



# City of Park Ridge



June 12, 2017

## Stormwater Master Plan Level of Protection Determination



## Purpose of Tonight's Presentation

- Update Flood Survey Results
- Discuss Current Level of Protection
- Concept Project Areas for Proposed Level of Protection
- Direction for SMP Level of Protection



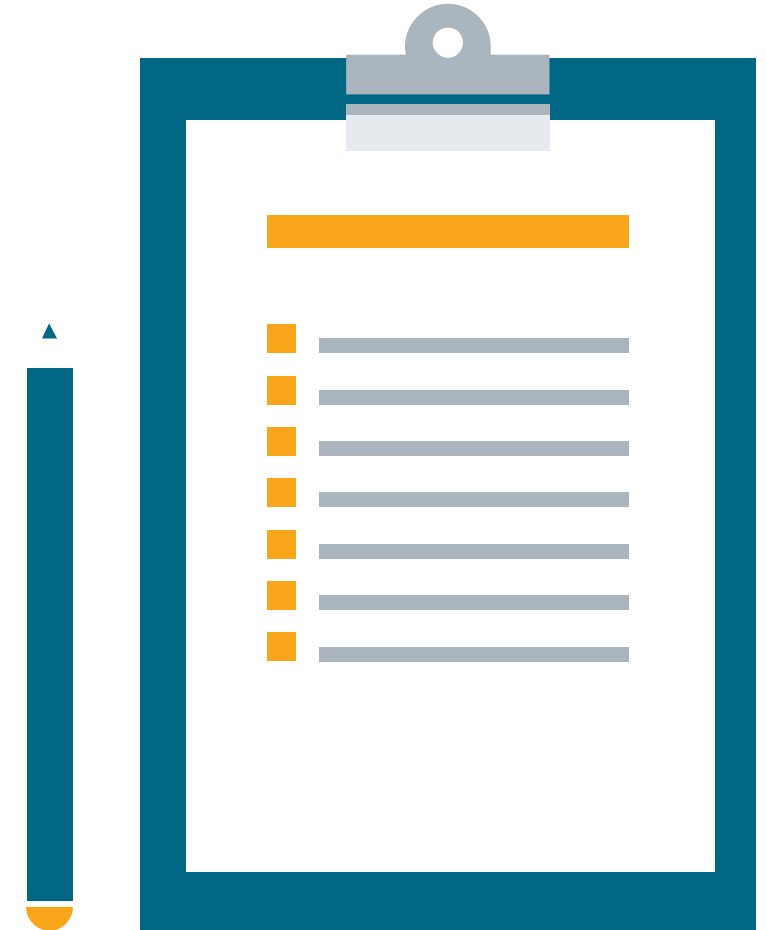
# Flood Survey Update

**465** surveys received

**210** reported sewer backup  
*(96 were reports of backup before Flood Control was installed)*

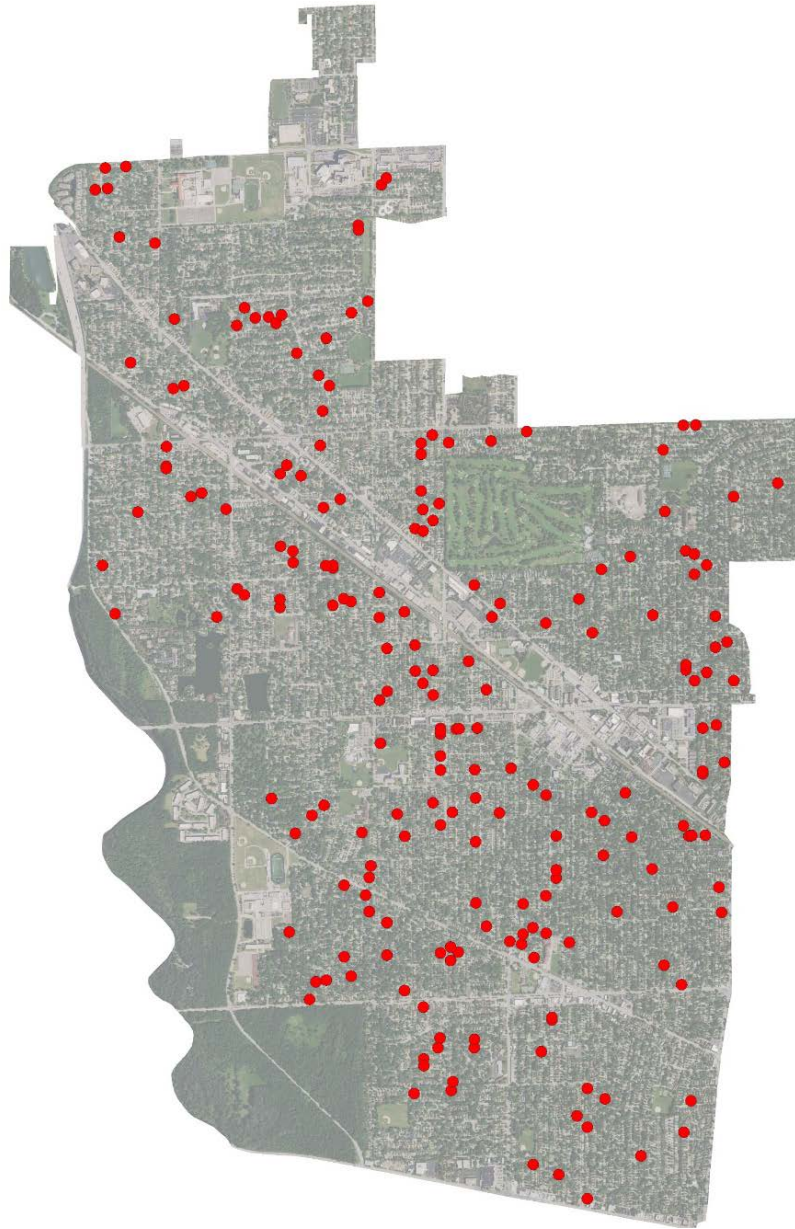
**200** reported overland flooding

**257** reported having a Flood Control system



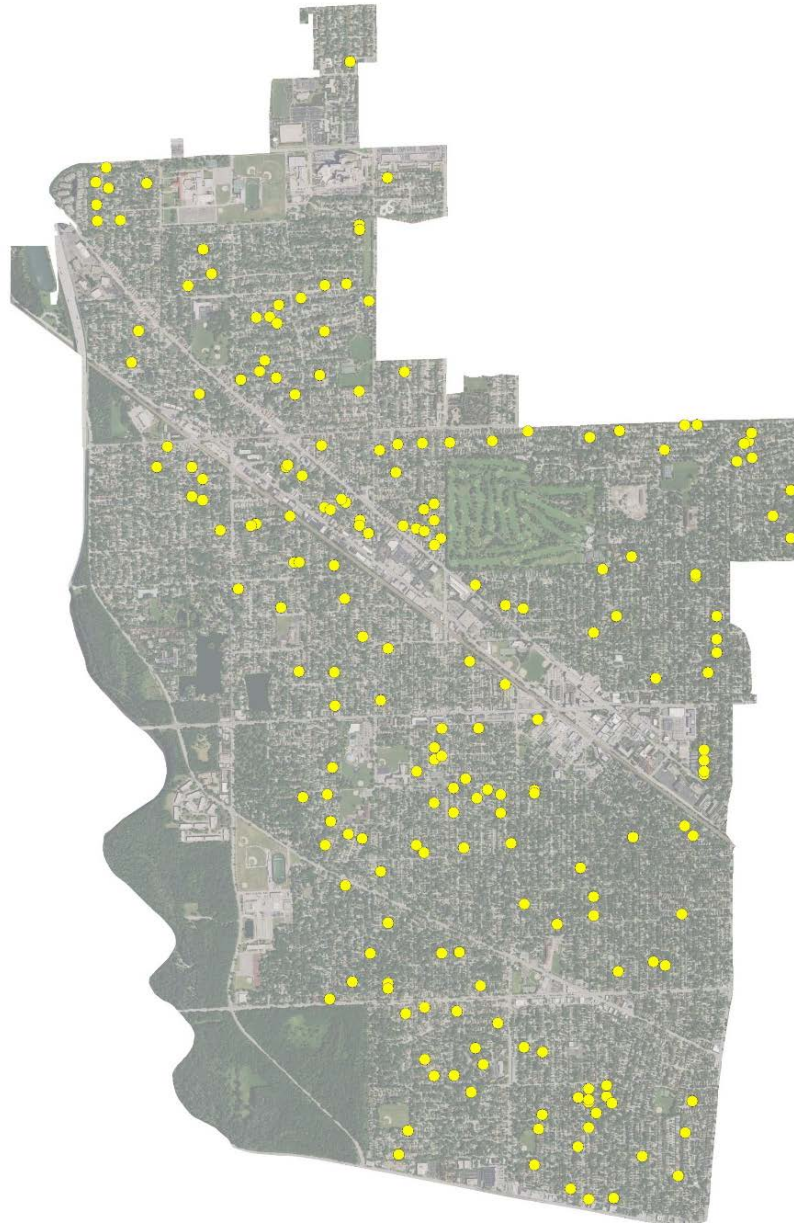
# Flood Survey Update

- Sewer Backup Mapping (210)



# Flood Survey Update

- Reported Overland Flooding (200)



## Level of Protection (LOP)

To develop the Stormwater Master Plan, we need direction on what the desired Level of Protection (LOP) from flooding will be.

*(Higher LOP = Higher Cost \$\$)*



## Level of Protection (LOP)

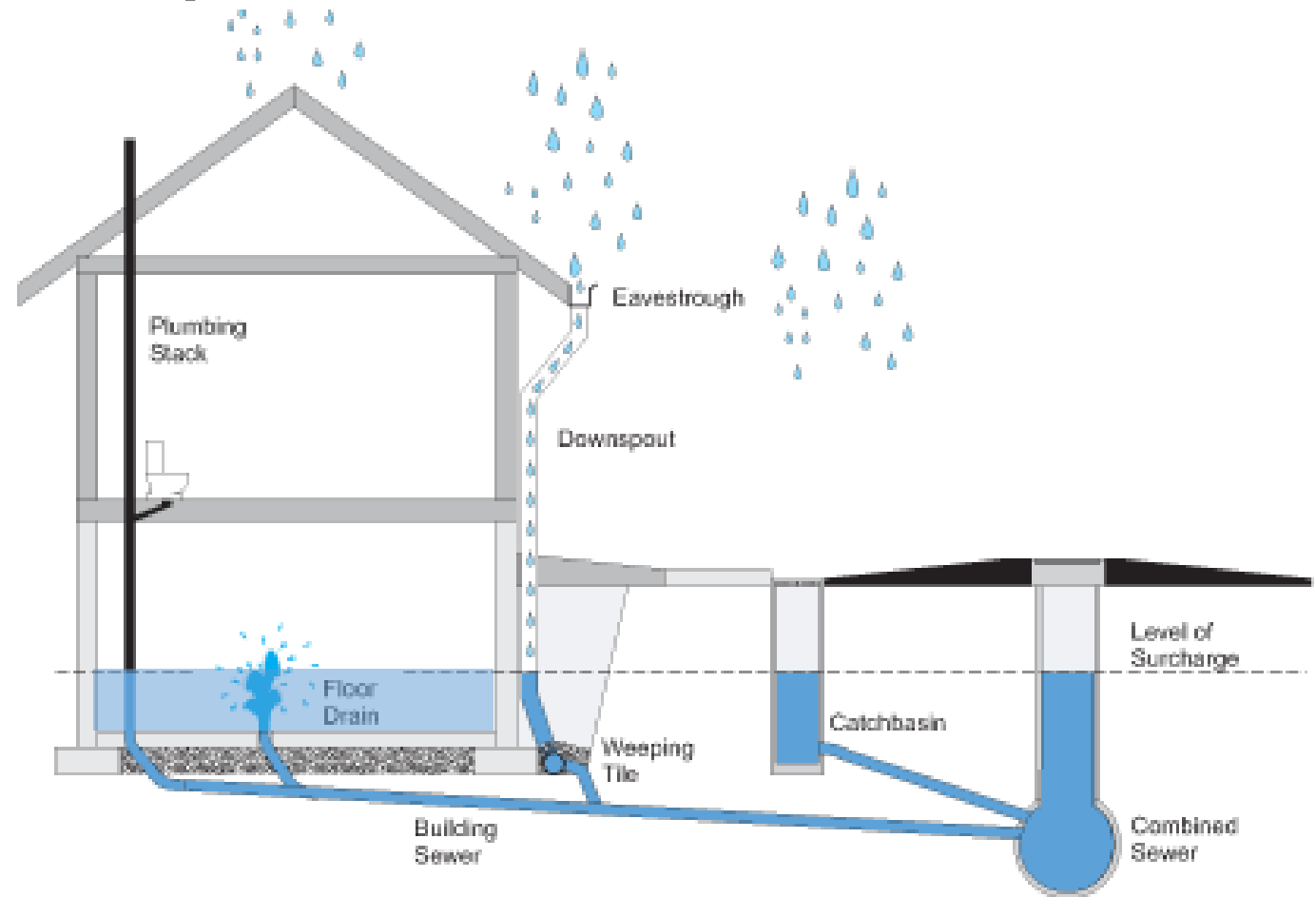
Need to consider LOP for 2 types of flooding –

