THE VILLAGE OF
Wilmette
EST. 1872

Municipal Services Committee

January 28, 2015
7:00 PM

Wilmette's Sewer System

Today's presentation will cover:

- Overview of the Separate Sewer System
- Why Homes Flood
- Sanitary vs. Storm
- Past Sewer Infrastructure Investments
- Current Sewer Infrastructure Investments
- Separate Storm Sewer Results

Wilmette's Sewer System

Separate Sewer System

- West of Ridge Road
- 1930 to 1950 – Separate sewers constructed
- Sanitary system has two outfalls

  Harms Road and Princeton Place

- Stormwater collected and conveyed to the pump station on Lake Avenue with discharge to the North Branch of the Chicago River

Why homes Flood

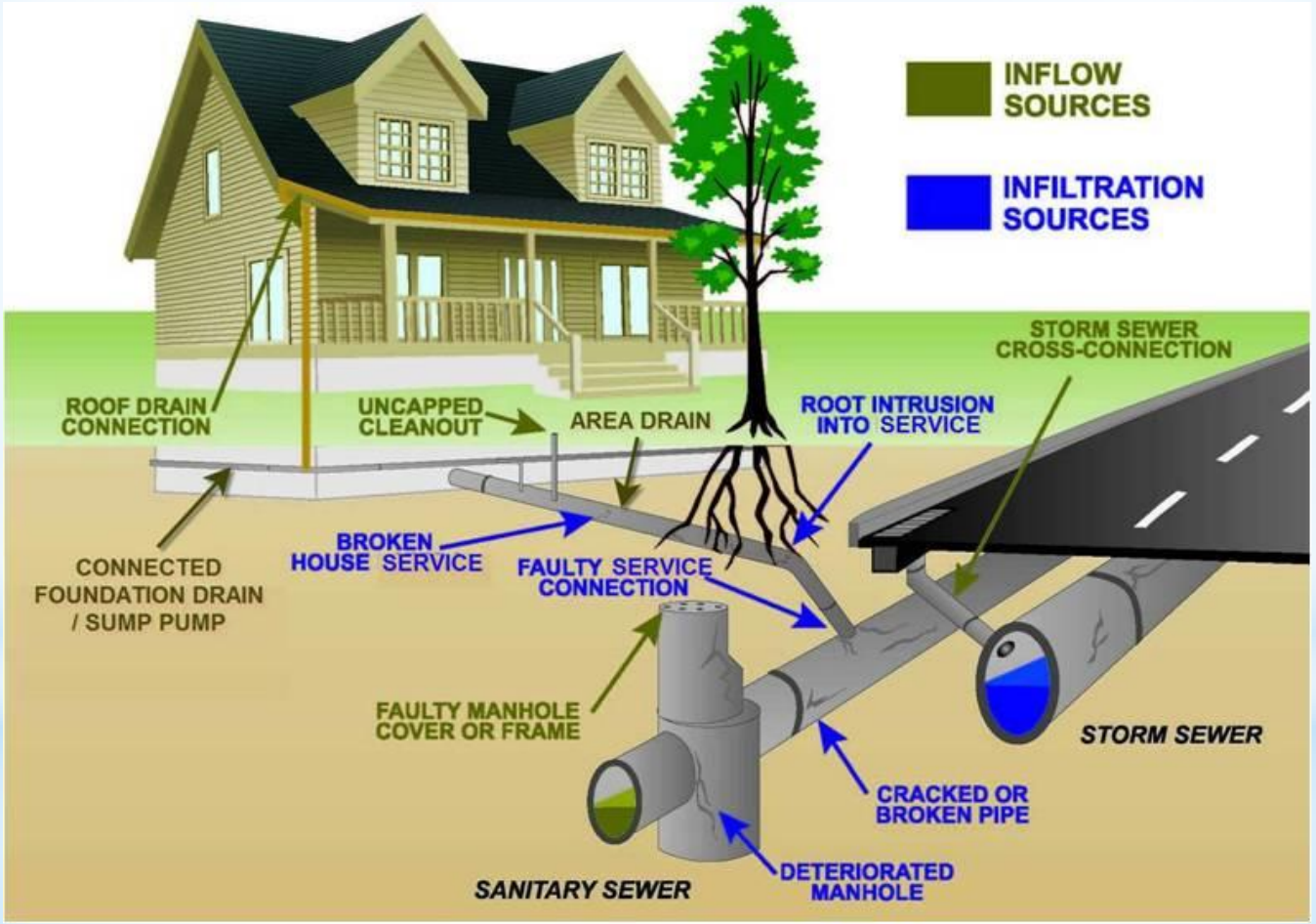
Many different reasons

- Sanitary backups
- Foundation seepage
- Overland flooding
- Window wells, basement doors, depressed garages
- Sump pump failure

It is critically important to understand why a home floods so that the appropriate flood protection measures can be installed.

