Flow Monitoring of Blueprint Columbus Sump Pump Pilot Program

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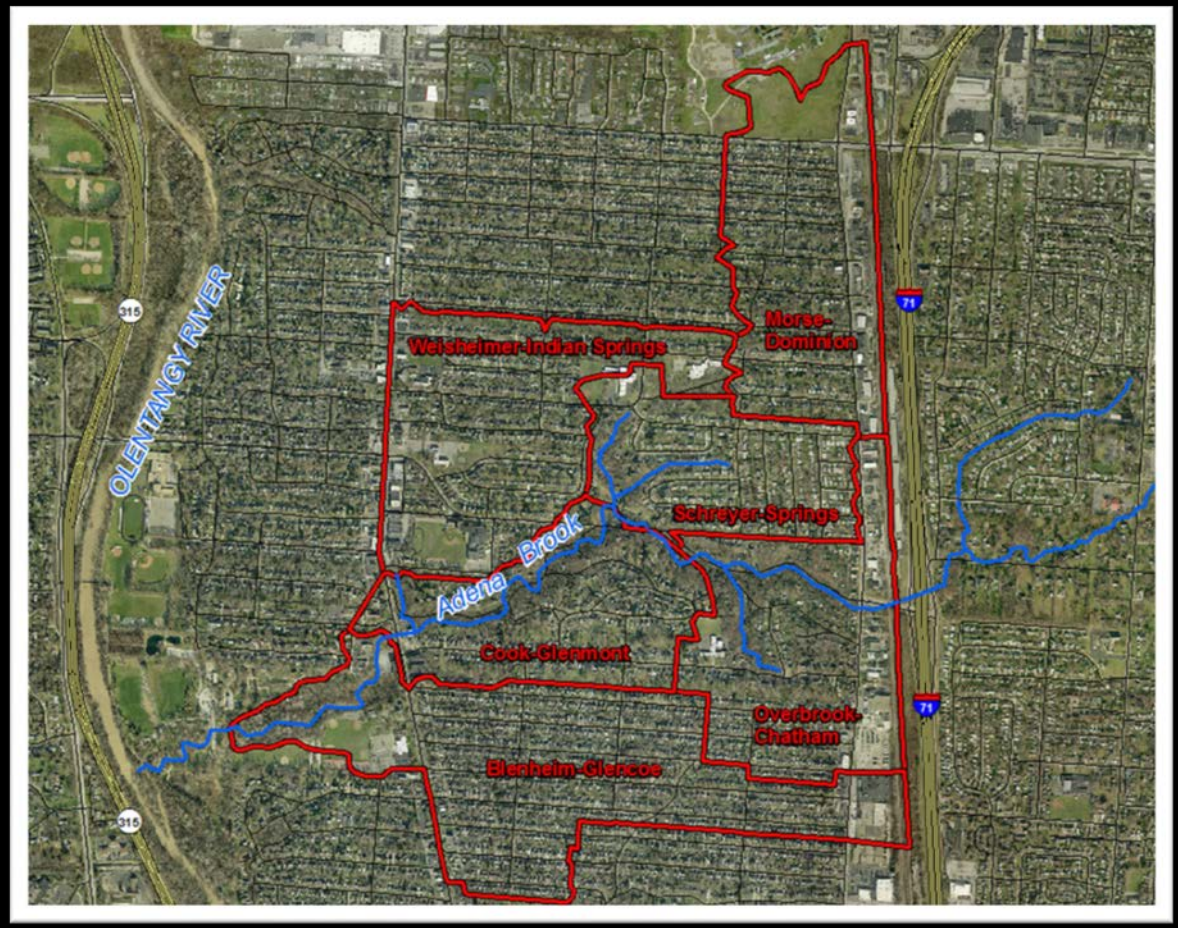
Outline

- Background
- Objectives
- Flow Monitoring Equipment
- Preliminary Results
- Lessons Learned