# Sewer Backup and Overland Flooding



# Level of Protection – Backup vs Overland

**Sewer Backup** can occur when the water level of the combined sewer in the street exceeds the basement elevation of an adjacent home with a gravity flow sewer connection:



# Level of Protection – Backup vs Overland

**Overland Flooding** occurs when the sewer capacity is exceeded and surface runoff enters a structure through an opening such as door, window well, etc:



# Level of Protection – Backup vs Overland

- City's SMP request describes a comprehensive, citywide level of protection
  - **In our opinion, a separate criteria is needed for sewer backup vs overland flooding**
    - Sewer backup protection is unlikely to be higher than 10-year level (without Flood Control)
    - Desired overland flood protection is likely higher
    - The design of any sewer backup protection projects will impact the sizing of any overland flooding projects
- Therefore, tonight's presentation is focusing on determining the level of protection ***for sewer backup only***



# Level of Protection Determination

- We can estimate the % of the City that is at risk of Sewer Backup for various storm events using the Citywide Sewer Model
  - The sewer model has been enhanced for this study in several ways, including:
    - Impervious area database from Stormwater Utility Study used to improve model detail
    - Flood questionnaires and pictures used to “calibrate” model



# Level of Protection Determination

- Major storm events since the Citywide Sewer Study was completed give us the opportunity to refine (calibrate) the sewer model built previously

Storm Event	Rainfall Depth & Duration	Approximate Recurrence Interval
April 2013	5.4" in 24 hours	25-year
June 2013	3.3" in 3 hours	25-year

- Model was run for these two events and the results were compared to flooding descriptions and photos from flood questionnaires



# Model Calibration

***3D Model of Northwest Park area generated from aerial drone footage:***



# Model Calibration



Photo from 4/18/13 Flood Event



Model Simulation of 4/18/13 Flood Event

# Model Calibration

***3D Model of Greenwood/NW Hwy area generated from aerial drone footage:***



# Model Calibration



Photo from 4/18/13 Flood Event



Model Simulation of 4/18/13 Flood Event

# Current Level of Protection

After calibration,  
“**design storms**” were  
run to establish current  
level of protection

Design Storms	
<b><u>Storm Event</u></b>	<b><u>Rainfall Depth/Duration</u></b>
1-year	1.2” in 1-hour
2-year	1.4” in 1-hour
5-year	1.8” in 1-hour
10-year	2.1” in 1-hour

## Assumptions:

- Basement floor elevation = 6’ below lowest ground on a property
- Sewer water level exceeding basement floor = “at-risk” of flooding  
(i.e. ***assume no flood control systems***)



# Estimate of INSTALLED Flood Control Systems

*(Estimate focused on 11,600 Single Family homes only)*

*(records kept since 2002)*

## Data Sources for Estimate:

1. Homes built new since overhead sewers required – Est. **1,300** homes  
(based on Census Bureau statistics)
2. Permits issued for Flood Control – Est. **1,600** homes  
(records kept since 2002)
3. Flood Control Systems installed before 2002 – Est. **270** homes
  - Based on avg. of 10 per year installed from 1975 to 2002
4. Flood Control Systems installed without permit – Est. **320** homes
  - Assume 1:5 ratio of non-permit to permit installation

***Total = 3,500 homes or 31% of Single Family homes in City  
estimated to have a Flood Control System***



# Estimate of FUTURE Flood Control Installations

*(Estimate focused on Single Family homes only)*

1. Average Teardown Rate = +/- 40 per year
  2. Flood Control Permit Rate (since 2008) = +/- 150 per year
  3. Assumed Non-Permit Flood Control Installation = +/- 30 per year
- Total = 220 per year***

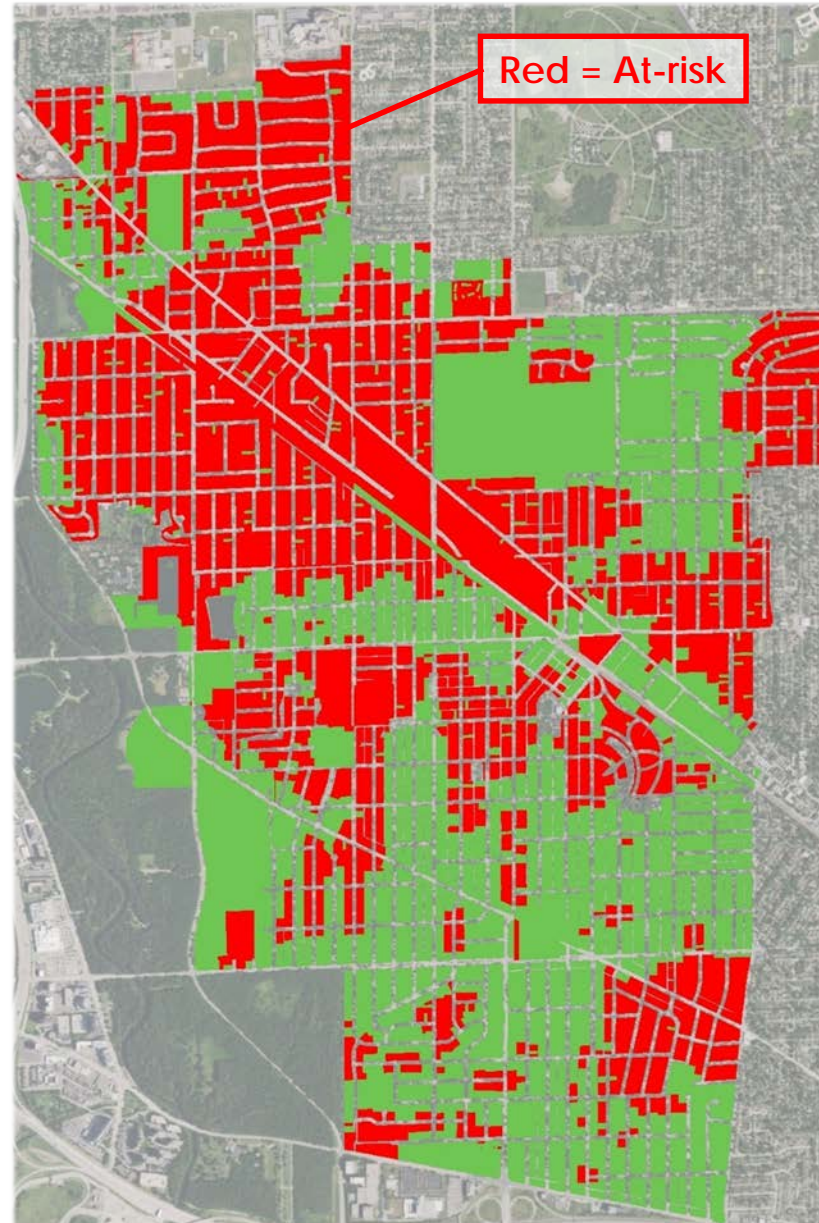
***Based on assumption of 220 installations per year, the estimated 8,100 single family homes currently without flood control would have systems installed within 37 years.***



# Current Level of Protection

1-Year Storm (1.2" in 1-hour):

- 52% of properties at risk of sewer backup



*(Note: Map does not account for individual property flood control systems)*

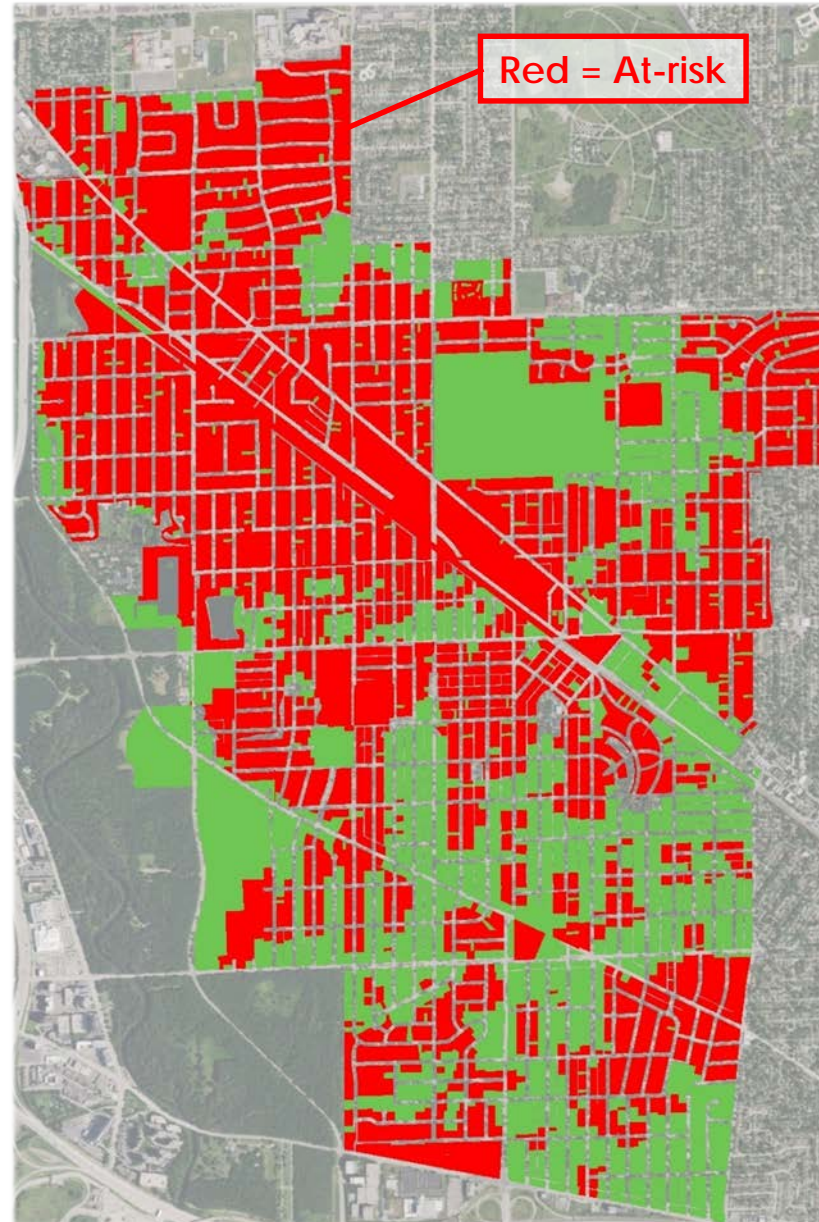
Stormwater Master Plan



# Current Level of Protection

2-Year Storm (1.4" in 1-hour):