Why homes Flood

Sanitary backup



rjngroup

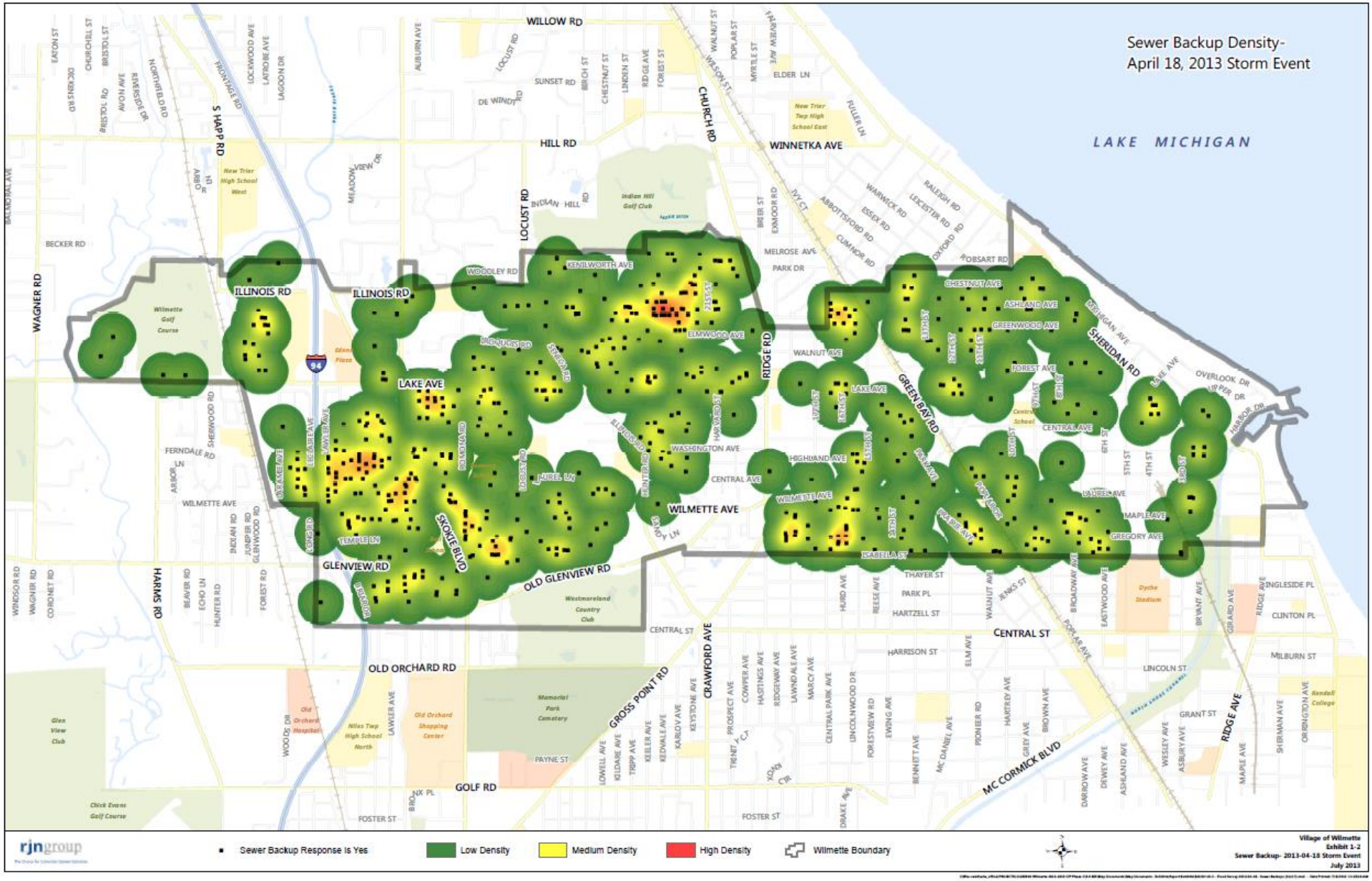
Flood Survey results from April 18, 2013

15% response rate (1,597 residents)

Number (percent) of responses per sewer area

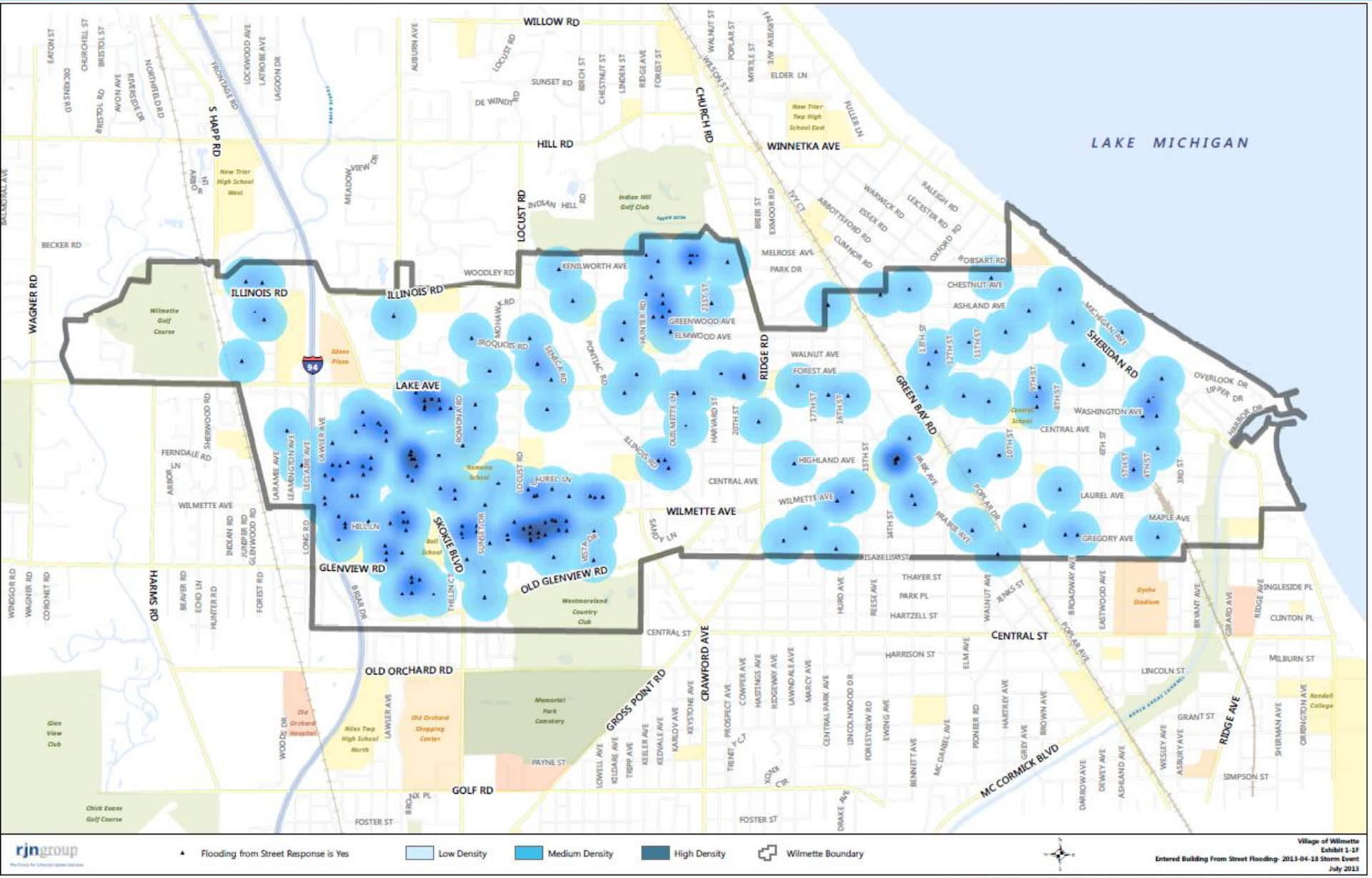
Description	Separate Sewer	Combined Sewer
Number of responses	916 (57%)	681 (43%)
The number of residents that experienced		
Sanitary Sewer Backup	396 (43%)	206 (30%)
Street Flooding Entered Home	126 (14%)	40 (6%)
Yard Flooding Entered Home	69 (8%)	20 (3%)

Sanitary Backup Results



Street Flooding Results

Water entered the home



How to Prioritize?
Sanitary vs. Storm

- Federal and State laws require that sanitary sewer backups and sanitary sewer overflows are addressed.
- 3 X more residents reported structure damage from sanitary sewer backups than street flooding after the April 2013 storm.
- Sanitary backups result in raw sewage in basements which poses a health concern.
- Sanitary sewer flow metering and hydraulic study identified system bottlenecks and evidence of backflow from MWRD system.