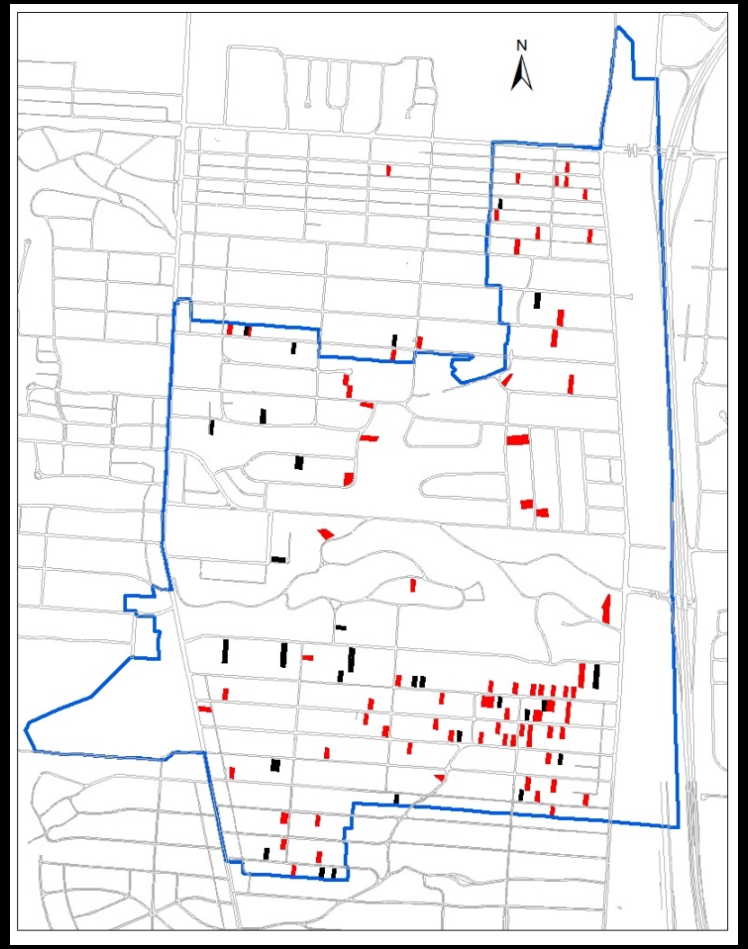
Sump Pump Program

- One of the four pillars of Blueprint Columbus Program
- Voluntary
- Goal is to reduce private source I/I
- Plan to install sump pumps in 25% of homes within Blueprint area
- No direct cost to home owners
- Prior to full scale implementation, a pilot sump pump project was performed



Sump Pump Pilot

- Public outreach team solicited volunteers
- Installation started in Oct. 2016
- ~110 sump pumps installed
- Average cost of $6,000 per sump pump including discharge piping
- 29 sump pumps are monitored
- Plan monitoring for minimum 12 months per site



Objectives of Flow Monitoring

- Quantify sump pump effectiveness
- Quantify Inflow/Infiltration reduction of sump pump installation
- How to improve sump pump effectiveness – regular sump pit vs. deeper pit
- How many sump pump do we need to install?

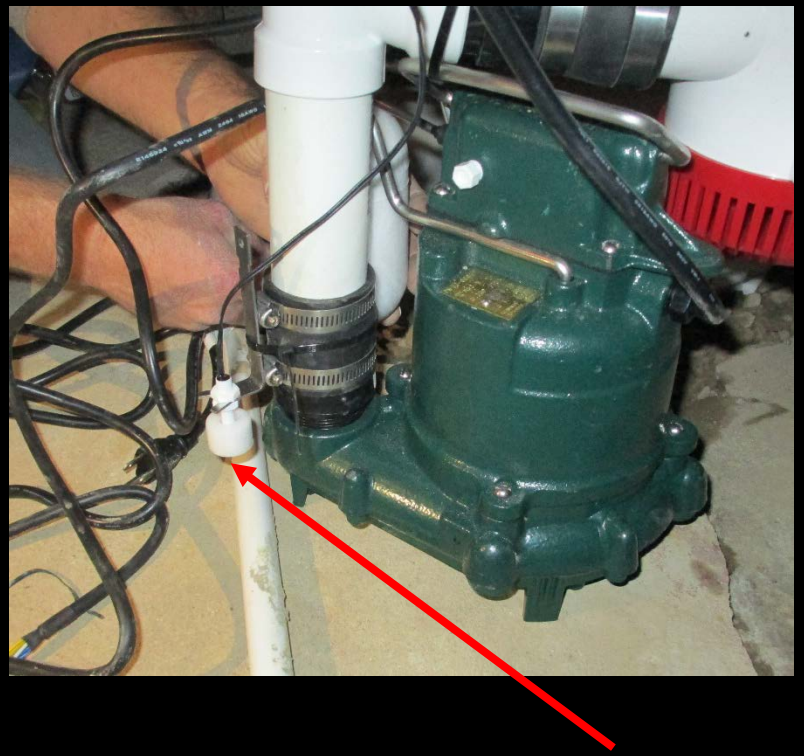
Regular Pit (22’’) vs. Deeper Pit (30’’)