- 65% of properties at risk of sewer backup



*(Note: Map does not account for individual property flood control systems)*

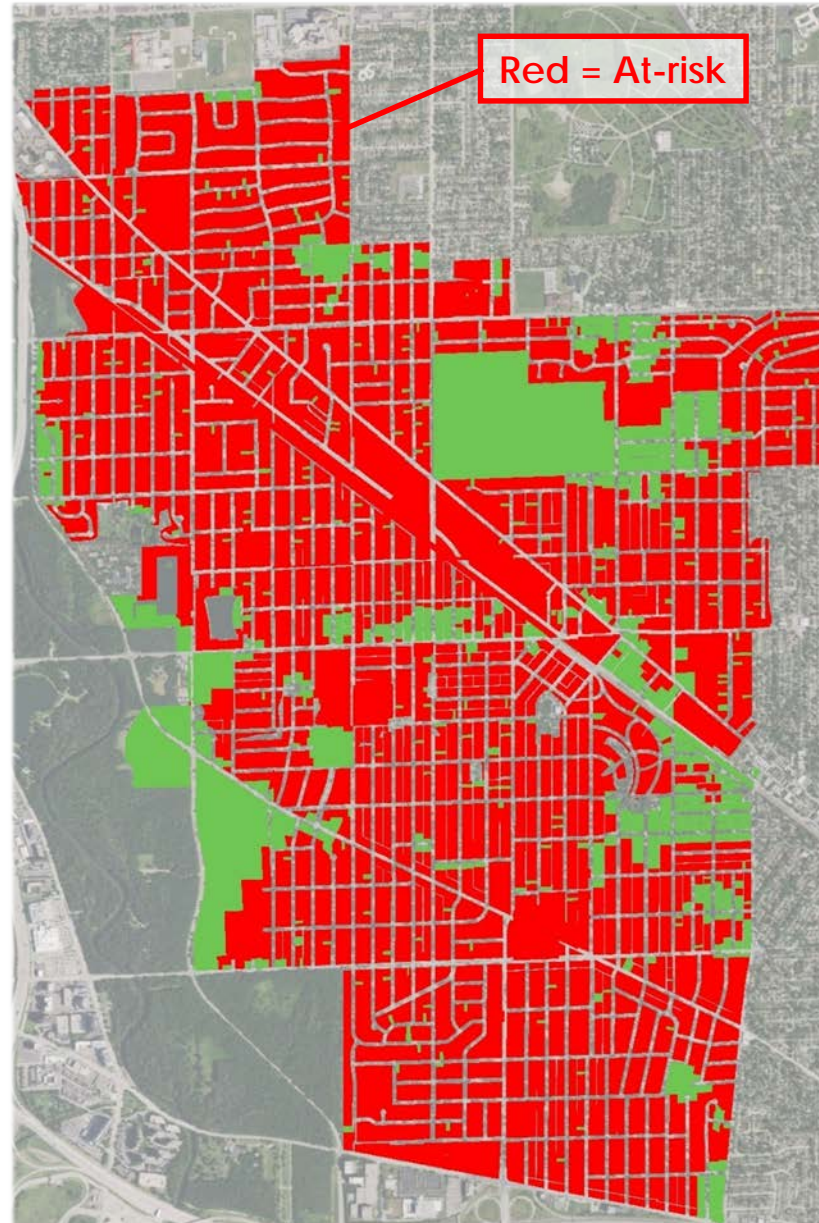
Stormwater Master Plan



# Current Level of Protection

5-Year Storm (1.8" in 1-hour):

- 88% of properties at risk of sewer backup



*(Note: Map does not account for individual property flood control systems)*

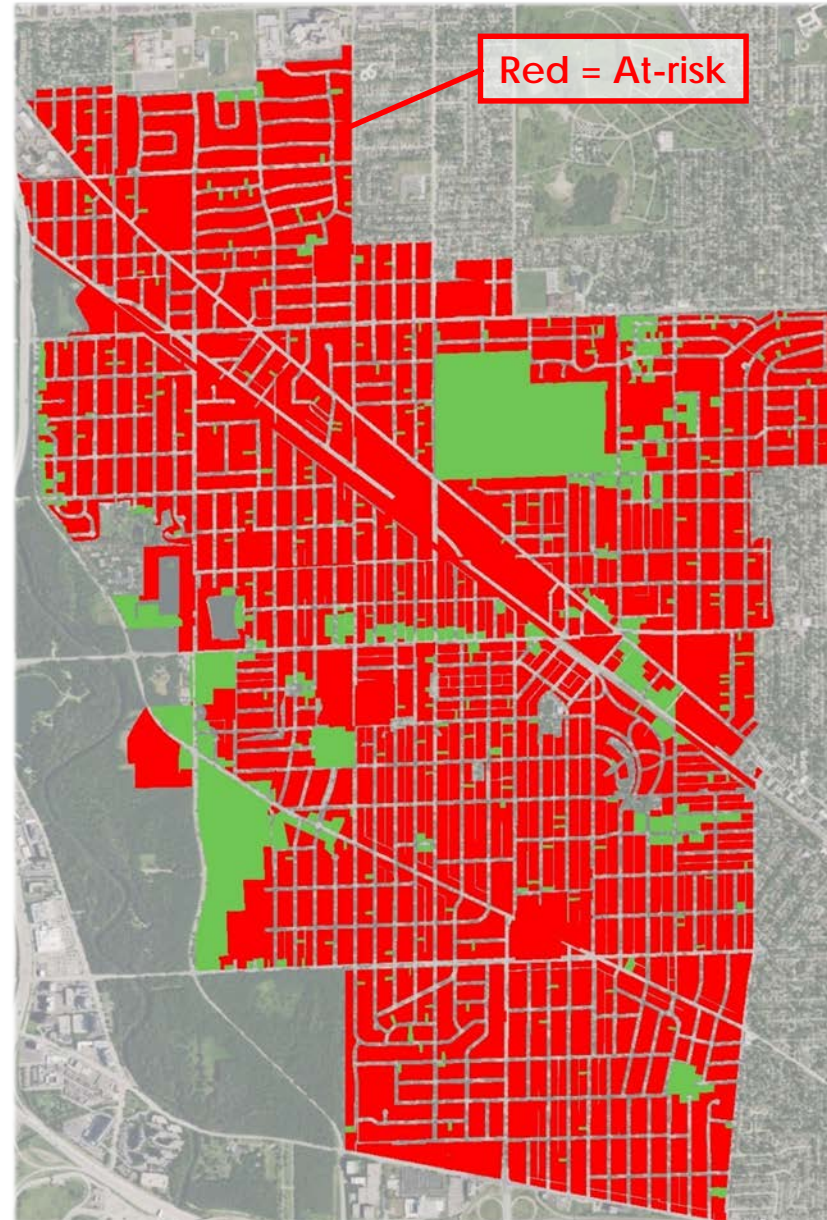
Stormwater Master Plan



# Current Level of Protection

10-Year Storm (2.1" in 1-hour):

- 93% of properties at risk of sewer backup



*(Note: Map does not account for individual property flood control systems)*

Stormwater Master Plan



# Level of Protection (LOP) Determination

## **Strategy:**

- Use “Concept Project Areas” to estimate the LOP costs for several areas of City
- Establish average LOP costs and extrapolate to entire City



# Level of Protection Determination

- Improvements to LOP can be through many types of projects:
  - Relief Sewers
  - Storage Basins/vaults
  - Sewer Separation
  - Green Infrastructure
- Concept Project Areas used traditional relief sewers and storage vaults
  - Can be applied universally
  - Feasible
  - Works within existing sewer systems
  - Used as a template to estimate citywide costs



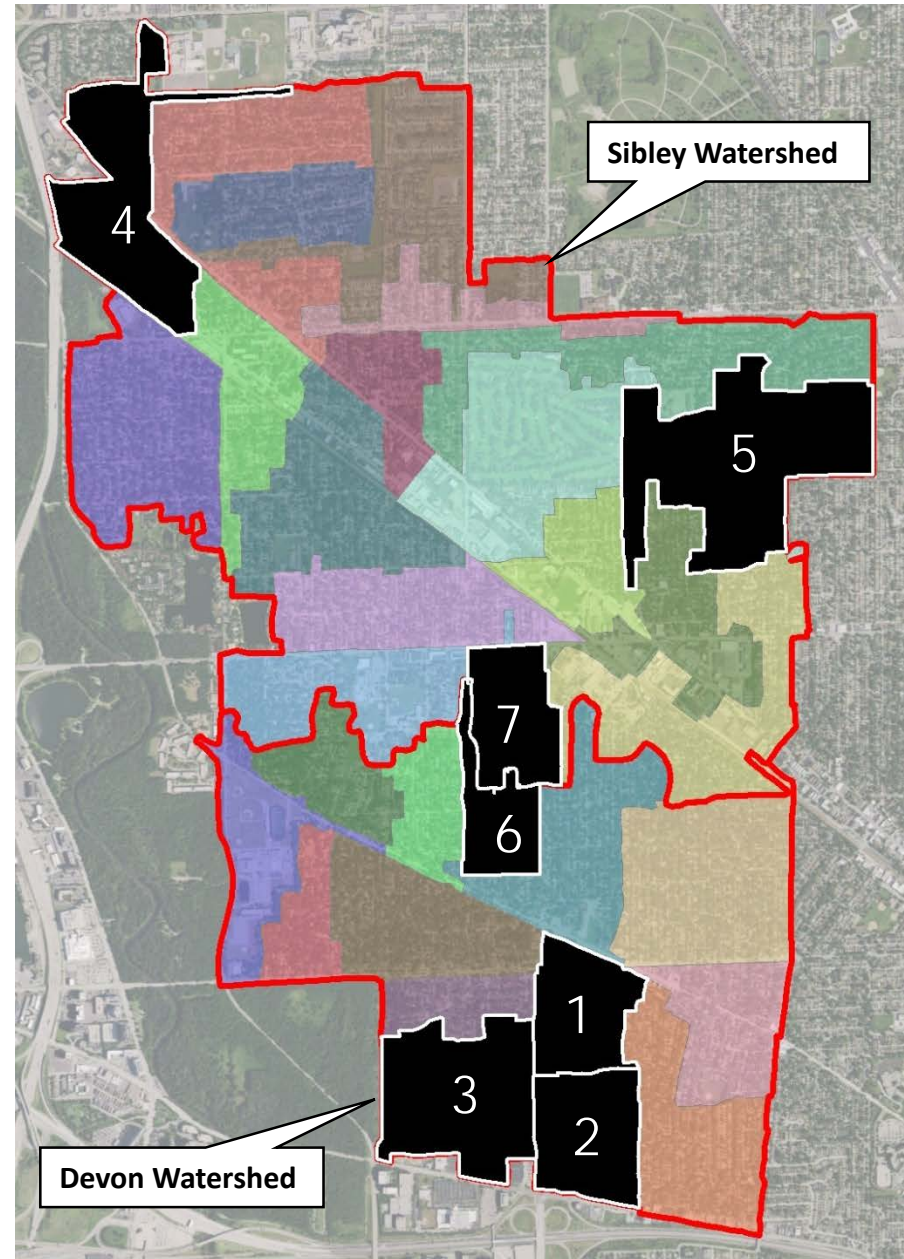
# Level of Protection Determination

- Final SMP will evaluate **all** types of improvement projects
  - The Concept Project Areas are NOT proposed projects
  - Other project types or larger projects affecting greater areas may be found to be more cost effective
  - The Concept Project Areas are only used as a cost estimating template