Sewer Infrastructure Improvements to Date

Village-wide investment since 1990: $51,825,688

Separate Sewer Area

- Relief sewers
- Second stormwater outfall
- Backup generator at stormwater pump station

Village Wide Maintenance

- Sewer Cleaning/ Televising Lining

Sanitary Sewer Improvements
$26 Million

Sanitary System Flow Metering and Modeling (2012)

Hunter Road Sewer Replacement (2013)

Local Storage (Wilmette Ave and Hibbard Road) 2014

West Park Sanitary Storage Project (Fall, 2015)

Manhole Lining (Spring, 2015)

Smoke Testing and I/I Removal Kenilworth Gardens (2014)

Separate Storm Sewer System Study Results

Presented by:

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Darren Olson, PE, **CFM, D.WRE**

VILLAGE OF WILMETTE
STORMWATER
ACTION PLAN

Separate Storm Sewer Study
Final Presentation

January 28, 2015

CBB

THE VILLAGE OF
Wilmette
EST. 1872

Outline of Presentation

- Data Collection
- Summary of Existing Model Results
- Identification of System Bottlenecks
- Summary of Potential Drainage Improvement Projects
- Summary of Benefits and Costs
- Discussion of Potential Funding Sources

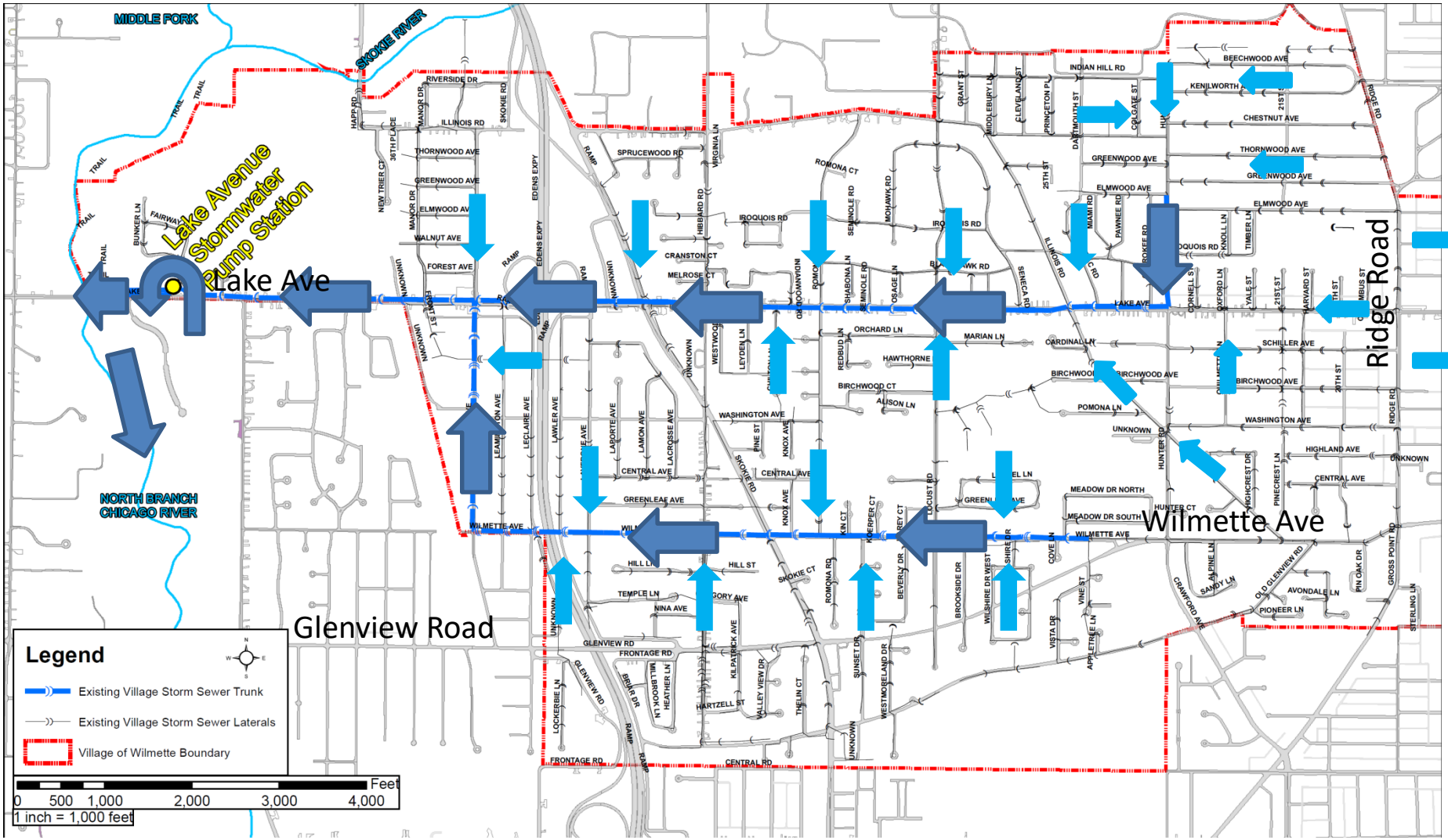
Definitions

- 100-year storm event – Storm event with a 1% chance in occurring in any given year.
- 10-year storm event – Storm event with a 10% chance of occurring in any given year.
- 2-year storm event – Storm event with a 50% chance of occurring in any given year.
- Depth of flooding – Depth of standing water in the street.
- (cfs) cubic feet per second – flowrate measurement of water
- Acre-foot – Volume measurement for stormwater
    - 1 acre of land 1 foot deep
    - A flat football field with a depth of 1 foot
    - 616,715 2-liter bottles

