic Model Calibration (1997): Red Squares show Flow Meter Locations



# Exclusion of Several Phase II Meters

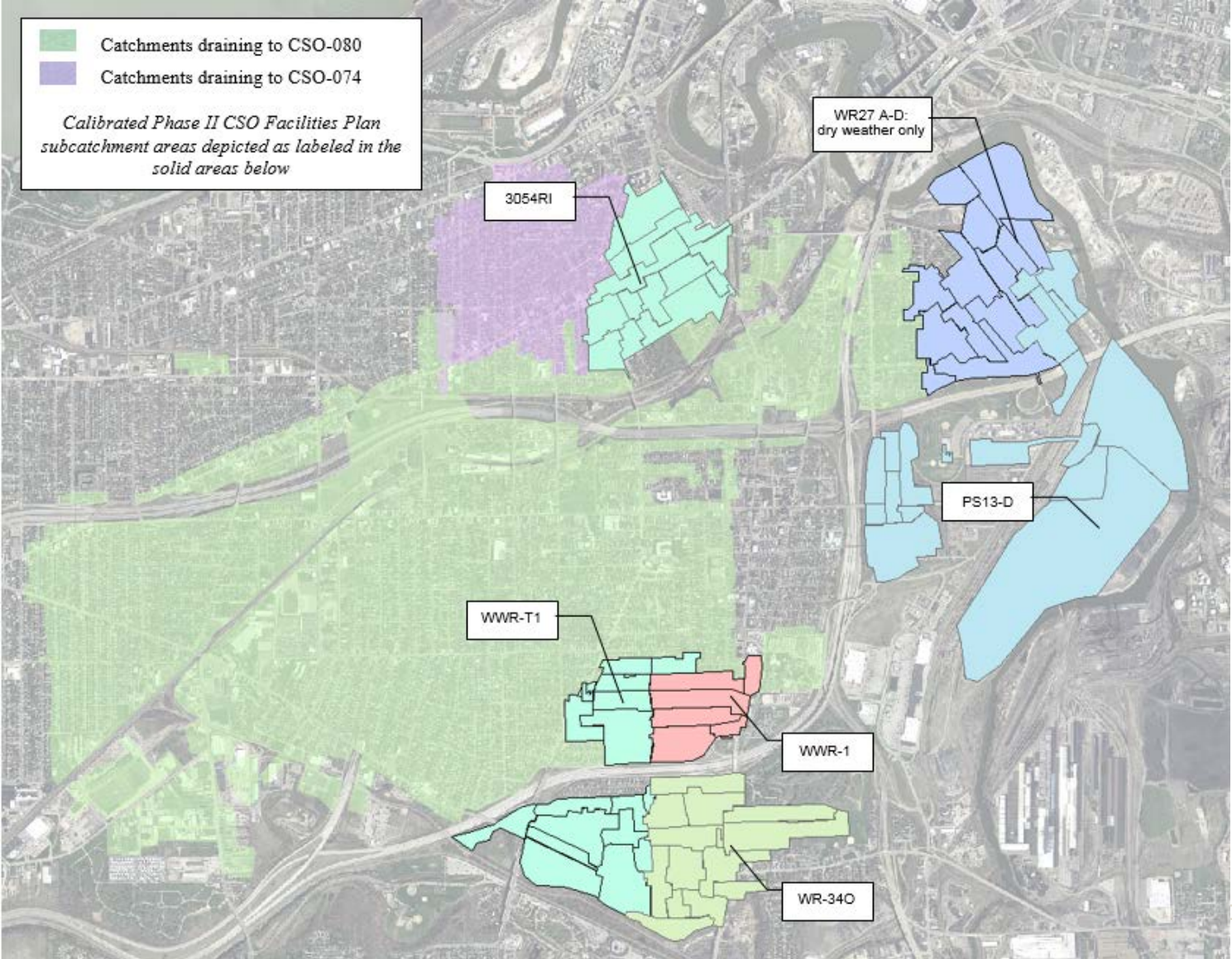
Some of the reasons why certain sites were not considered verified were:

- Poor flow data (ragging, turbulence, flows too low to be recorded by probes, etc.)
- O&M problems, such as blockages
- Simplified representation of system in peripheral sewersheds
- Over prediction of flooding and spills in peripheral areas
- Unknown connections between sewer branches or storm and sanitary sewers
- Unknown flows contributing to system (highway drainage, additional inflows)
- Complex interaction between sewers in over/under sewer systems
- Complex nature of hydrological processes (non-linear rainfall-runoff relationship)