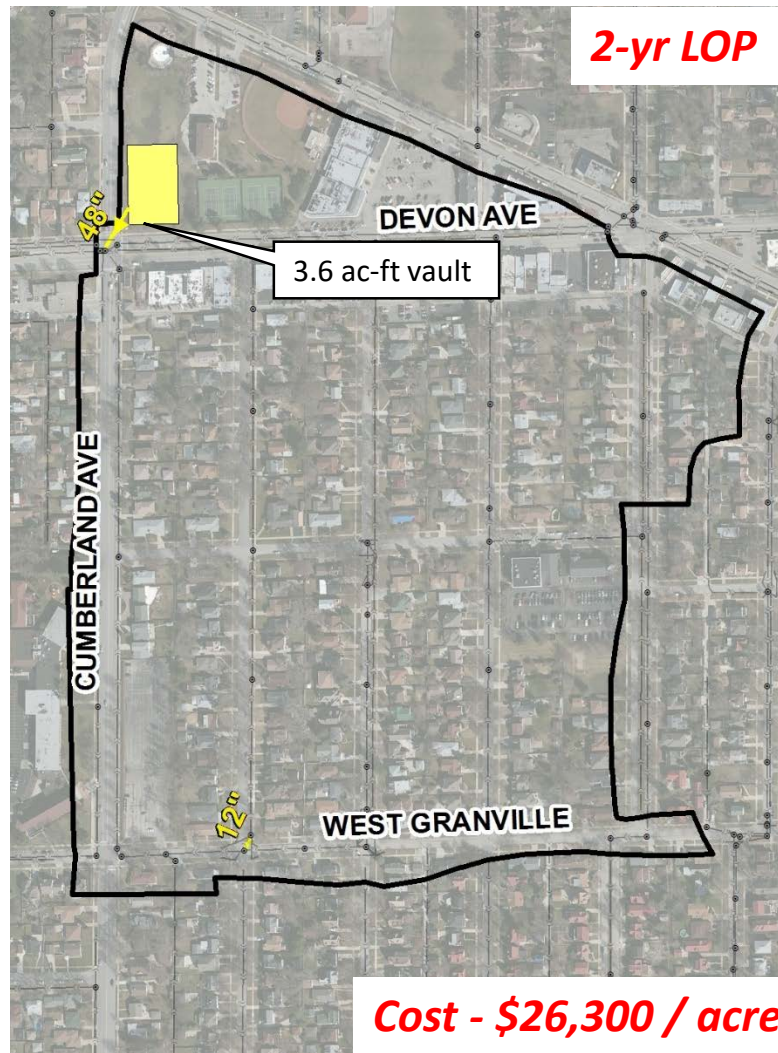


# Concept Project Areas

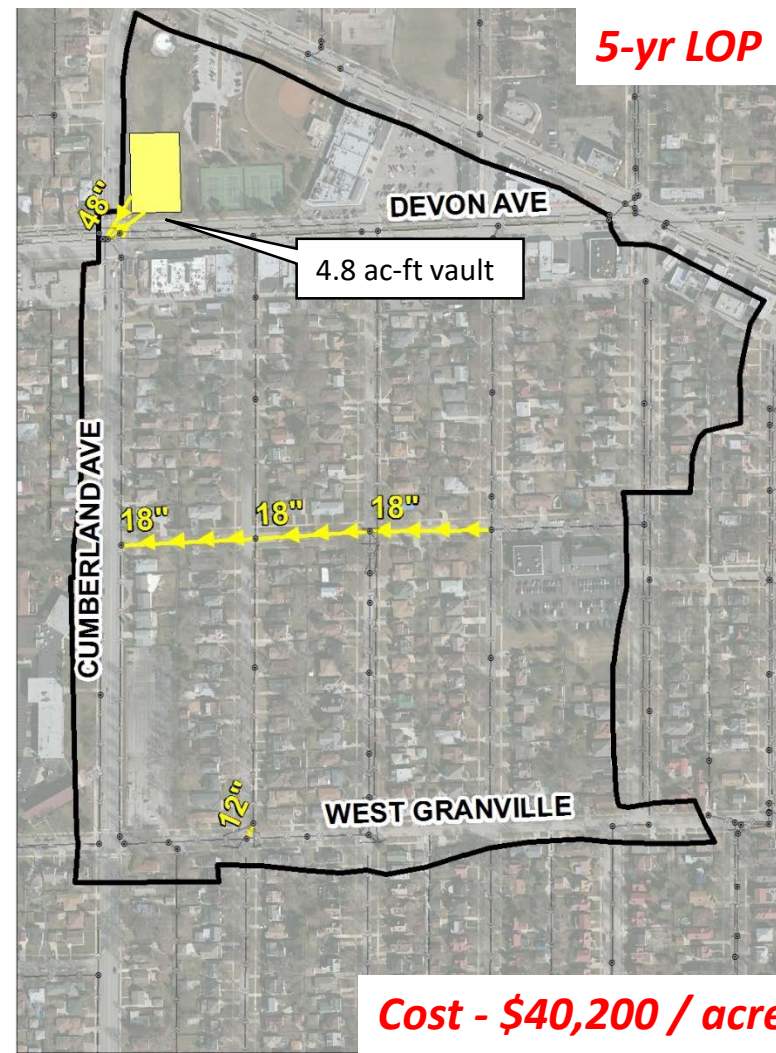
- Selected 7 areas to analyze based on original drainage subarea map
- Comprise roughly 20% of the combined sewer area (3400 acres)



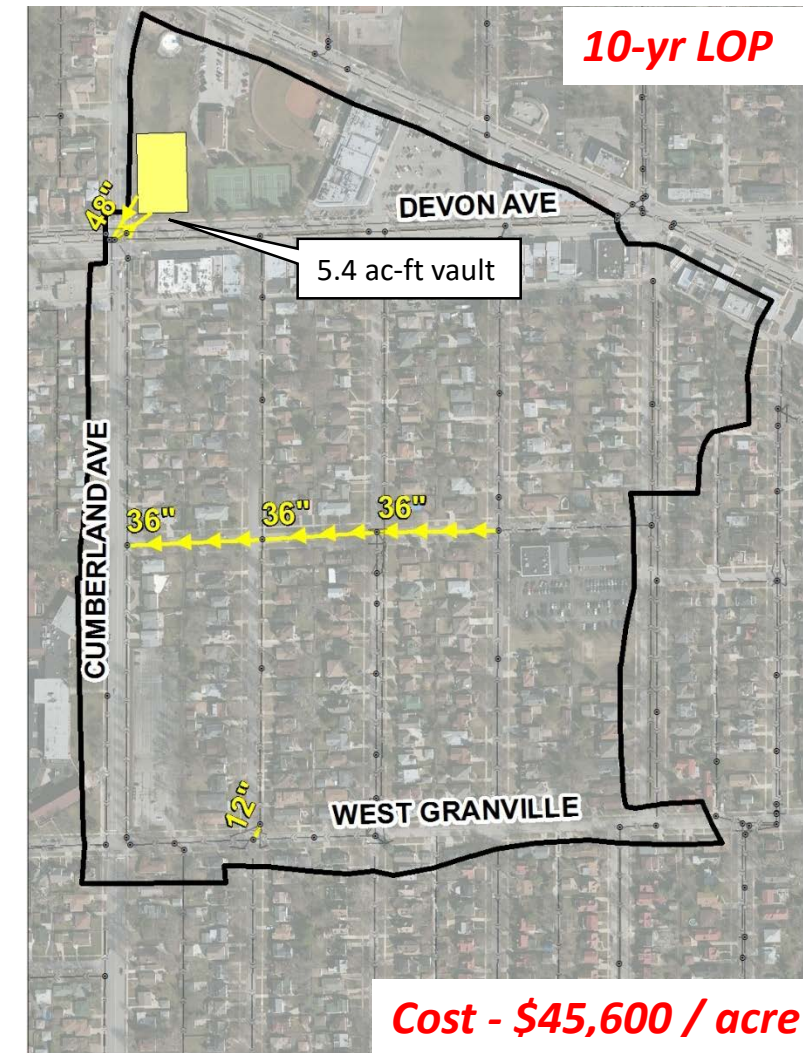
# Level of Protection – Concept Area #1 – 73 acres