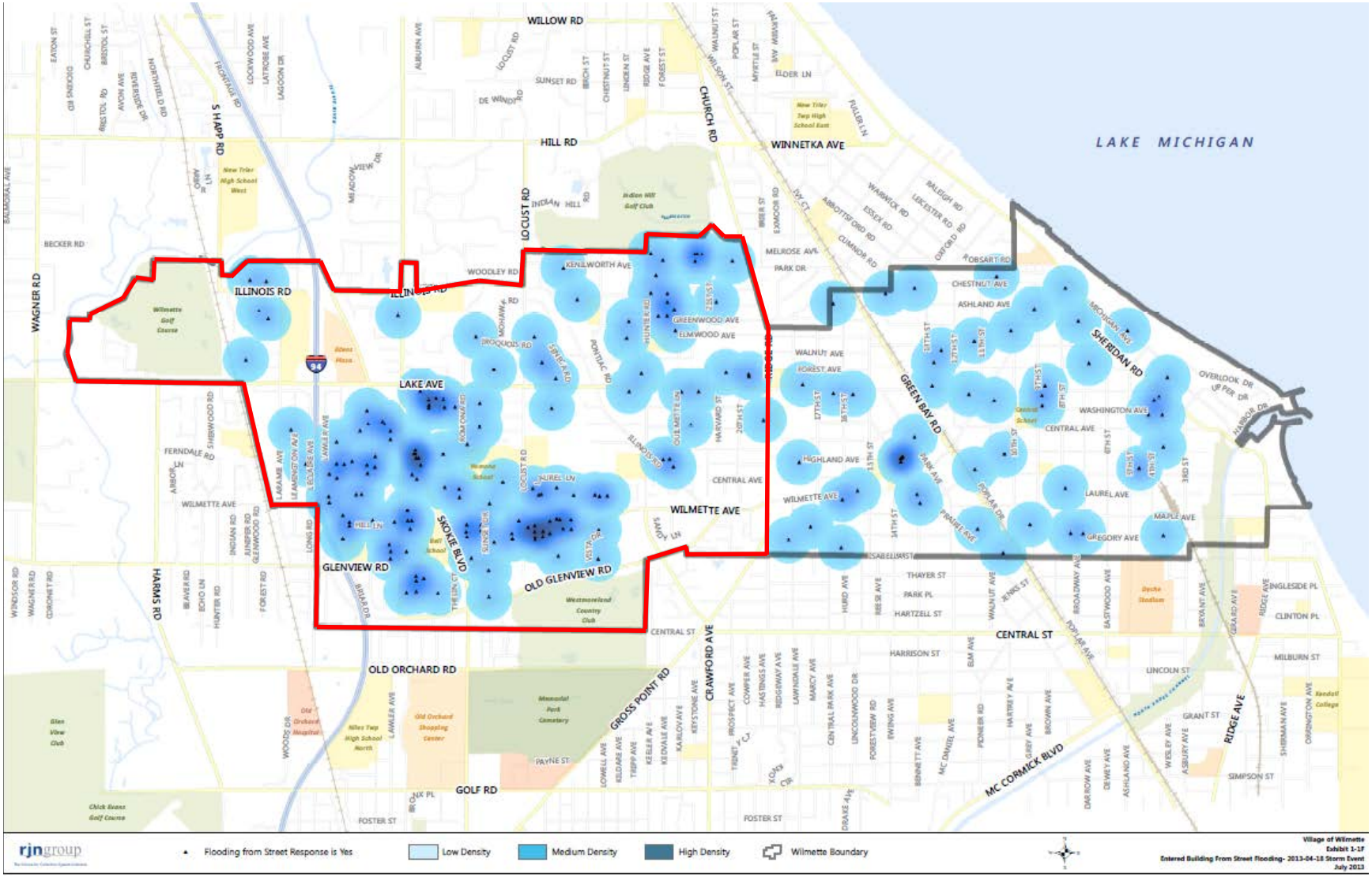
Data Collection

- Survey of Storm Sewer System
  - >1,500 storm sewer manholes and pipes
- Storm Sewer Flow Monitoring
  - Two locations for 3 months – model calibration
  - Rainfall data collection
- Compilation of Resident Information
  - 168 residents attended Open Houses
  - 137 questionnaires/surveys
  - Photographs
  - Videos
  - Field visits

Existing Drainage System



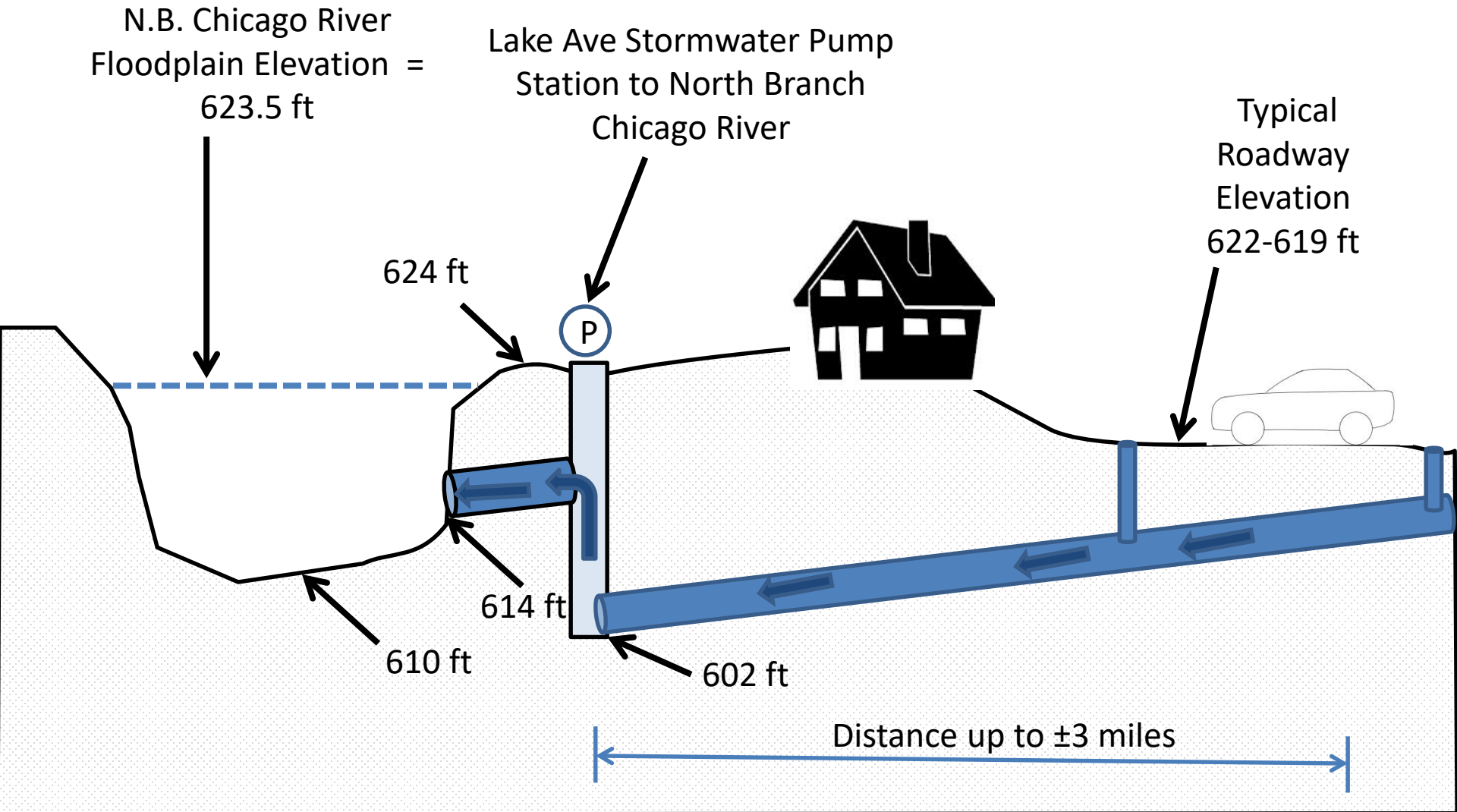
Flood Heat Maps



April 2013 - Flooding from street response is “Yes”