*From Westerly Phase II Facilities Report, 1997*

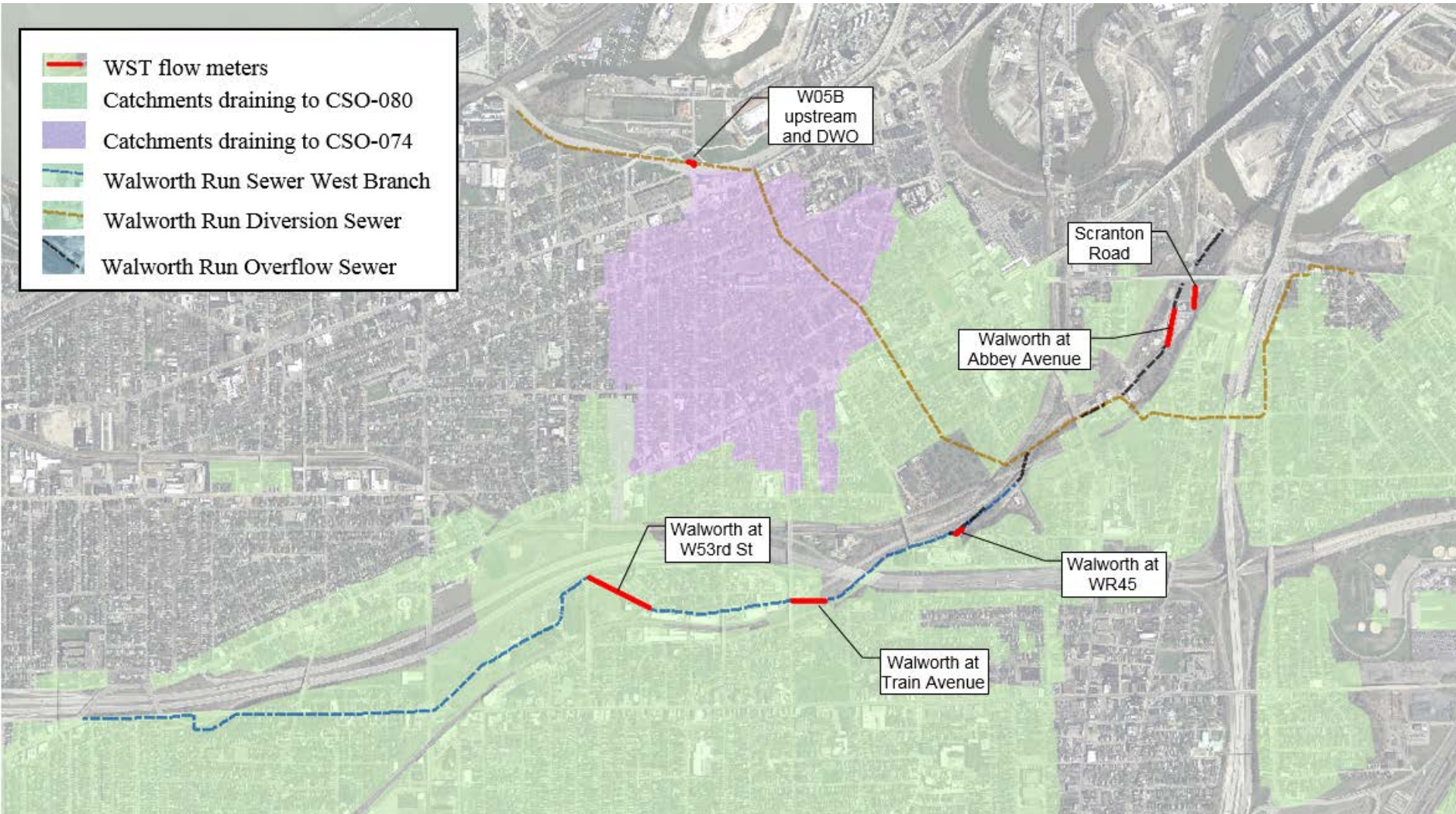
# Original Hydraulic Model Calibration (Overlay):