**Cost - \$26,300 / acre  
(\$1.9 million)**

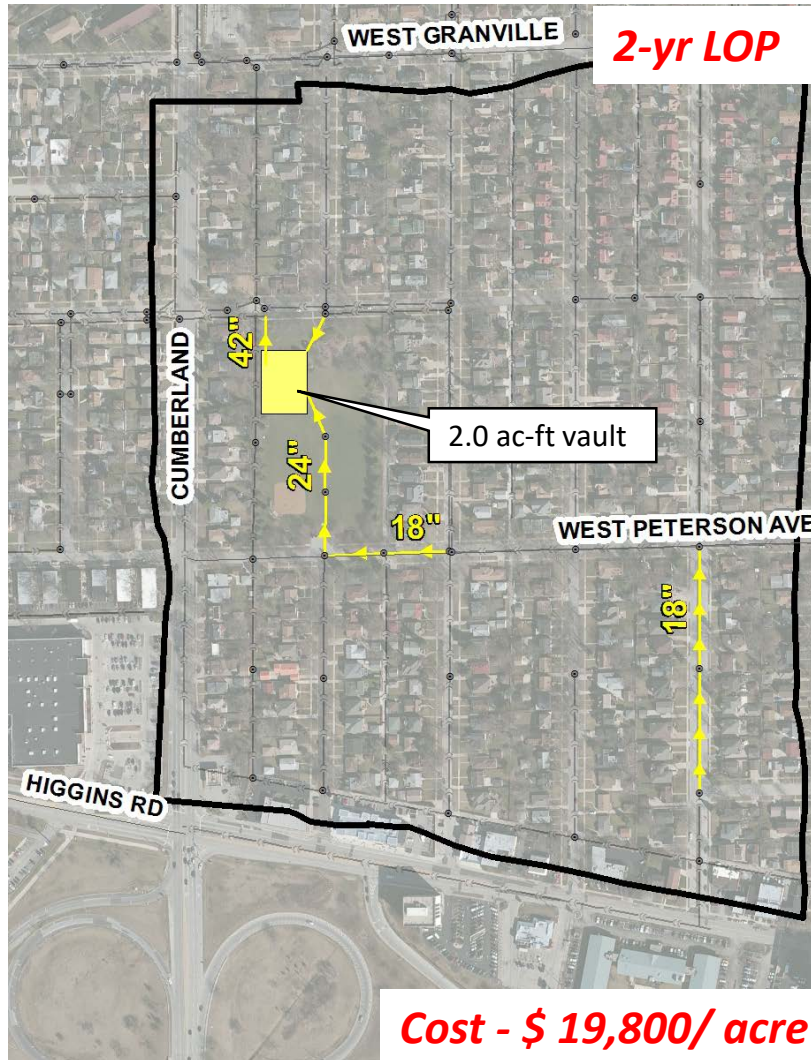


**Cost - \$40,200 / acre  
(\$2.9 million)**

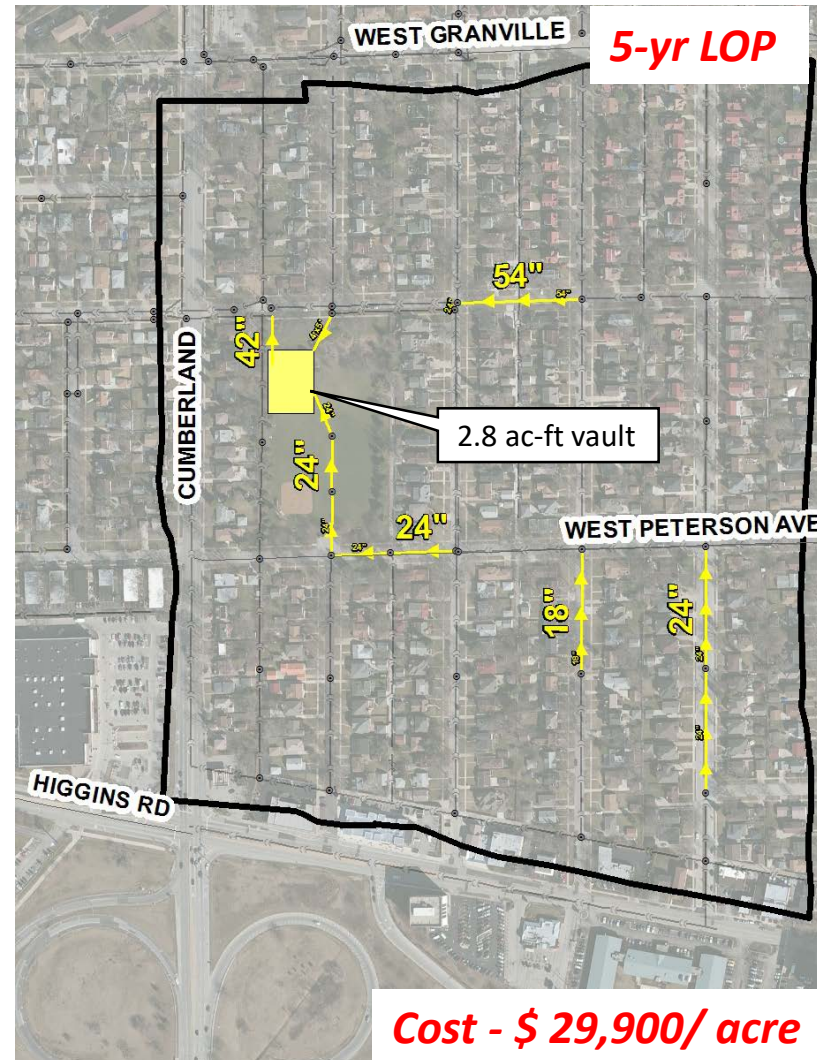


**Cost - \$45,600 / acre  
(\$3.3 million)**

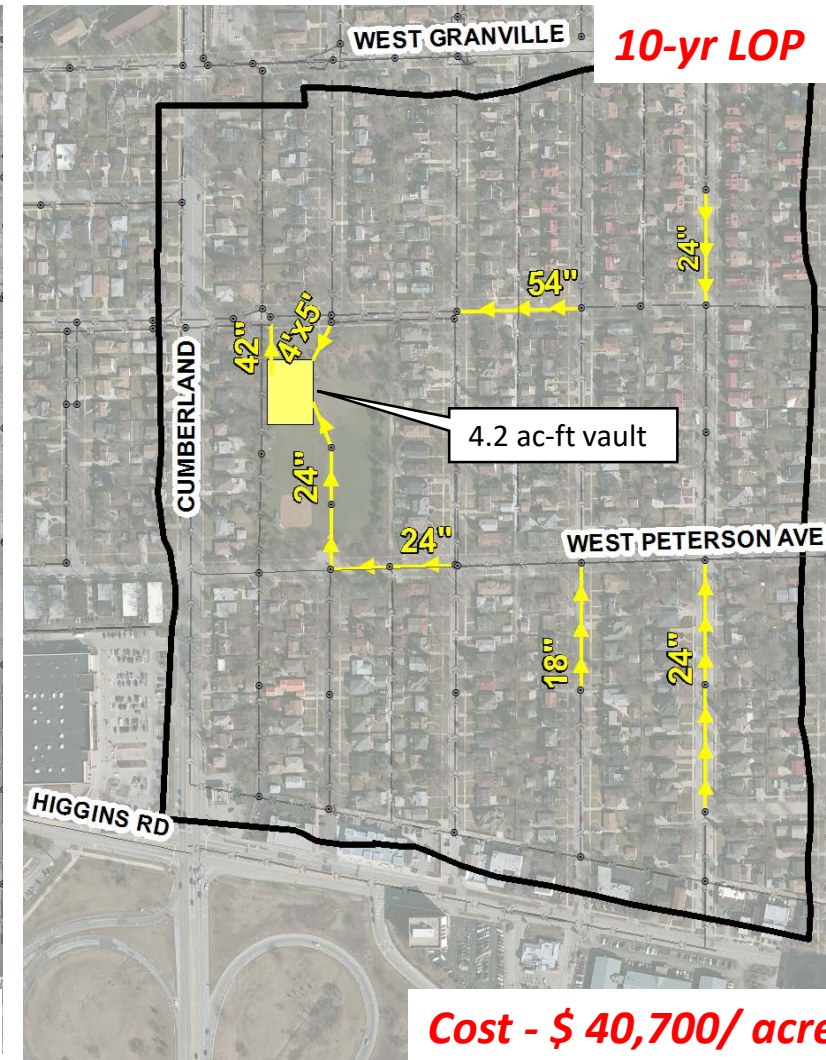
# Level of Protection – Concept Area #2 – 81 acres



Cost - \$ 19,800/ acre  
(\$1.6 million)



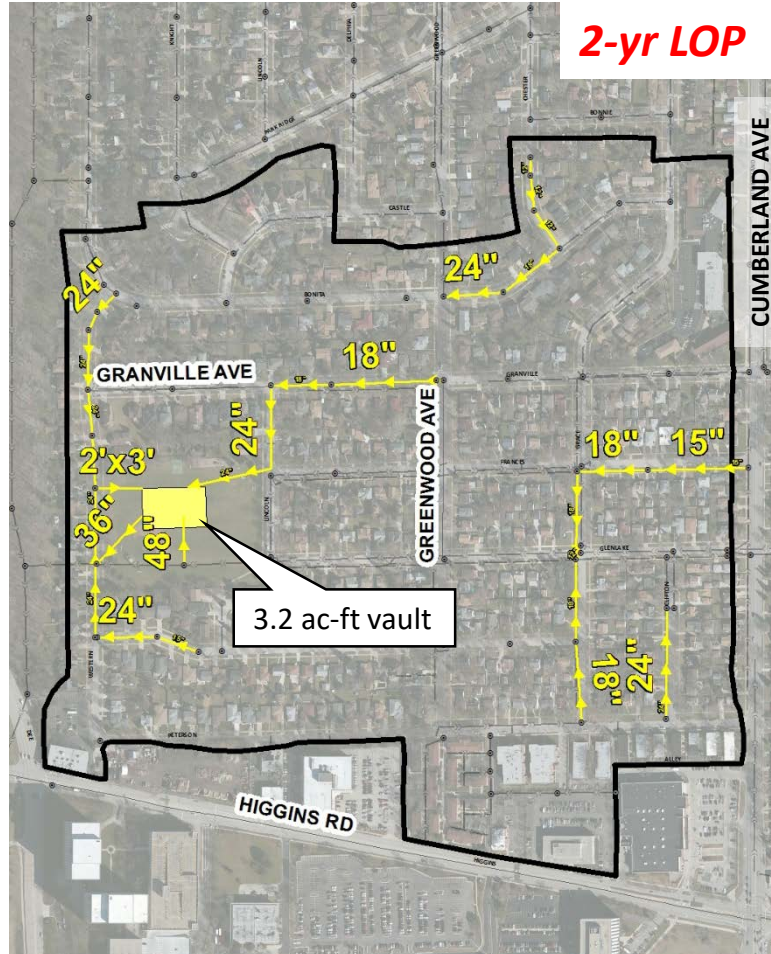
Cost - \$ 29,900/ acre  
(\$2.4 million)



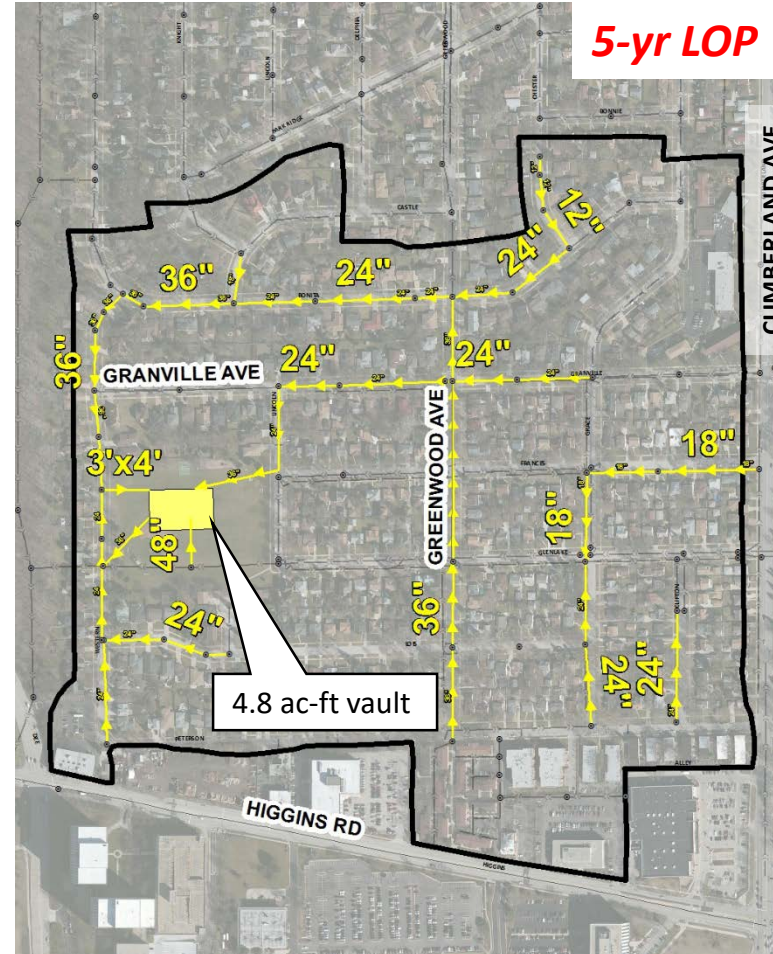
Cost - \$ 40,700/ acre  
(\$3.3 million)

Stormwater Master Plan

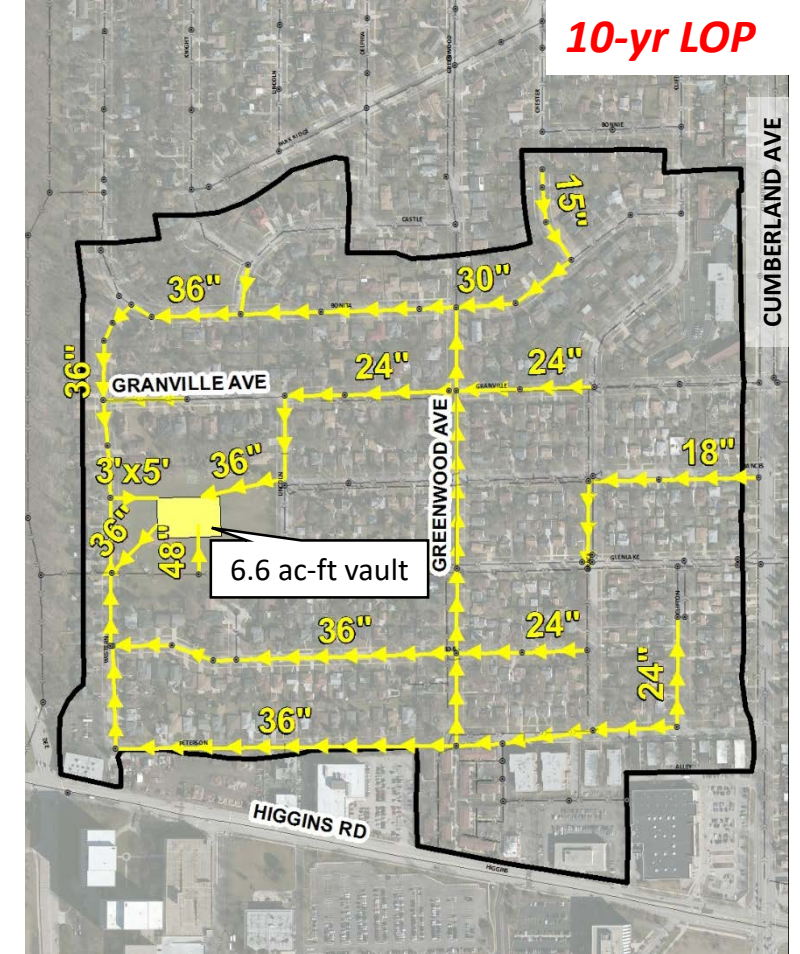
# Level of Protection – Concept Area #3 – 127 acres



