MISSION IMPOSSIBLE
HUNTING DOWN I/I IN PONTIAC

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AGENDA

- Background
- 2014 Metering/Modeling results
- How to start on Phase II CAP
  - Where to start?
- MFM Technology
- MFM field work
- MFM Results Discussion
- Recommendations
- Implementation
- Questions
Original Pontiac Sewage Disposal System (SDS) is 75+ yrs old, composed of clay sewer

Total system includes over 250 miles of sanitary sewer

Pontiac SDS historically had high I/I

Pontiac Water Resource Recovery Facility (WRRF) did not have capacity to fully treat peak flows, resulting in partial treatment bypass

City of Pontiac & MDEQ entered into a Consent Judgment in 2009 outlining specific actions to address partial treatment bypass (SSOs)
The City implemented Phase 1 Corrective Action Plan (CAP) from 2010 through 2012.

The Office of the Oakland County Water Resources Commissioner (OCWRC) took over ownership and operation of the Pontiac SDS in 2012.

OCWRC inherited the Consent Judgment, after Phase 1 CAP had been completed.

Continued partial treatment bypasses continued after Phase 1 CAP improvements were completed.

A metering and modeling study in 2012-13 indicated that several metering districts continue to have excessive I/I.
- Several metering districts still exceed 1500 gpcd
- MDEQ defines excessive inflow as >275 gpcd
- Phase II Corrective Action Plan is necessary
PHASE II CAP

- Consent Judgment (as amended) for Phase II CAP schedule:
  - Basis of Design for Phase II CAP – December 2020
  - Plans & Spec (with Part 41 construction permit) – June 2021
  - Commence construction in accordance with plans – July 2021
  - Complete construction in accordance with plans – March 2023
  - Work Plan for Project Performance Certification (PPC) – January 2023
  - Commence PPC Program – March 2023
  - Complete PPC Program – March 2024
Several metering districts have very high peak flows
Need to prioritize and find specific sources
F&V reviewed 2014 study and recommended use of Mass Flow Monitoring (MFM) technique to hunt down I/I
“Massive” measurements = **BIG DATA** (area-wide, every 5 minutes, 6-months)

- Originated as a technique to pinpoint locations receiving significant wet weather flow
- Develops a targeted approach for field investigation and sewer rehab
- Identifies areas with capacity issues and other problems (e.g. surcharging, backups, stagnant flow, infiltration)
MFM OBJECTIVES

Locate hydraulic issues, including:

- Sewer system capacity issues
- Undersized/undersloped pipes
- Downstream debris/clogs, pipe deformity, offsets
- Excessive I/I
- Surcharging
MFM OBJECTIVES

- What are we looking for?
<table>
<thead>
<tr>
<th>Time Period</th>
<th>Description</th>
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<tbody>
<tr>
<td>1950-80’s</td>
<td>“Storm Team” Measurements</td>
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<tr>
<td>1980’s-Current</td>
<td>Flow Metering</td>
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<tr>
<td></td>
<td>Costly / Large Area Overview / Difficult Install</td>
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<tr>
<td>1990’s-Current</td>
<td>Modeling + Metering (Est. of Capacity)</td>
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<tr>
<td></td>
<td>Expensive / Theoretical Model</td>
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- More data provides better clarity
- Millions of measurements
FLOW MONITORING

The Old Way
The Traditional Way

- Area-velocity Metering
- Hydraulic Modeling
THE MFM APPROACH
Many Depth / Temperature dataloggers vs. a few flow meters

$75/month rental vs. $600-$2,500/month per location

Flow meters used in key locations to check flow estimates based on depth and spot velocity measurements

Pontiac MFM Project (approx. 60-70% of the Service Area):

- 121 Leveloggers
- Data from 5 Lift Stations
- 11 Area-Velocity Flow Meters
THE MFM APPROACH

Finding the origin of capacity issues
- Depth measurements at many locations
- Measurements every 5 minutes
- Depth used to estimate flow
- Manning’s equation not usually applicable
- Location specific velocity-to-depth correlations using portable velocity meter
What does MFM Solve?

- Removes guess-work
- Prioritizes real Problem Areas
- Focuses your field investigation & Capital Improvement $$$
  - Gets you the most BANG for your Buck!!
- Studied Areas A, B, C, D, E and F.1/F.2
- 121 Leveloggers
- Flows from 5 LS
- 11 Flow Meters
- 1 Rain Gauge
- 9 County weather stations
- 2/28/17 – 9/15/17
MFM field work led to new insights into the system:

- Identified different flow routing patterns than historically believed
- Changed a few metering district boundaries from the 2014 Metering Study
- Revised the gpcd calculation based on more accurate customer count contributing to metered flow for historic data and data collected for this project
- 6 month study period
- 30 rain events
- A lot of data!
## MFM RESULTS

<table>
<thead>
<tr>
<th>Monitor</th>
<th>Area</th>
<th>Q / V</th>
<th>Peak Q (mgd)</th>
<th>Q Peak Factor</th>
<th>VPF (24-hour)</th>
<th>Wet Weather Flow (WWF)</th>
<th>Rainfall Dependent Inflow and Infiltration (RDII)</th>
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Prioritized areas for focused field investigation prior to Phase II CAP design work

Prioritized areas encompass a neighborhood or two
Broken bulkhead from an abandoned sewer near the Clinton River sewer crossing

Source of constant I/I
SPECIFIC RESULTS

I/I from lateral serving property where house was removed

Storm debris found in sanitary MH
Removing I/I in priority areas is more cost effective in high priority areas than storage & treatment.

### Table 0-1. I/I Problem Areas with Best Price Performance Potential.

<table>
<thead>
<tr>
<th>Service Area</th>
<th>Annual Total I/I</th>
<th>Design Storm I/I</th>
<th>Targeted I/I Mitigation</th>
<th>I/I Storage and Treatment</th>
<th>Total Storage &amp; Treatment Cost</th>
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<tbody>
<tr>
<td></td>
<td>Total Volume (mg)</td>
<td>Volume To Be Removed (mg)</td>
<td>Total Volume (mg)</td>
<td>Volume To Be Removed (mg)</td>
<td>Mitigation Cost ($/gal)</td>
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<td><strong>TOTAL</strong></td>
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<td><strong>18.02</strong></td>
<td><strong>85.5</strong></td>
<td><strong>7.40</strong></td>
<td><strong>$2,430,000</strong></td>
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Prioritized field investigation:
- Manhole inspection
- Smoke testing
- Sewer televising

Remove inflow sources:
- Locate and remove down spouts, sump pumps, storm cross connections
- Repair broken cleanouts, cap laterals serving vacated parcels
- Rehab/replace MHs with severe defects (missing bricks, mortar, etc)
NEXT STEPS
NEXT STEPS

- Prioritized field investigation (2019-2020)
- Design Phase II CAP based on field investigation (2020-2021)
- Construction and implement of Phase II CAP (2021-2023)
- Phase II CAP Project Performance Certification (2023-2024)
QUESTIONS?