Limitations of Existing System

- Reliance on Storm Sewers and Pump Station

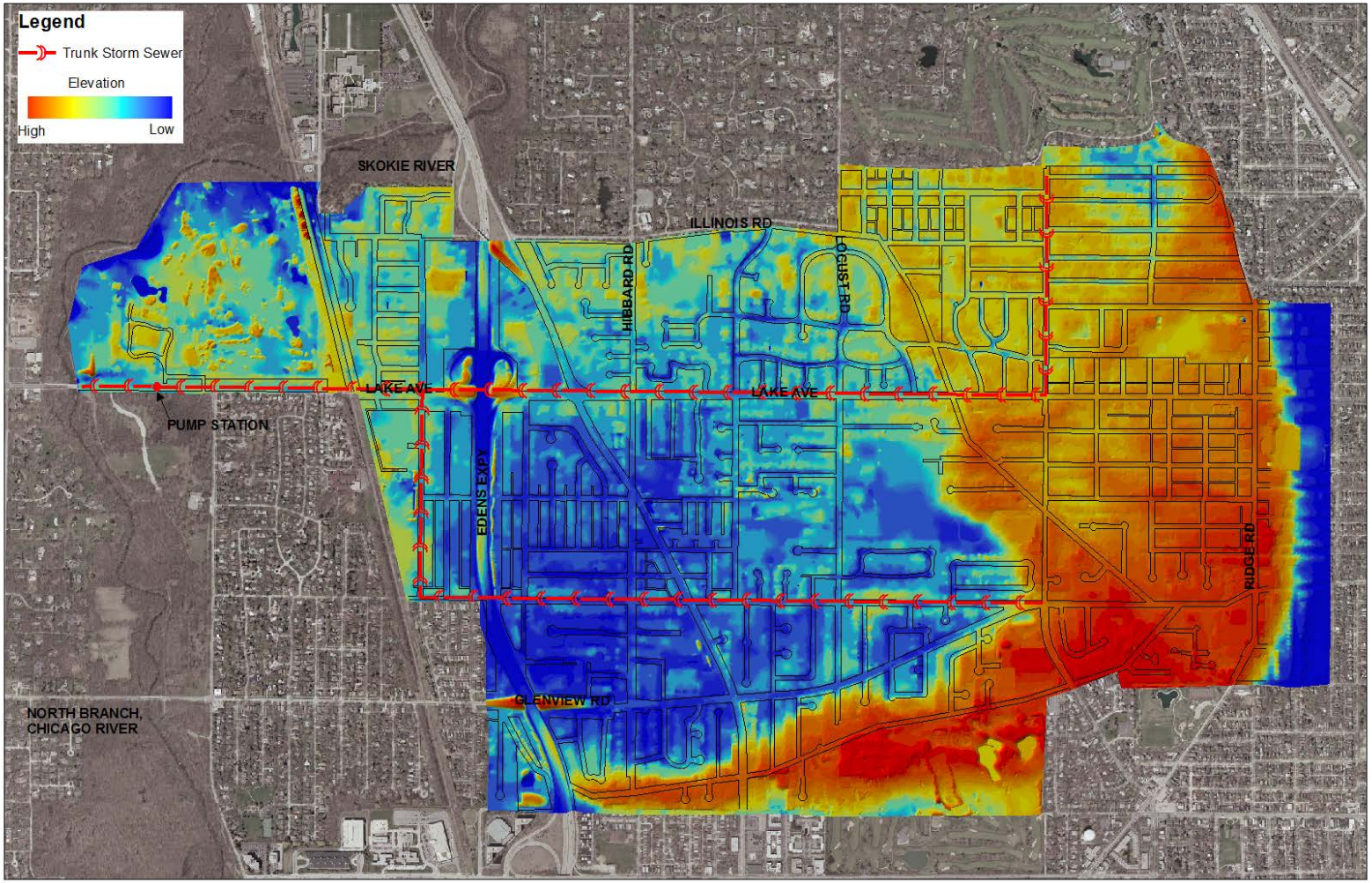


Limitations of Existing System

- Existing Pump Station Components
  - Inflow storm sewer: 102” diameter storm sewer
    - Trunk sewers (storm sewers > 48” diameter)
    - Lateral sewers (storm sewers 12”- 48” diameter)
  - Pumps operated on float system
    - Pump 1 – 14,000 gallons per minute (gpm)
    - Pump 2 – 54,000 gpm
    - Pump 3 – 54,000 gpm
    - Pump 4 – 70,000 gpm
    - Pump 5 – 70,000 gpm
  - Outflow storm sewers to NB Chicago River
    - 84” diameter storm sewer
    - 6’ x 10’ box culvert

Limitations of Existing System

- Topographic Limitations



Limitations of Existing System

- Highly developed residential area
- Developed prior to modern stormwater management practices
  - Limited stormwater storage
  - Storm sewer undersized compared to modern design standards
  - No overland flow paths
- Limited open space
- No easy place to safely store or send runoff

Hydrologic and Hydraulic Modeling

- Stormwater model development
  - Incremental approach to develop a plan
  - Comprehensive analysis
    - Digitally import survey data and landuse data
    - Study area divided into 150 subbasins
    - All trunk and lateral storm sewers modeled
  - Identify underutilized segments and/or restrictions
  - Identify potential improvements
- Calibration from monitoring & flood events
  - April 2013, May 2014 and June 2014