- Started with only 22’’ pit
- Early 2017, 30’’ pits began to be installed
- If foundation drains tie into floor drain – 22’’ pit
- If no foundation drains tie into floor drain
  - Excavate outside near 4’’ by 6’’ transition to locate external foundation drains
  - If no external foundation drain, install 30’’ pit inside
  - If external foundation drain exists, pipe it to a 30’’ pit inside

Monitoring Equipment

- Water meter (totalizer) installed on discharge pipe
- $200 / meter
- No time stamp
- No remote access ability
- Data retrieval by physical access, phone, and text from residents

Monitoring Equipment



- Sump pit float switch
- $20 /switch
- Positioned in between pump on/off water level
- Each switch closure sends a electric pause to data logger recording one pump cycle

Monitoring Equipment and Technology

- Retired ADS Flowshark data logger
- No additional cost
- Wireless communication enabled

Progression of a sump pump install.

Ohio Basement Authority (OBA) digs the pit.

OBA installs the well. We are using pits of 22” and 30” depth.

OBA prepares submersible pump for install into pit. Note float switch position.

Submersible pump lowered into pit.

Complete install, showing discharge piping, inline ZPM water meter, backup battery, and float switch data logger.

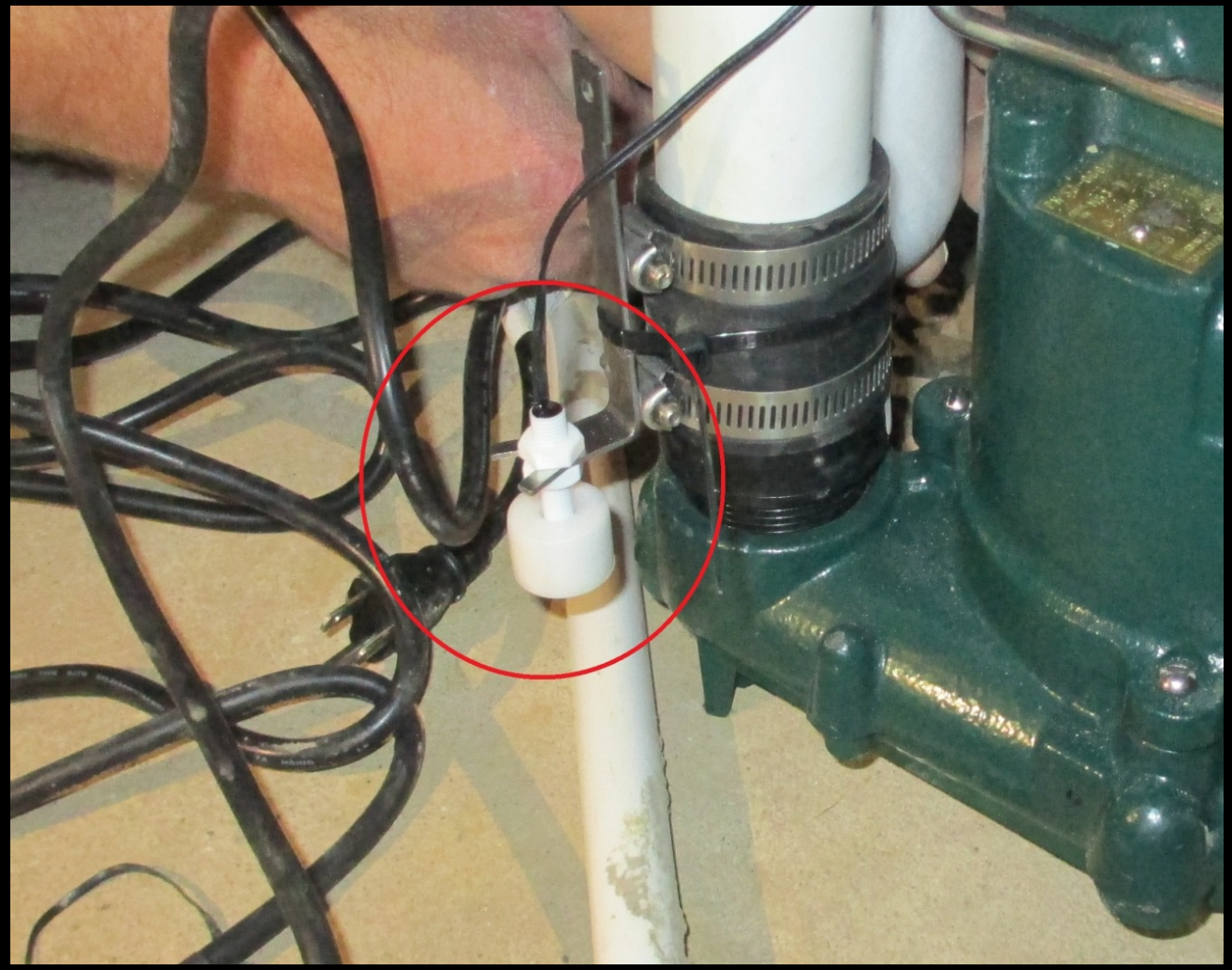
Discharge pipe to be laid from home to curb.