Solid areas were accurately calibrated & verified in Phase II Facilities Plan

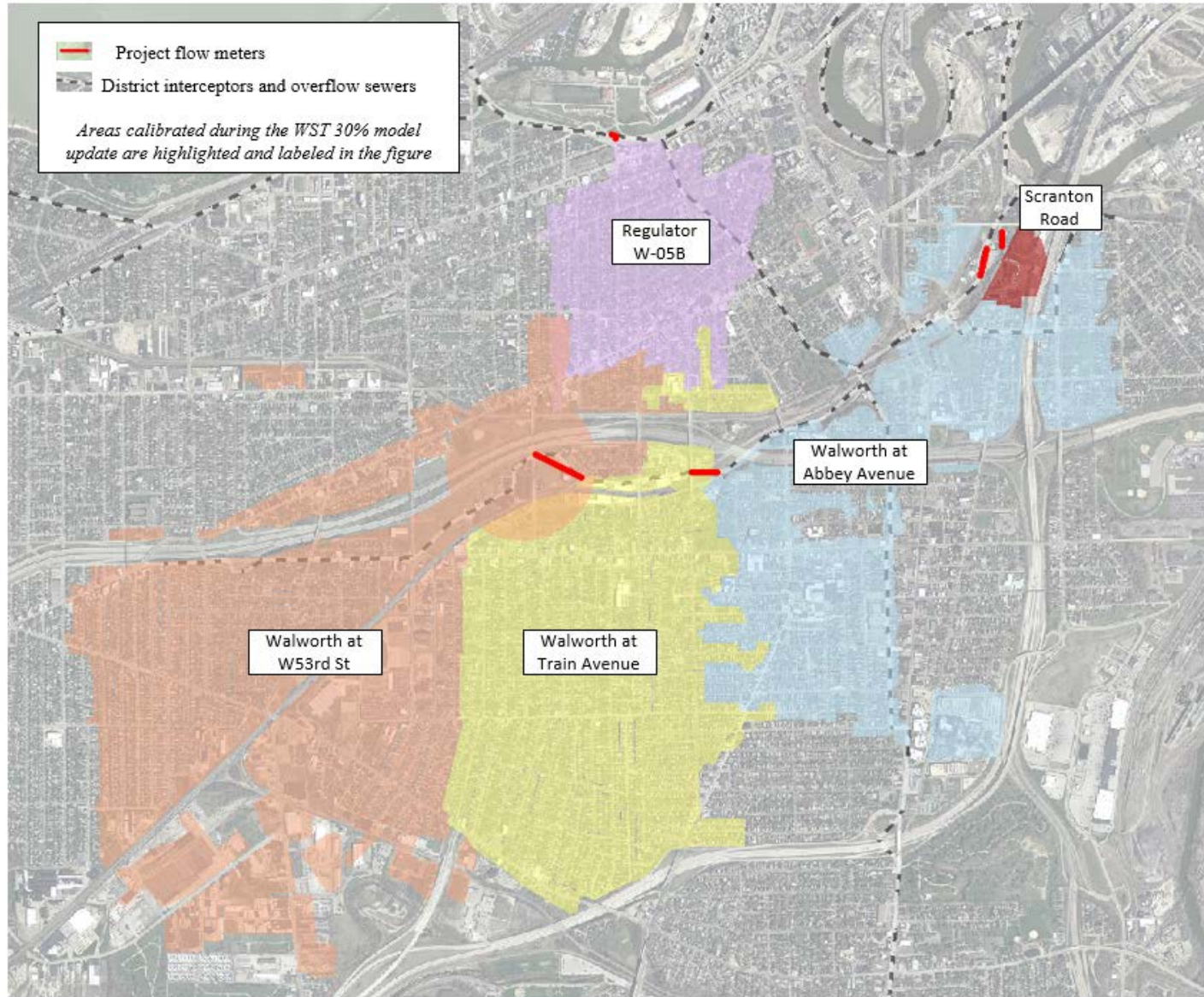




# Flow Monitoring Locations (in red)

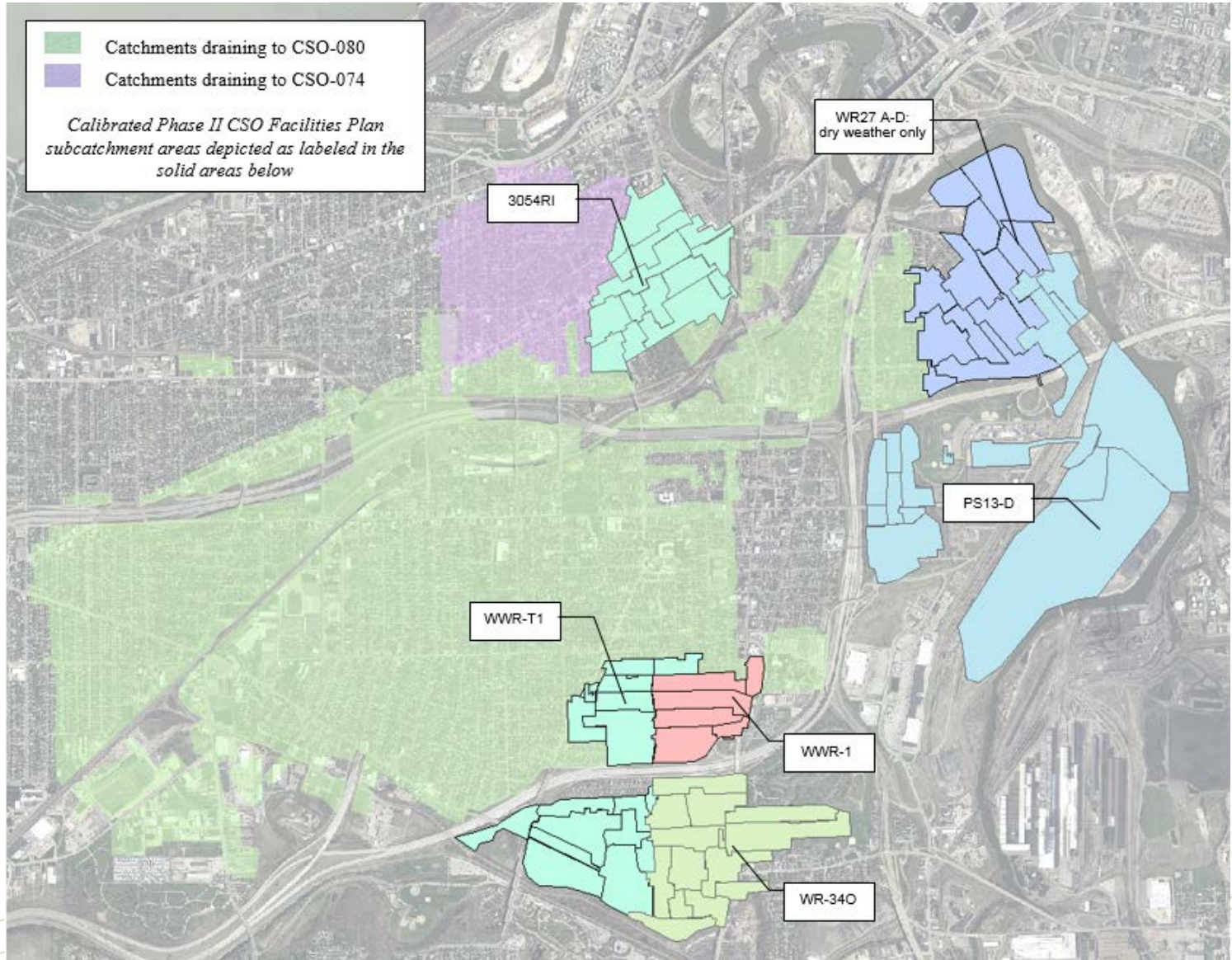