Model Calibration Results

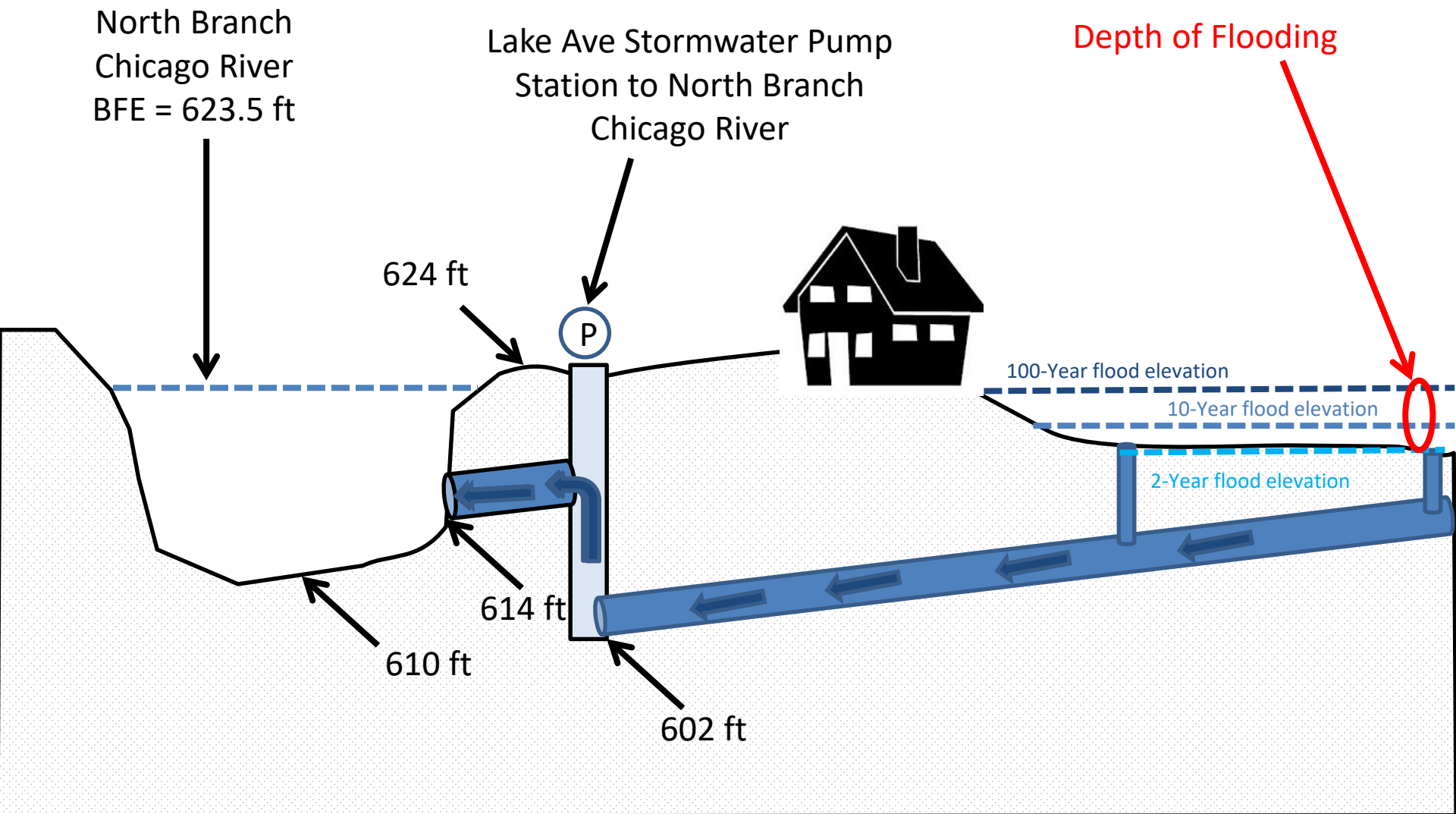
- Kenilworth Gardens (April 2013)