Float switch, made by Wayne Pumps.

Switch opens as float rises with water level.

When pump kicks on, float falls causing switch closure.

Data logger reads and time stamps the switch closure.



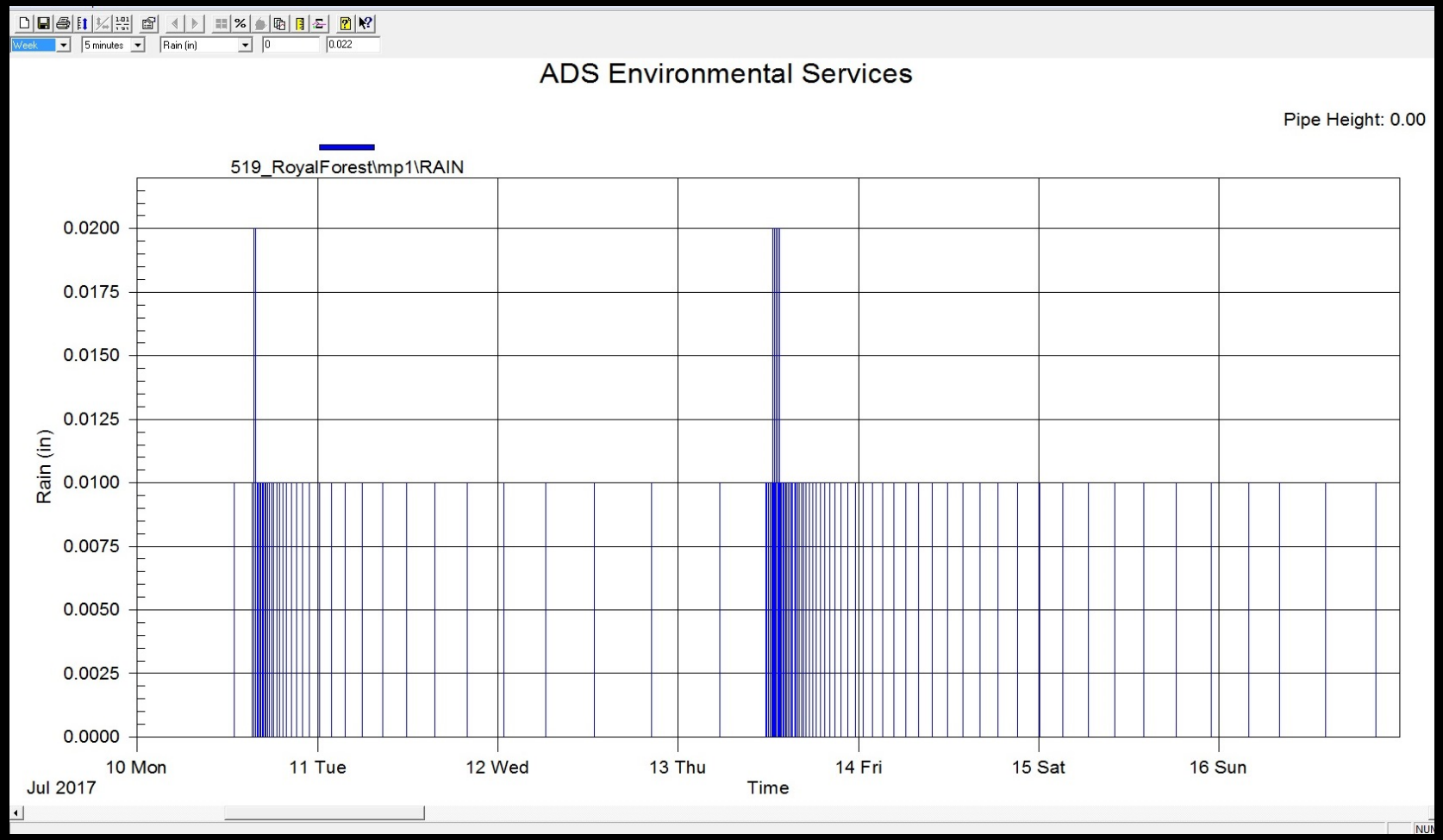
The data logger is a retired ADS Flowshark meter using the rain gauge port to count the float switch closures.