**Cost - \$ 31,500/ acre  
(\$4.0 million)**

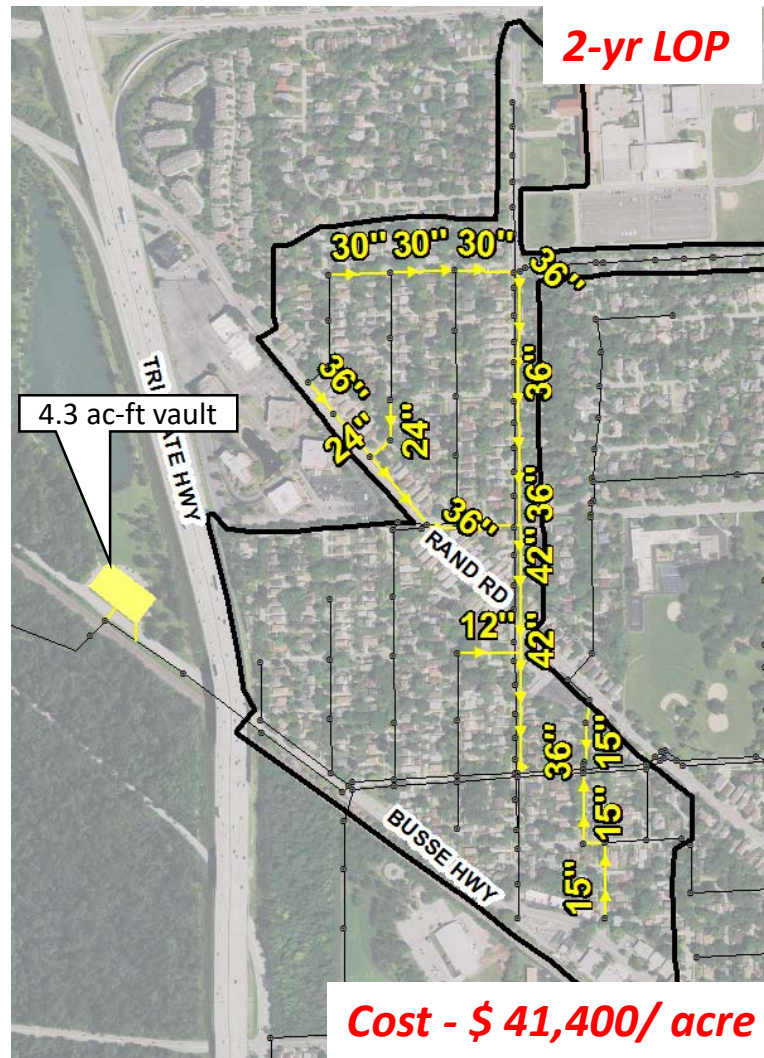


**Cost - \$ 50,700/ acre  
(\$6.4 million)**

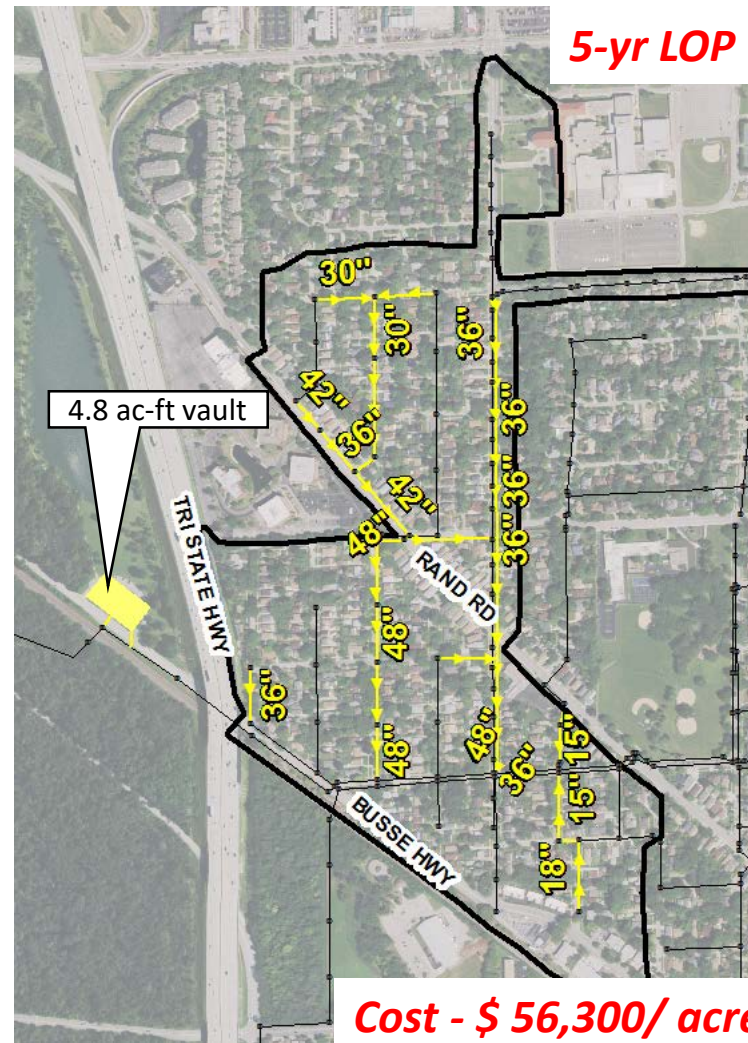


**Cost - \$ 69,100/ acre  
(\$8.8 million)**

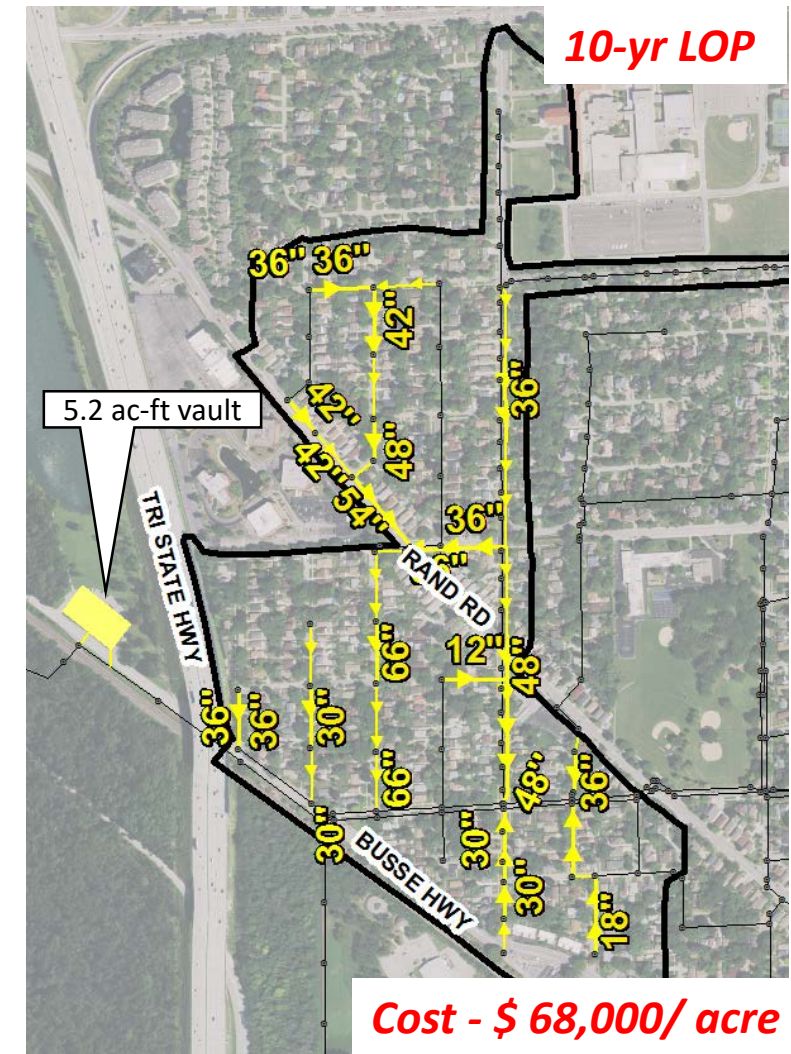
# Level of Protection – Concept Area #4 – 140 acres



**Cost - \$ 41,400/ acre  
(\$5.8 million)**



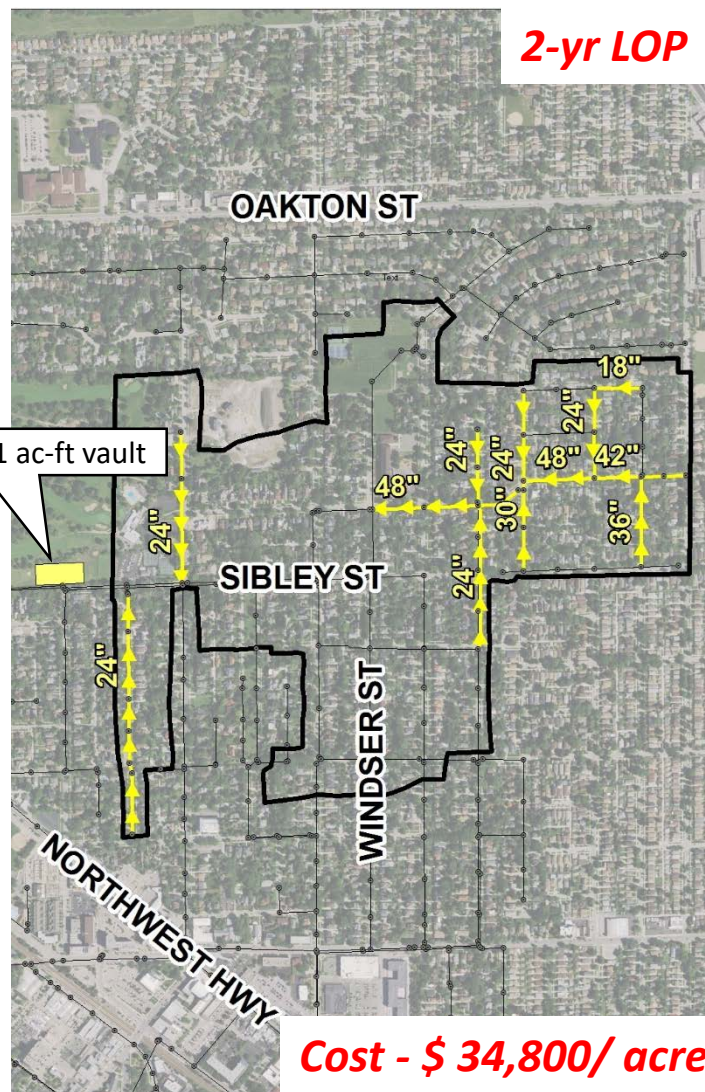
**Cost - \$ 56,300/ acre  
(\$7.9 million)**