Debris at High Water Mark

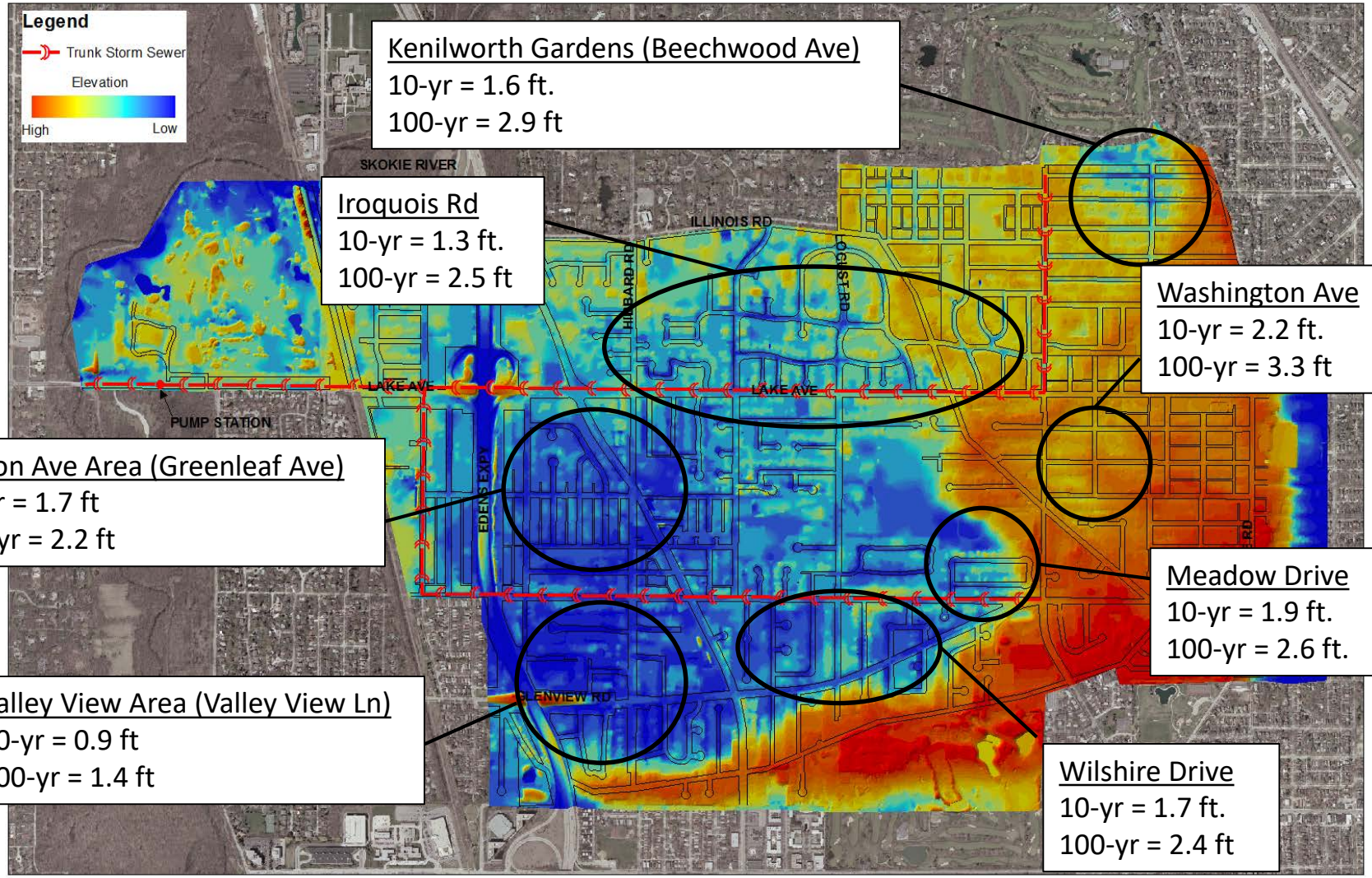
Existing Conditions Model Results

- Storm sewer system has 2-year capacity
- 10-Year storm event
  - Street flooding up to 2 feet in depth
- 100-year storm event
  - Street flooding up to 3 feet in depth
- April 2013 storm event
  - Equivalent to a 25-year storm event
  - Street flooding over 2.5 feet in depth
- June 2014 storm event
  - Equivalent to a 5-year storm event
  - Street flooding reported

Existing Conditions Model Results



Existing Conditions Model Results
Maximum Street Flooding Depths



Kenilworth Gardens (Beechwood Ave)
10-yr = 1.6 ft.
100-yr = 2.9 ft

Iroquois Rd
10-yr = 1.3 ft.
100-yr = 2.5 ft

Washington Ave
10-yr = 2.2 ft.
100-yr = 3.3 ft

Lamon Ave Area (Greenleaf Ave)
10-yr = 1.7 ft
100-yr = 2.2 ft

Meadow Drive
10-yr = 1.9 ft.
100-yr = 2.6 ft.

Valley View Area (Valley View Ln)
10-yr = 0.9 ft
100-yr = 1.4 ft

Wilshire Drive
10-yr = 1.7 ft.
100-yr = 2.4 ft

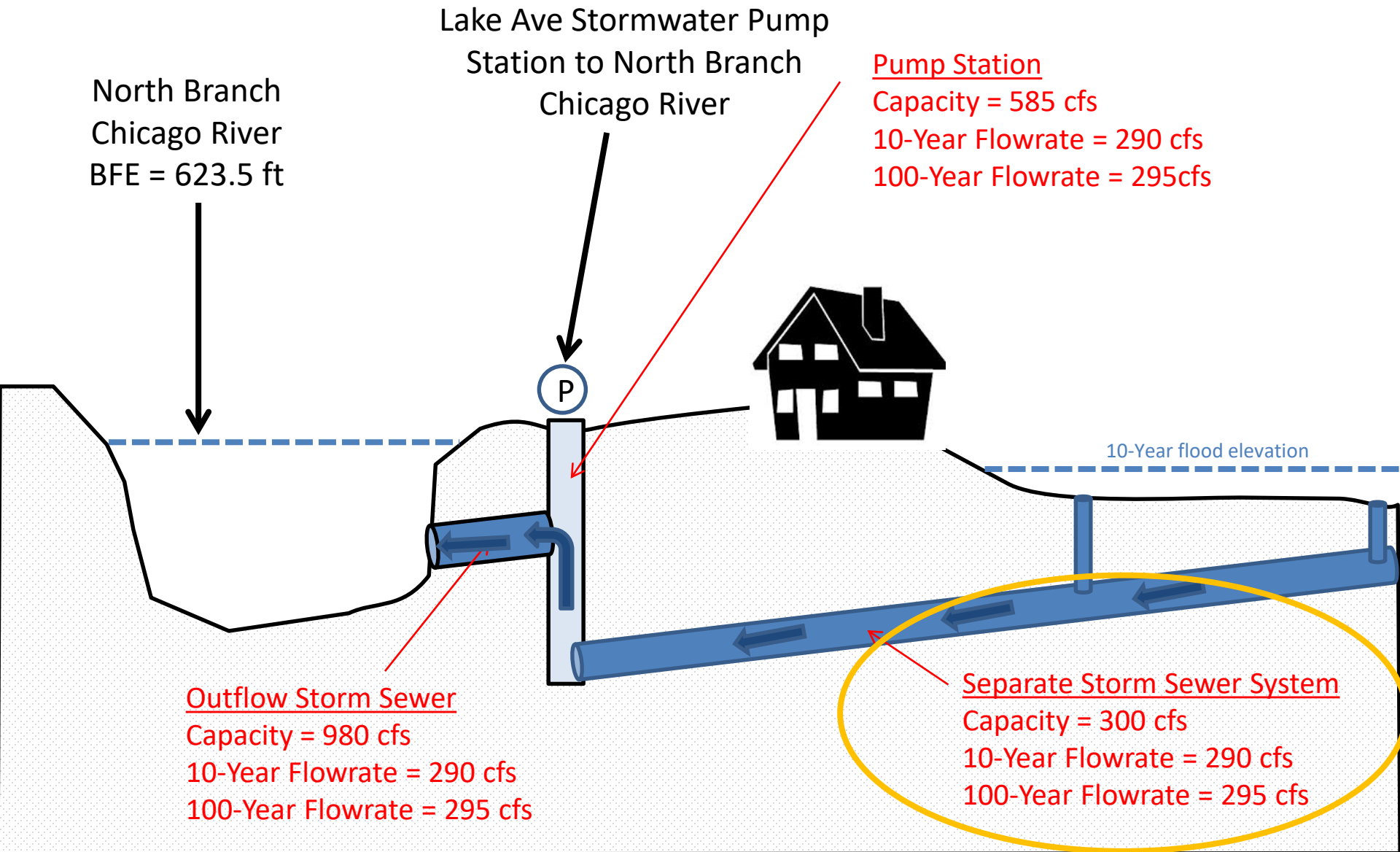
Existing Conditions Model Results

Estimated Number of *Structures* Impacted by Flooding

Return Interval Storm Event	Number of Structures*
10-year	120
25-year	280
50-year	480
100-year	700