# Flow Meter Sub-basins

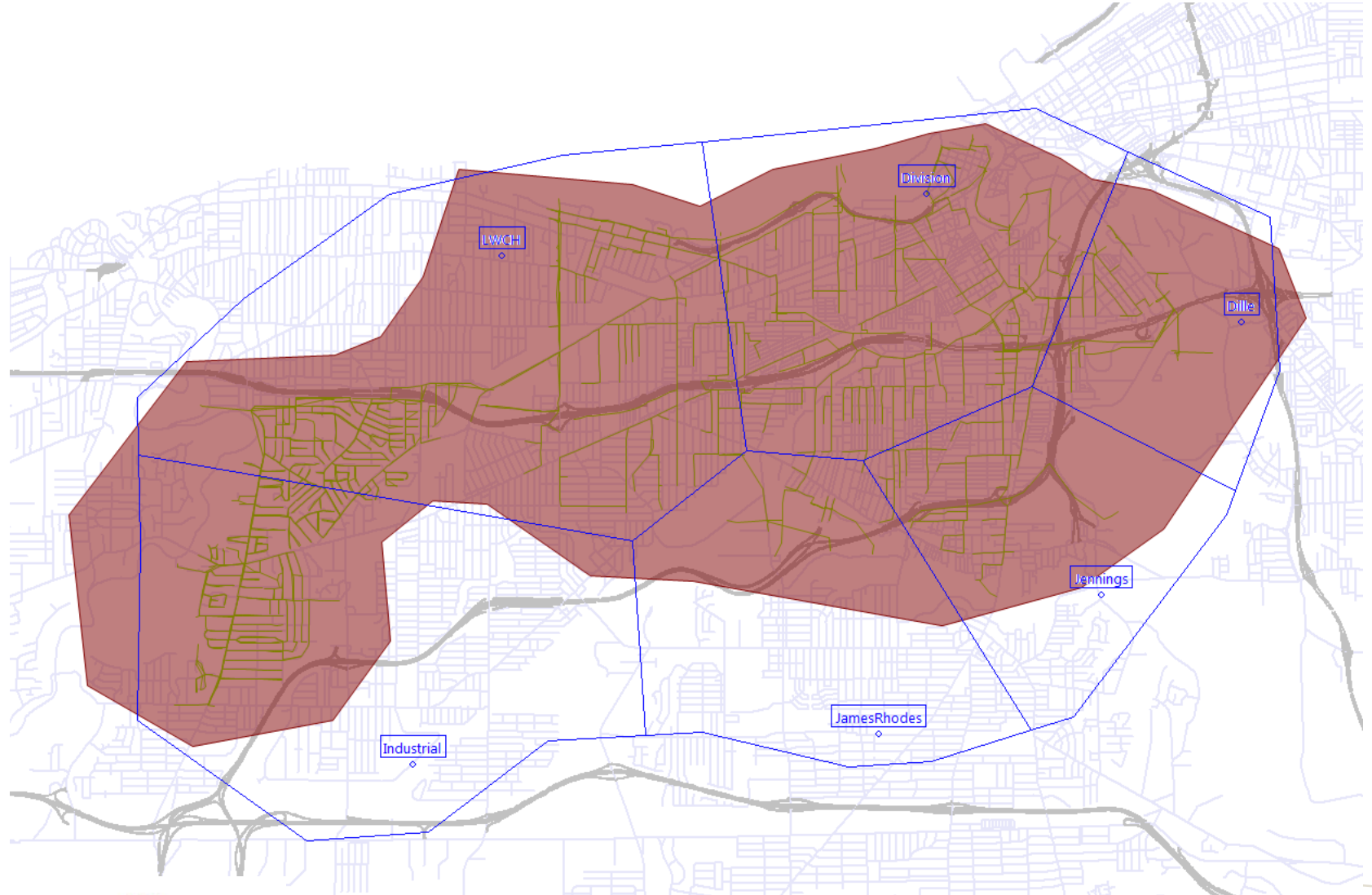


# Recalibration of Hydraulic Model (Overlay):

Transparent areas (pink and green) recalibrated per 2016 flow monitoring



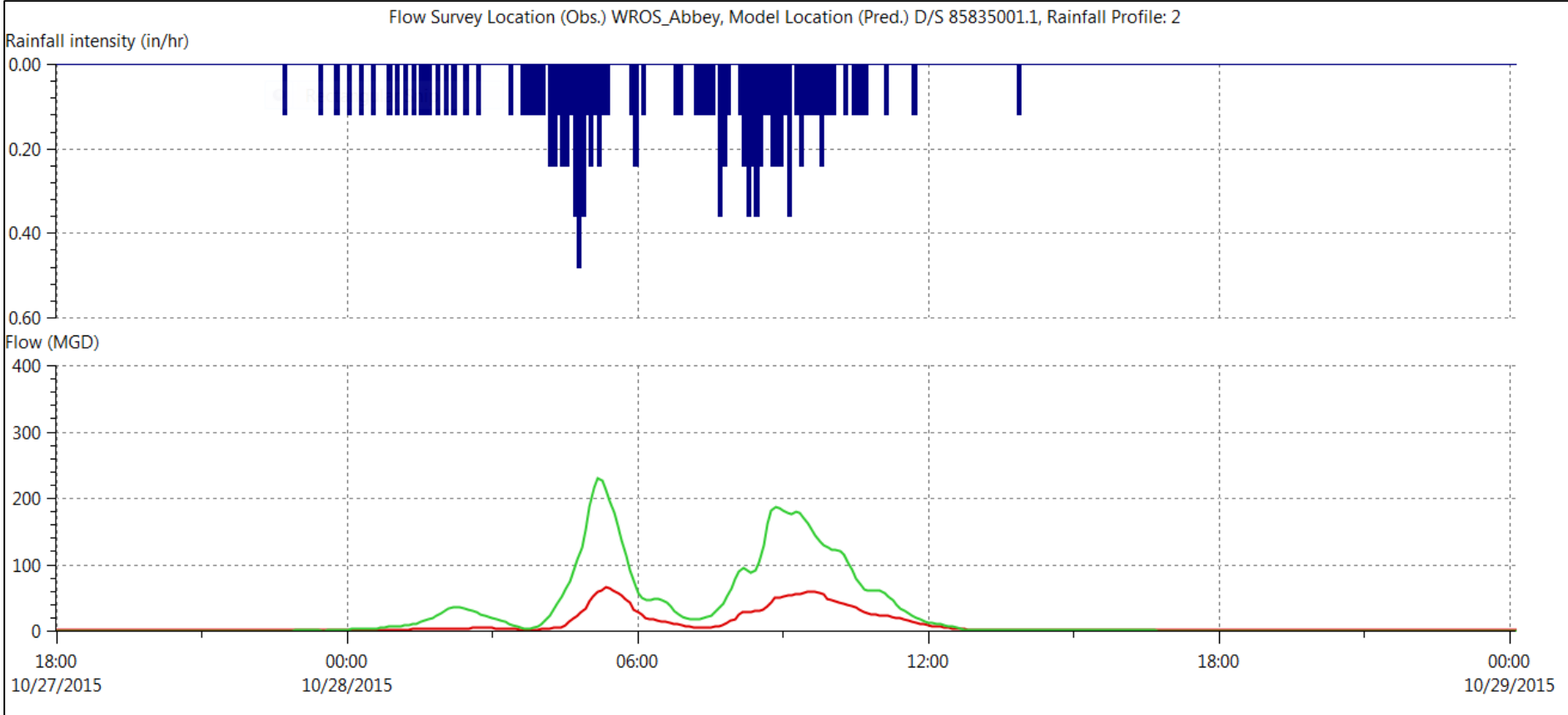