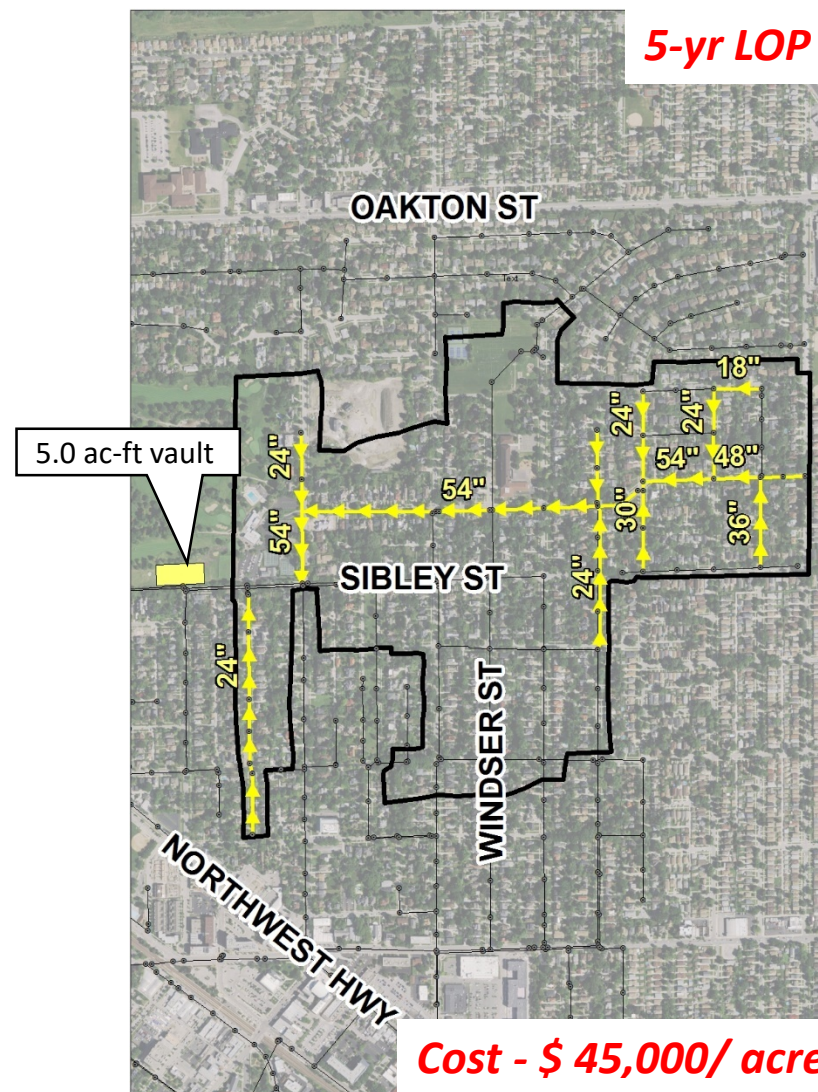
**Cost - \$ 68,000/ acre  
(\$9.5 million)**

# Level of Protection – Concept Area #5 – 208 acres

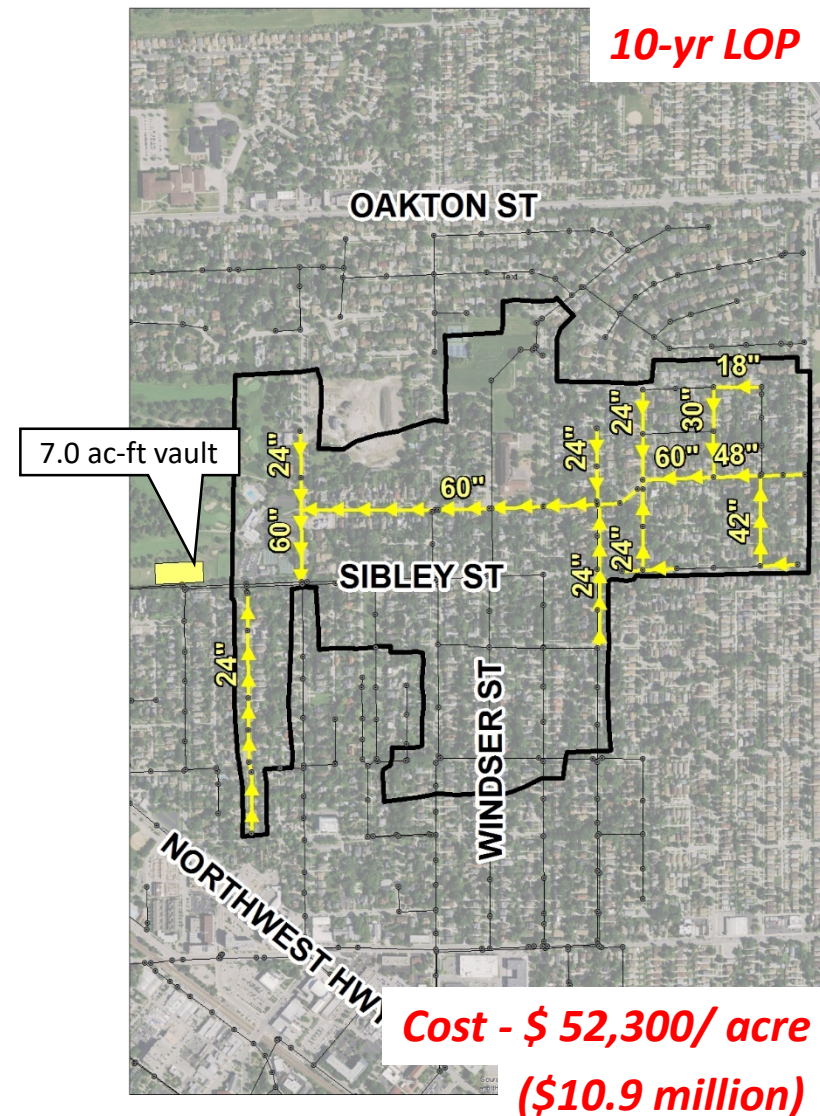
**2-yr LOP**



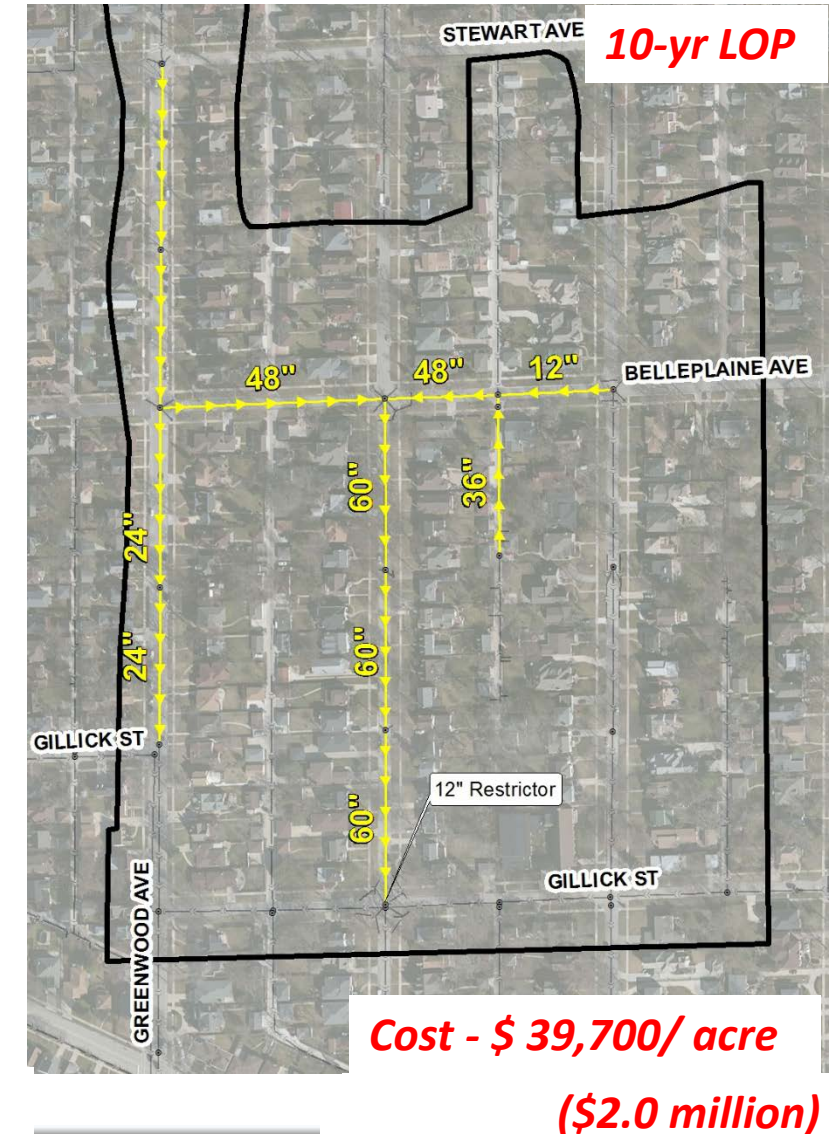
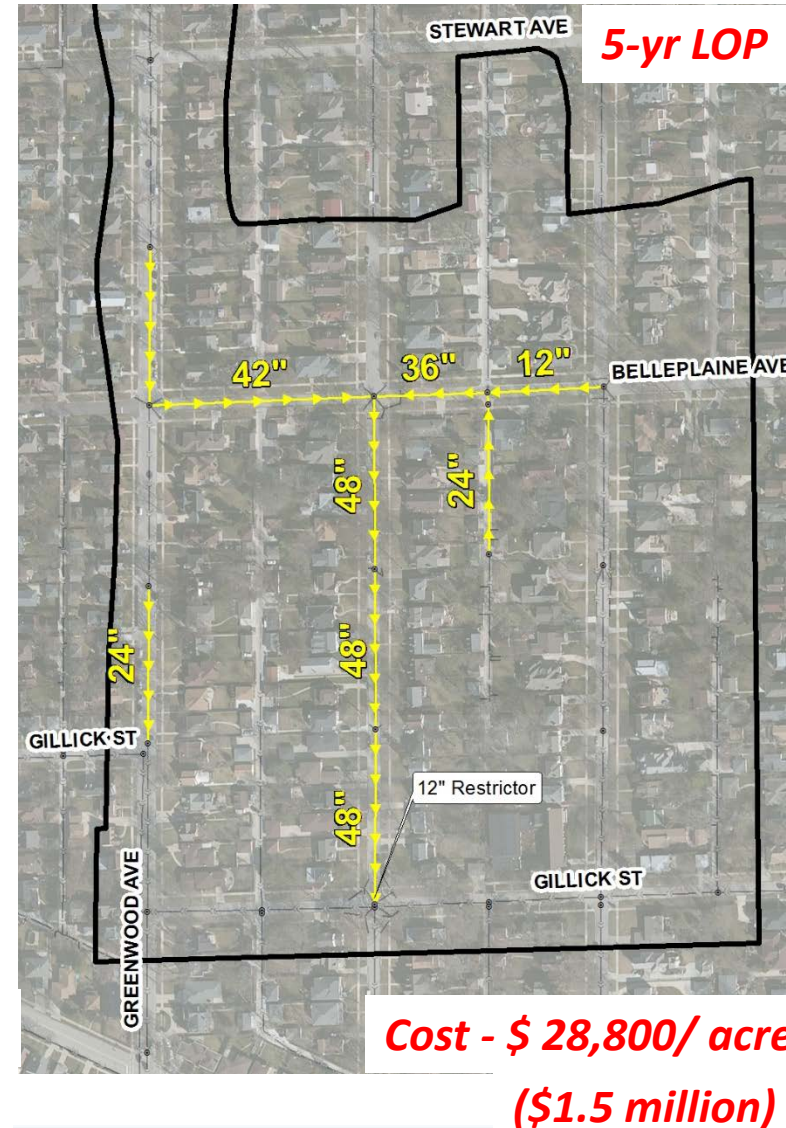
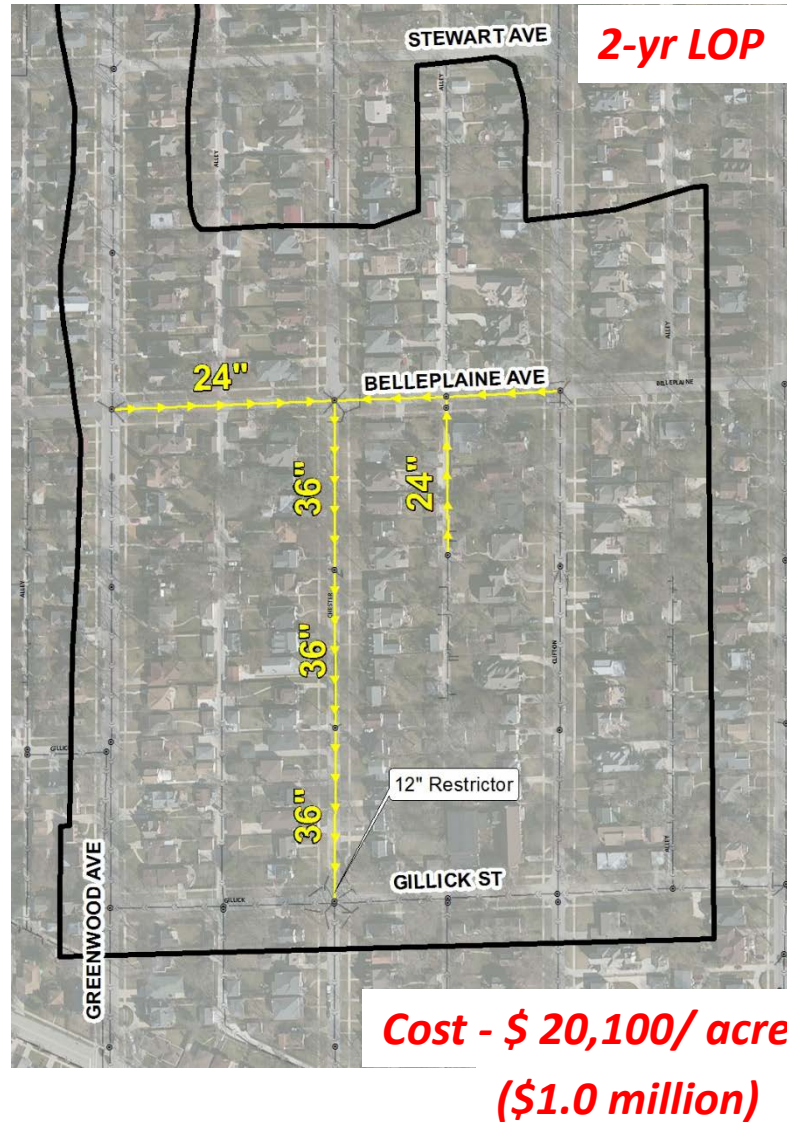
**5-yr LOP**