Meters are programmed in five minute interval.

Sample Float Switch Data

The big storms on 7/10 and 7/13 greatly impacted the pump cycling at this location.

The data logger is programmed as a rain gauge, it displays the switch closures as tipping bucket tips.



The float switch data alone was not giving us enough information on what was going on in the pits.

We began installing retired ADS depth/pressure sensors into the pits as well.

Sensors are attached to 1” pvc pipe and mounted at the bottom of the pit.

Sample data from a location with both the float switch and pressure sensor installed.

Working well.

Sump Pump Flow Monitoring Periods

Preliminary Results – Water Meter

- Pump discharge volume was normalized by total rainfall between the installation and date of reading

Sump Pump Discharge Volume per Inch of Rainfall

Float Switch with Data Logger

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- Each pump cycle discharges 3-5 gal of water
- < 10 secs to drain the sump
- Filling time varies greatly by site and by storm

Float Switch Challenges

- Not correlated with water meter readings
- Switch could be stuck in one position

Solution - Depth Sensor

- Depth sensors were installed in 8 sites started June, 2017
- Discharge volume can be calculated accurately
- More detail information on how sump is filled and emptied

Sump Pump Peak I/I reduction
- July 13, 2017 Event

- 1.94 ‘’ over 1.5 hours
- Between 10-year to 25-year storm
- Flow meter Clintonville_0342
  - Peak flow 1.1 MGD
  - 157 parcels
  - 31 sump pumps installed
  - 4 sump pumps monitored

Sump Pump Discharge Peak Occurred at the same time

What is the sump pump peak discharge?

- Average 1.9 gpm

Most effective site : 6 gpm

How Much Peak I/I Can Sump Pump Reduce?

Total sump pump discharge =

peak discharge rate * Number of pumps

1.9 gpm * 31 = 60.1 gpm

Sump pump peak I/I reduction = Total sump pump discharge/(monitored peak I/I +Total sump pump discharge)

60.1 gpm/(1.03 mgd +60.1 gpm) = 7.8%

How Many Sump Pumps Do We Need?

- With average 1.9 gpm and 25% Sump Pump, I/I peak reduction is

9.7%

- 365 sump pumps per 1 MGD I/I reduction

Conclusions

- Sump pump results are promising
- More storms will be analyzed to confirm the effectiveness
- Deeper sump pits are more effective
- We could develop a specific target number of sump pumps needed for each Blueprint Area
- Lessons Learned
  - Water meter without time stamp can be misleading
  - Remote access if possible
  - Depth sensor is most reliable

Questions?

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