# Rainfall Data from NEORSD Gages



# Flow Monitoring Results



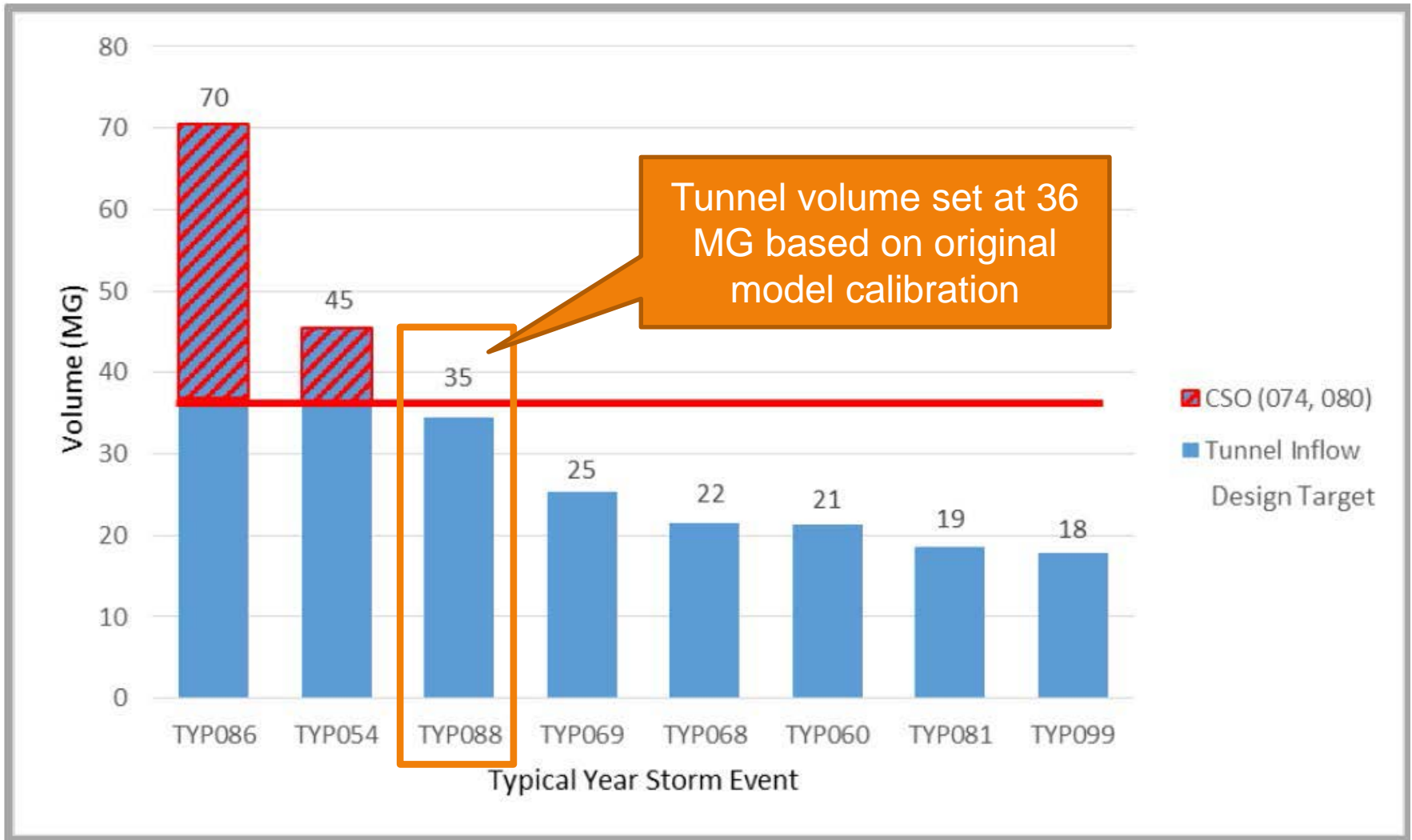
Flow Survey Location (Obs.) WROS\_Abbey, Model Location (Pred.) D/S 85835001.1, Rainfall Profile: 2