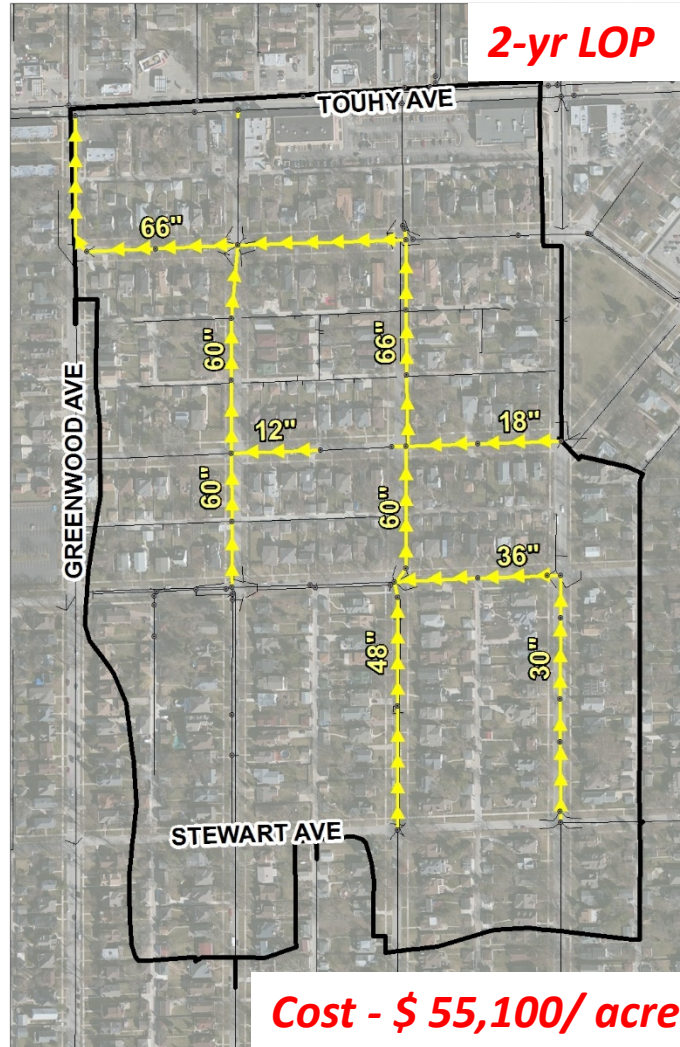
**10-yr LOP**



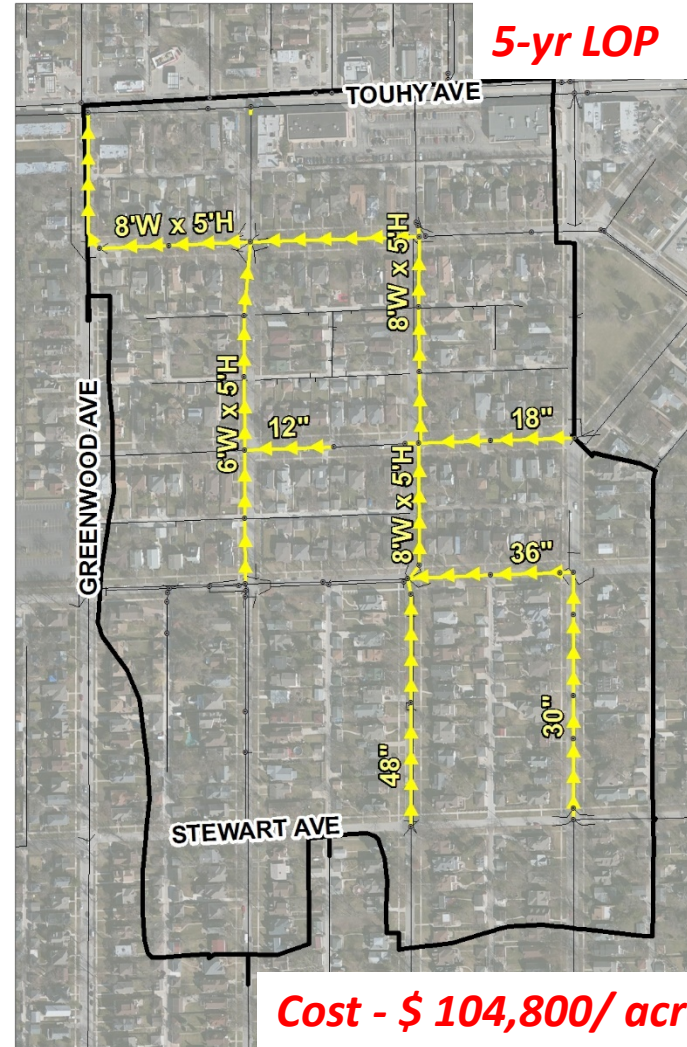
# Level of Protection – Concept Area #6 – 51 acres



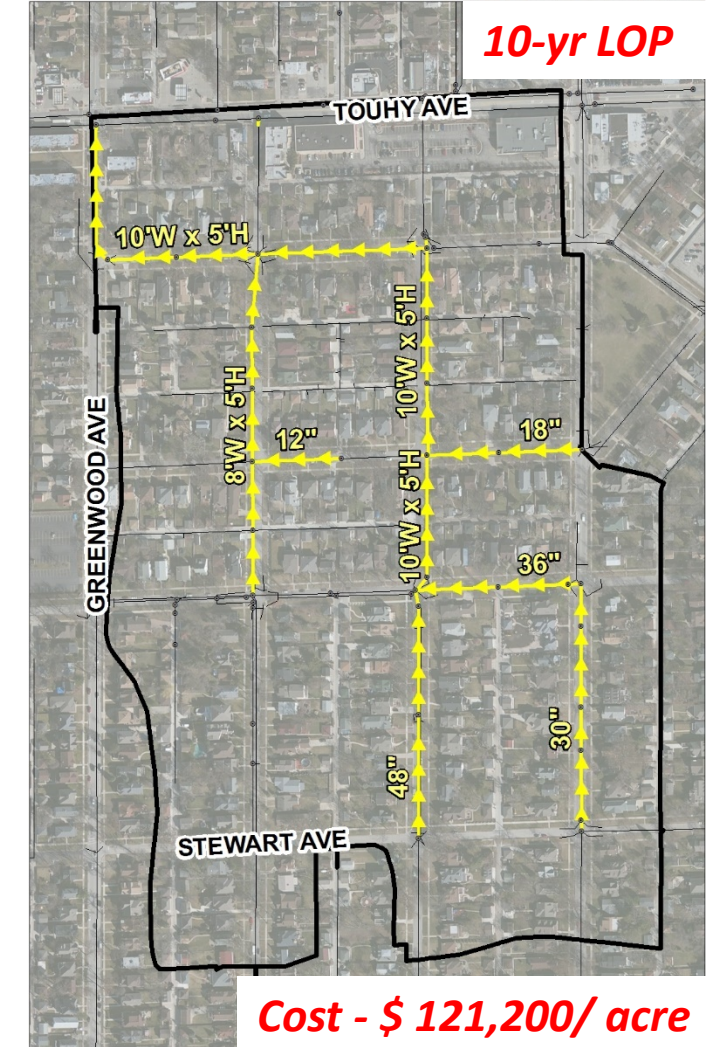
# Level of Protection – Concept Area #7 – 70 acres



**(\$3.9 million)**



**(\$7.4 million)**



**(\$8.5 million)**

# Level of Protection Determination

- Costs for the 7 Concept Areas were averaged:
  - 2yr LOP = \$32,800/ac
  - 5yr LOP = \$51,000/ac
  - 10yr LOP = \$62,500/ac
- Costs applied to entire City area (reflecting current LOP) to estimate overall cost to achieve desired LOP:

Estimated Cost to Provide Citywide Sewer Backup Protection	
<u>Level of Protection</u>	<u>Estimated Cost (2017 dollars)</u>
2-yr (1.4" in 1-hour)	\$71 million
5-yr (1.8" in 1-hour)	\$150 million
10-yr (2.1" in 1-hour)	\$194 million



# Level of Protection Determination

- Decision on LOP should consider costs of flood control for individual properties and the “natural” installation rate of flood control systems:

Estimated Cost to Provide Citywide Sewer Backup Protection		
<u>LOP</u>	<u>Estimated Cost</u>	<u>Cost per Single Family Parcel*</u>
2-yr	\$71 million	\$6,100
5-yr	\$150 million	\$13,000
10-yr	\$194 million	\$16,700
<i>* Approx. 11,600 SF properties in City</i>		

- Costs of flood control systems can vary widely but are generally between \$6,000 and \$12,000



# Level of Protection Determination

## Potential Approaches to Development of SMP:

- Citywide Approach to Sewer Backup issues
- Develop projects based on available infrastructure and stormwater opportunities that will **reduce** sewer backup
- Rely on individual property solutions for sewer backup and focus SMP on Overland Flooding



## Next Steps

1. Receive direction for SMP direction regarding sewer backup issues.
2. Return to Council to present estimated costs for Overland Flooding projects
3. Develop SMP project list based on identified criteria



*Questions?*