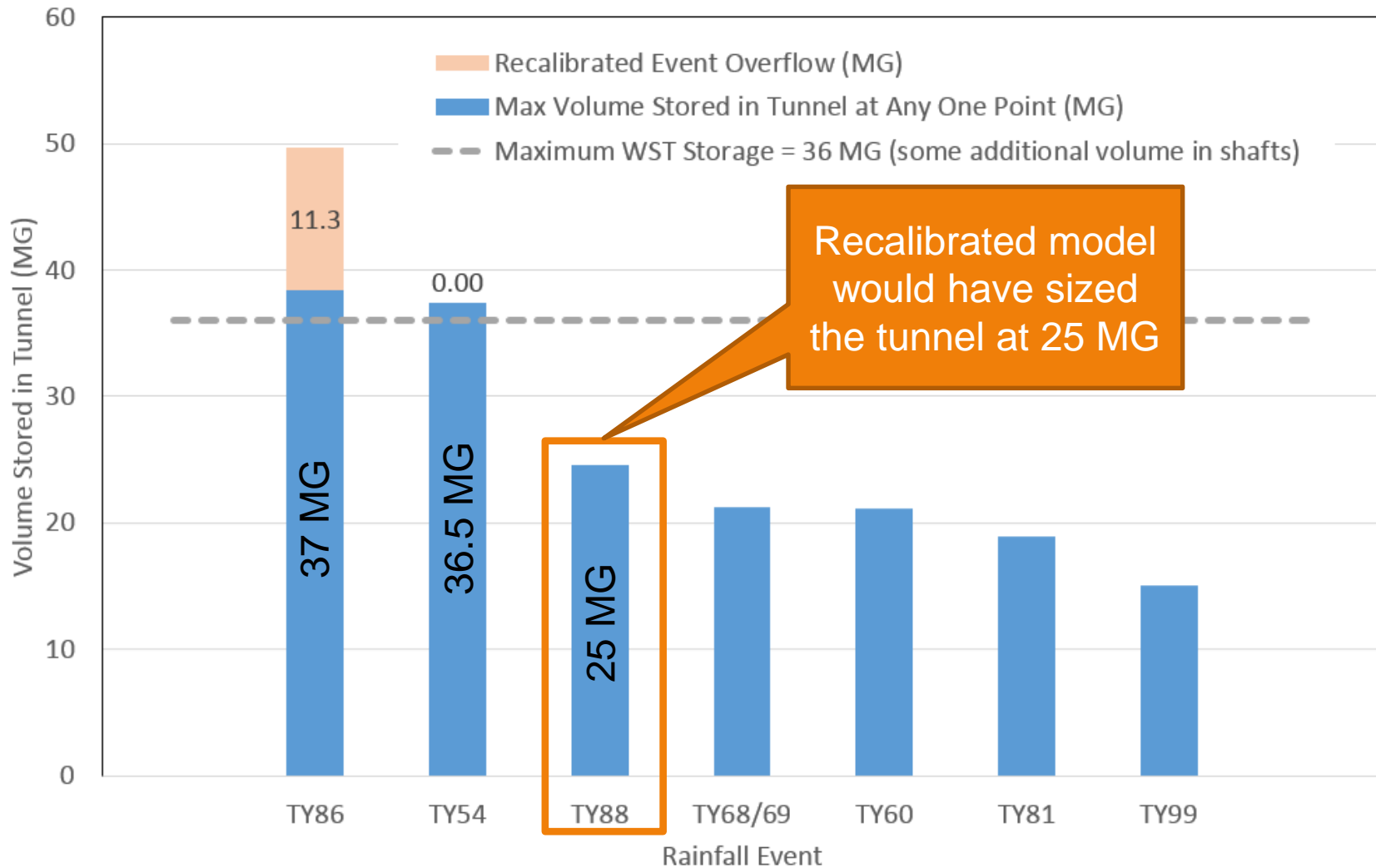
— Rainfall    — Model    — Meter

*Early monitored events suggest that the model is overpredicting, but more data must be collected before recalibration can finally be accurately performed, during 60% design of WST/WTDPS*

# Original Model Calibration Results: 36 MG Tunnel Controls to 2 CSO Activations/TY



# Model Recalibration Results: 36 MG Tunnel is Oversized



# Implications for Design Post-Recalibration

- During the 60% design stage, NEORSD and the Stantec/MM Joint Venture review the best available options to take advantage of the recalibration results.
- The Consent Decree requires a **36 MG tunnel** to be built, but the connecting structures can be resized as needed so long as the performance requirement ( $\leq 2$  activations/TY) is achieved
- So...
  - **EITHER** design features can be downsized
  - **OR** the tunnel's connecting structures can be left oversized and thereby capable of exceeding the requirements of the Consent Decree

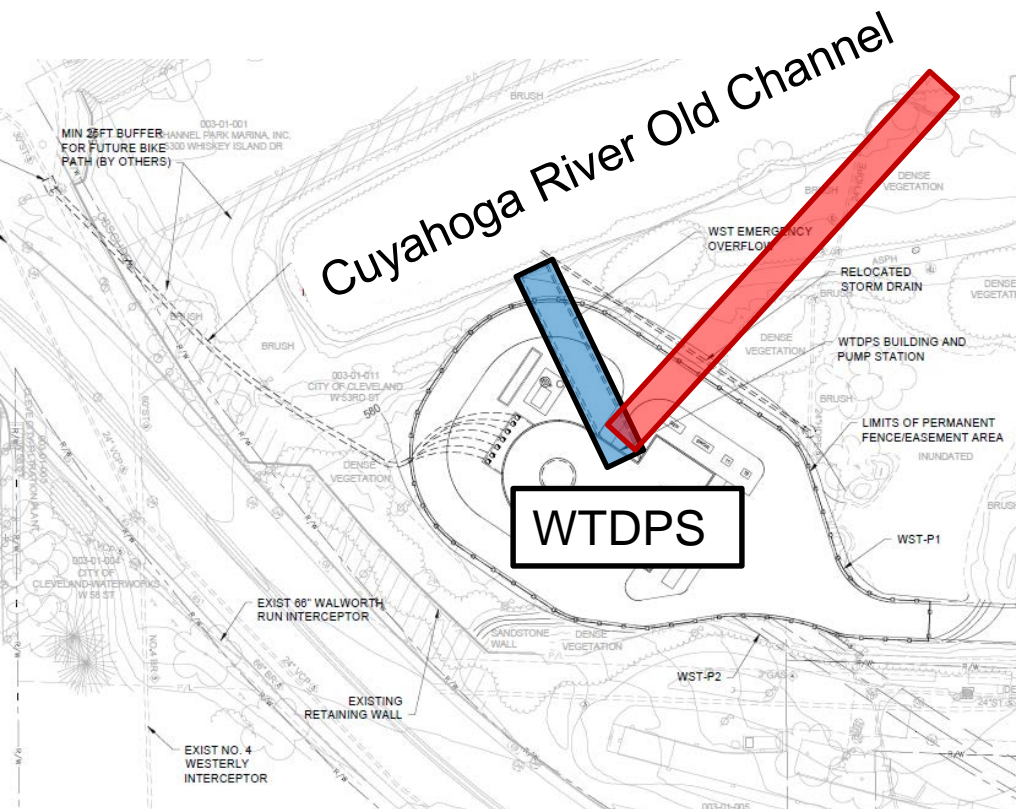


# Design Implications – Pump Station (WTDPS)

- WTDPS:
  - Surge risk mitigated by lower-than-expected flows

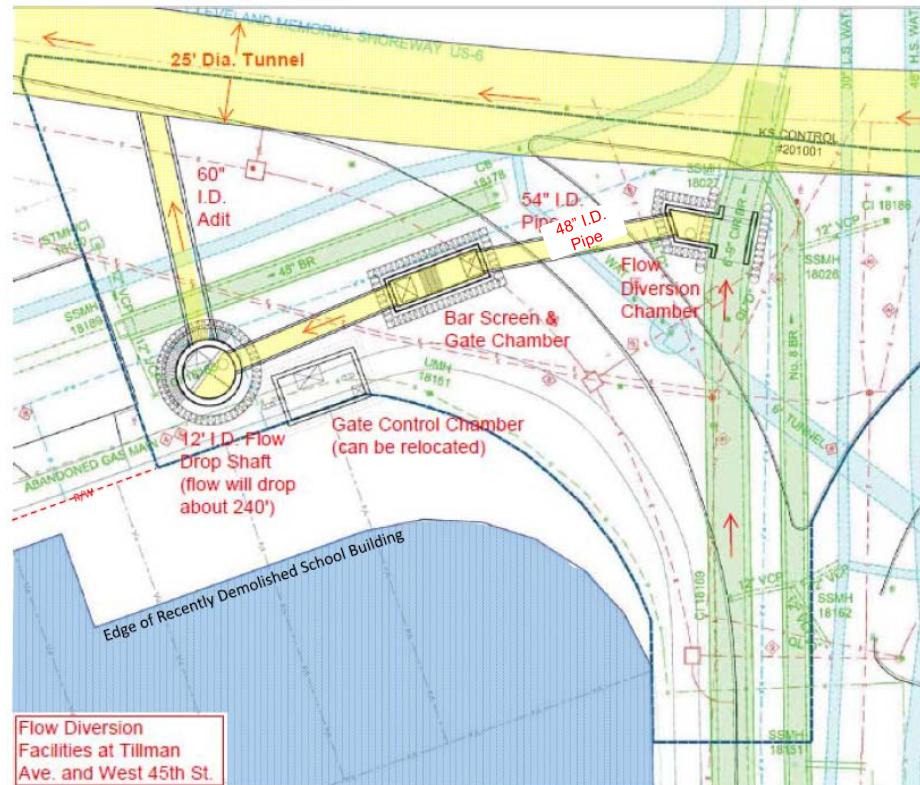


- Validation of an earlier proposal to remove the dedicated overflow conduit proposed in planning-stage design
- Elimination of 1,100 linear feet of 8'x20' box culvert



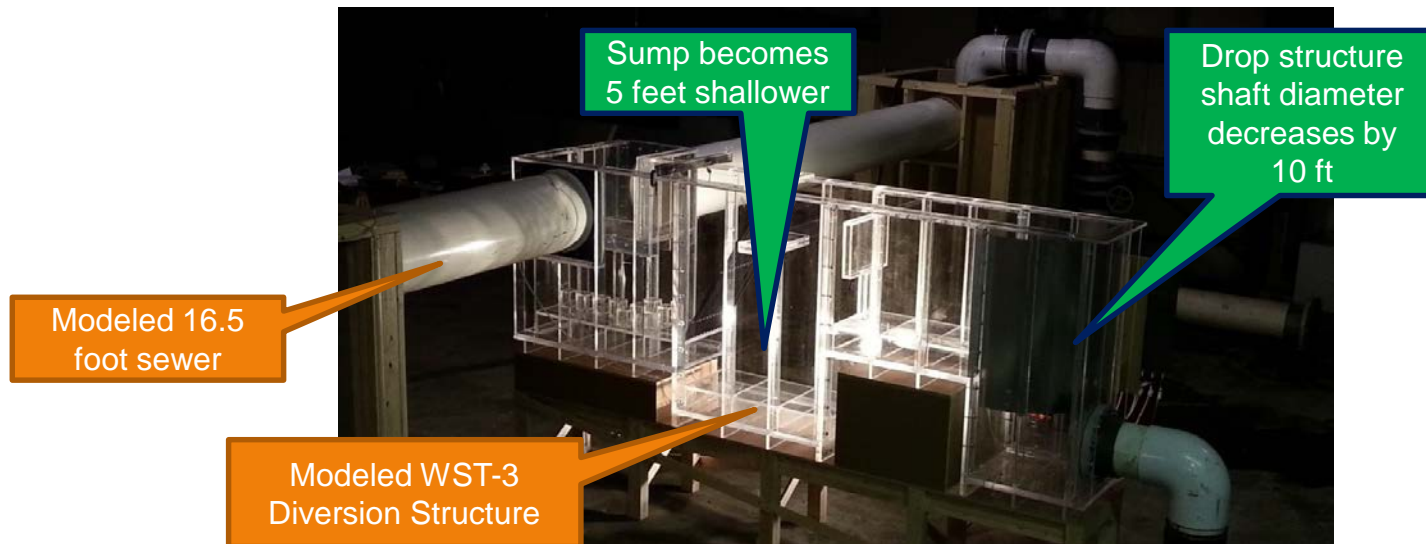
# Design Implications – WST-2

- WST-2:
  - **Baffle drop structure shaft diameter is reduced from 18' to 12'**
  - Depth of diversion structure's grit sump is reduced by 4 feet
  - Connecting sewer sizes reduced from 60" to 48"



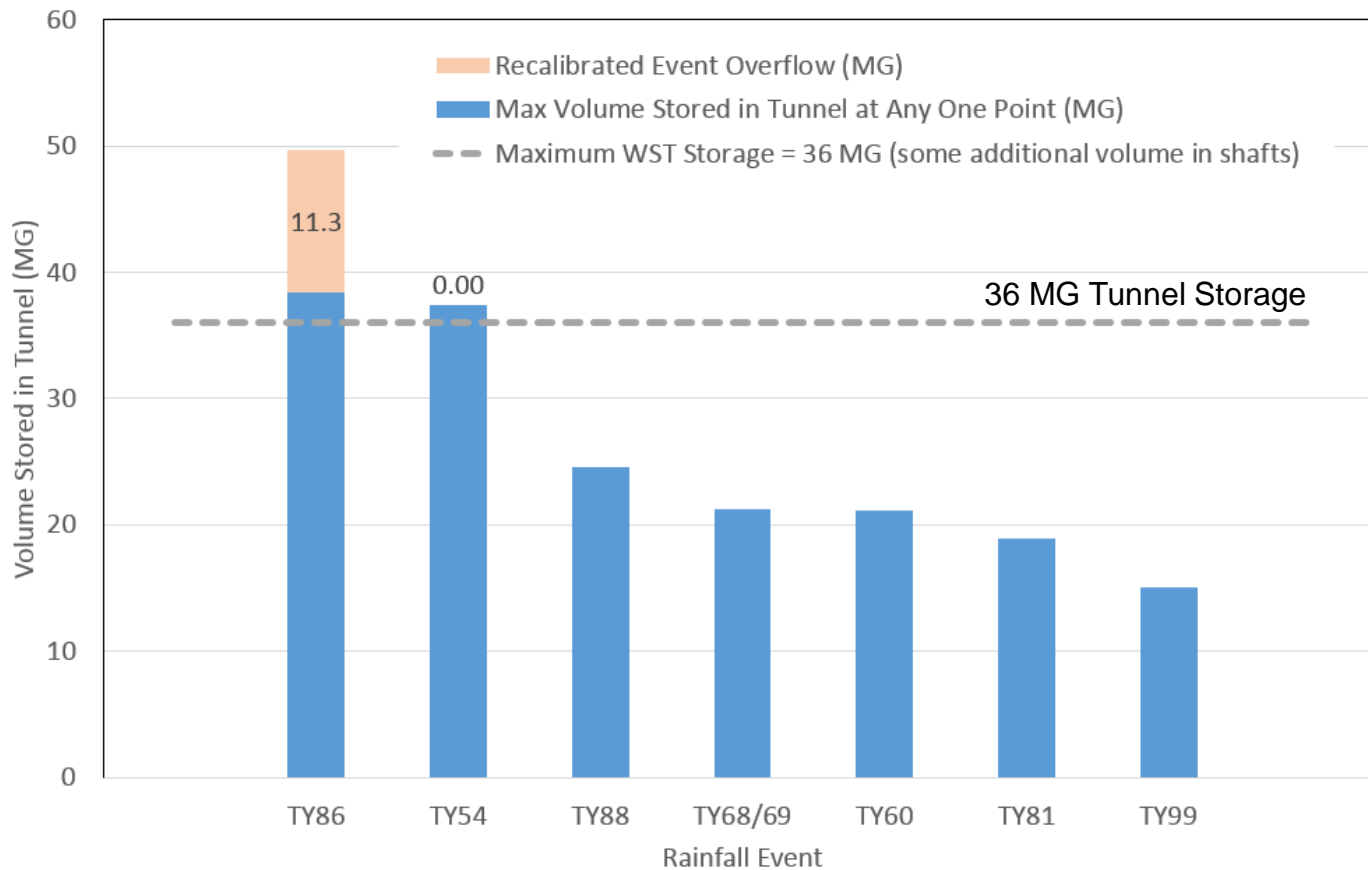
# Design Implications – WST-3

- WST-3:
  - ***Baffle drop structure shaft diameter is reduced from 50' to 40'***
  - Twin 7'x10' hydraulic gates become twin 7'x6' gates
  - Depth of diversion structure's grit sump is reduced by 5 feet



# Implications for Consent Decree Targets

- 0 overflows now predicted at WST-2 (3 allowed per CD)
- 1 overflows per year predicted at WST-3 (2 allowed per CD)

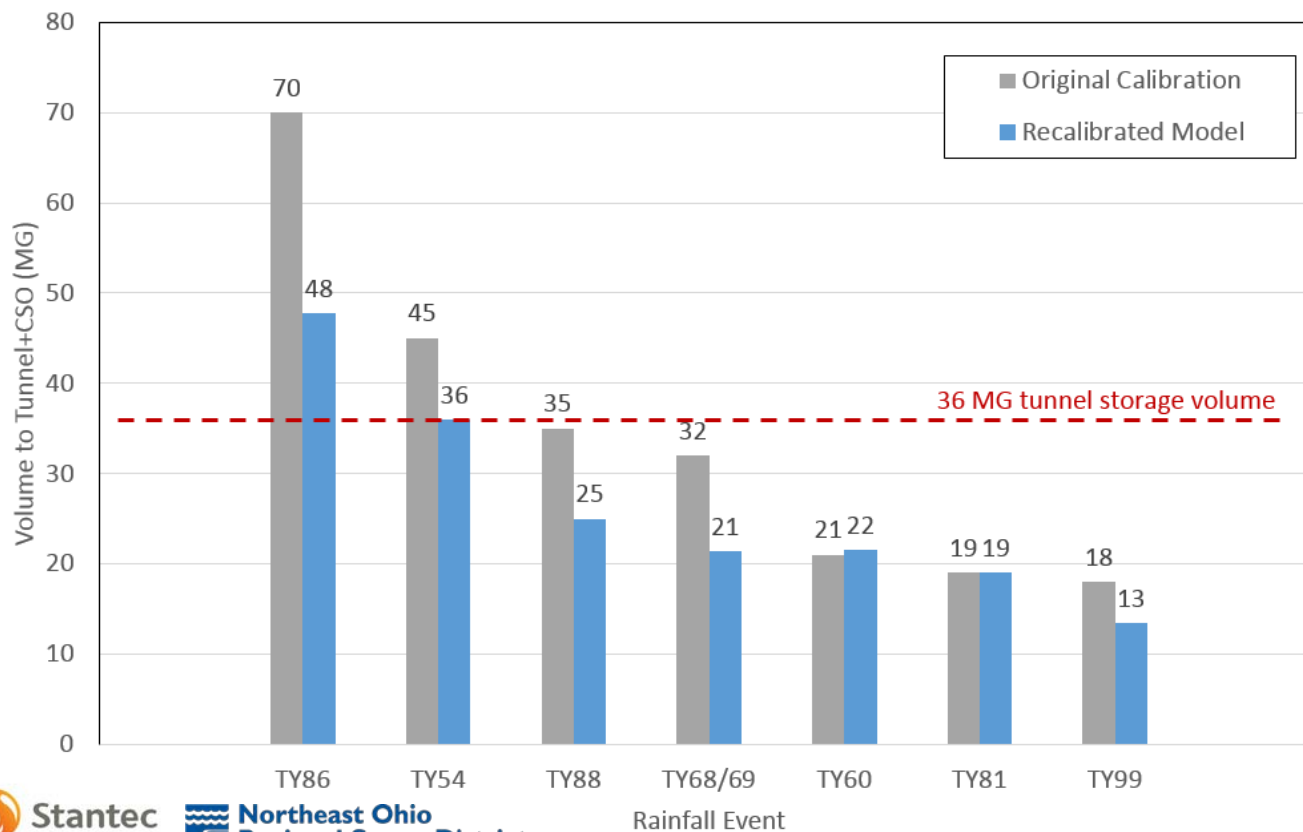


\*data per  
6/20/2017  
calibration

# Implications for Consent Decree Targets, continued

## Overflow volumes reduced relative to CD Targets

- 72 MG of CSO proposed in 2010 per original model
- 43 MG of CSO expected post-AFP (shown in grey)
- 11.3 MG CSO predicted per recalibrated model (shown in blue)



\*data per  
6/20/2017  
calibration

# QUESTIONS?



*"Industry and Nature in Harmony": Artist's depiction of Walworth Run near the confluence with the Cuyahoga River, 1874*