*Structure impacted when flood level is within 1 foot of highest lot elevation

Identification of System Bottlenecks

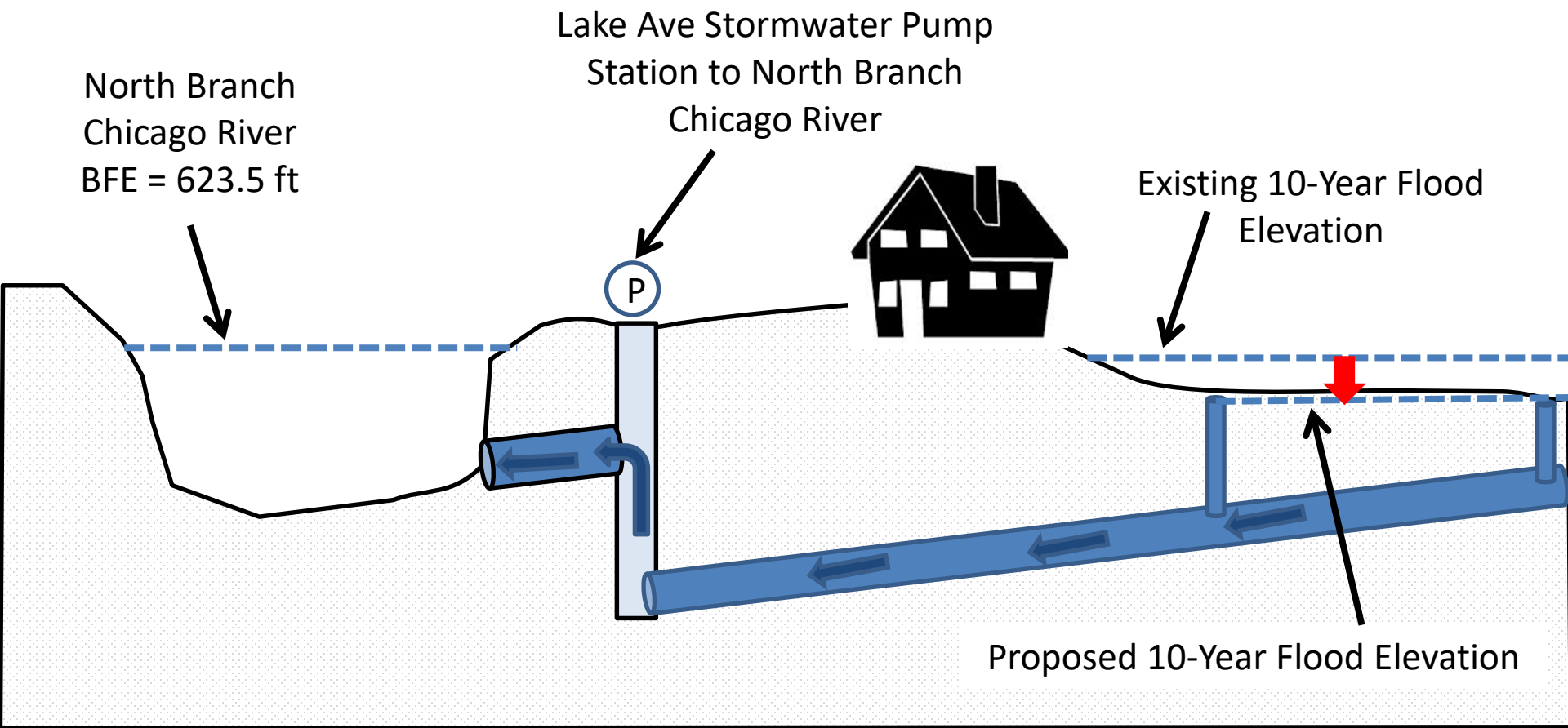


Identification of System Bottlenecks

- Separate storm sewer system capacity is limiting factor:
  - Trunk line storm sewers
  - Lateral storm sewers
- Designed and constructed prior to modern stormwater management practices
- Pump station can only pump water delivered to it by storm sewer system
- Stormwater model used to identify bottlenecks and develop proposed drainage improvements

Proposed Drainage Improvements

- Goal: 10-Year System Capacity per August MSC meeting
  - Reduce 10-year flood elevation below pavement elevation
  - Similar to design standard for new construction



Proposed Drainage Improvements

- Near Term Improvements & Green Infrastructure

- Long Term Capital Improvement Projects

Near Term Drainage Improvements

- High Capacity Inlets
  - Reduce potential for clogging
  - Will allow for additional capacity upon completion of long term capital projects
  - Will ***not*** significantly reduce flooding in short term
  - Potential to be incorporated into road program

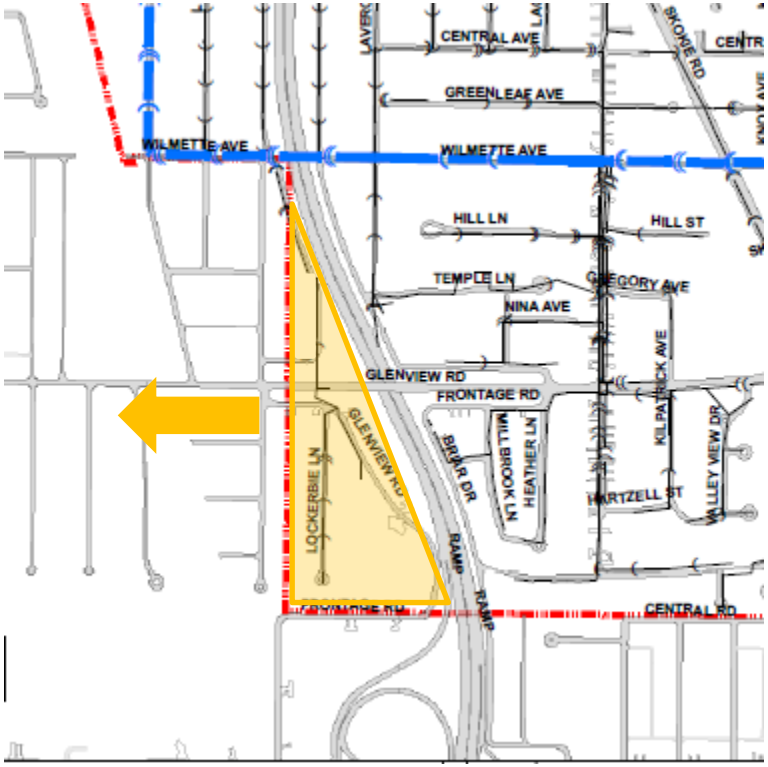
Typical Existing Inlets

Replace with

Typical High Capacity Inlet

Near Term Drainage Improvements

- Coordination with Glenview
  - Glenview Phase 2 East of Harms Project (currently in design)
  - Potential to divert up to 25 acres of land to new Glenview storm sewer system
  - Will require coordination with Glenview
  - Reduction in flow to pump station
  - Limited overall flood reduction benefits – dependent on Glenview design



Green Infrastructure Improvements

- Green Roadways

Shoulder Bioswales

Island Rain Gardens

Permeable Pavement

- Private Property Improvements

Rain Gardens

Rain Barrels

Downspout Disconnection

Green Infrastructure Improvements

- Benefits
  - Water quality improvements
  - Can address local drainage issues
  - Reduce runoff and stormwater pumping
  - Required for larger developments under new Cook County Watershed Management Ordinance (WMO)

ECOLOC® PERMEABLE PAVERS

Green Infrastructure Improvements

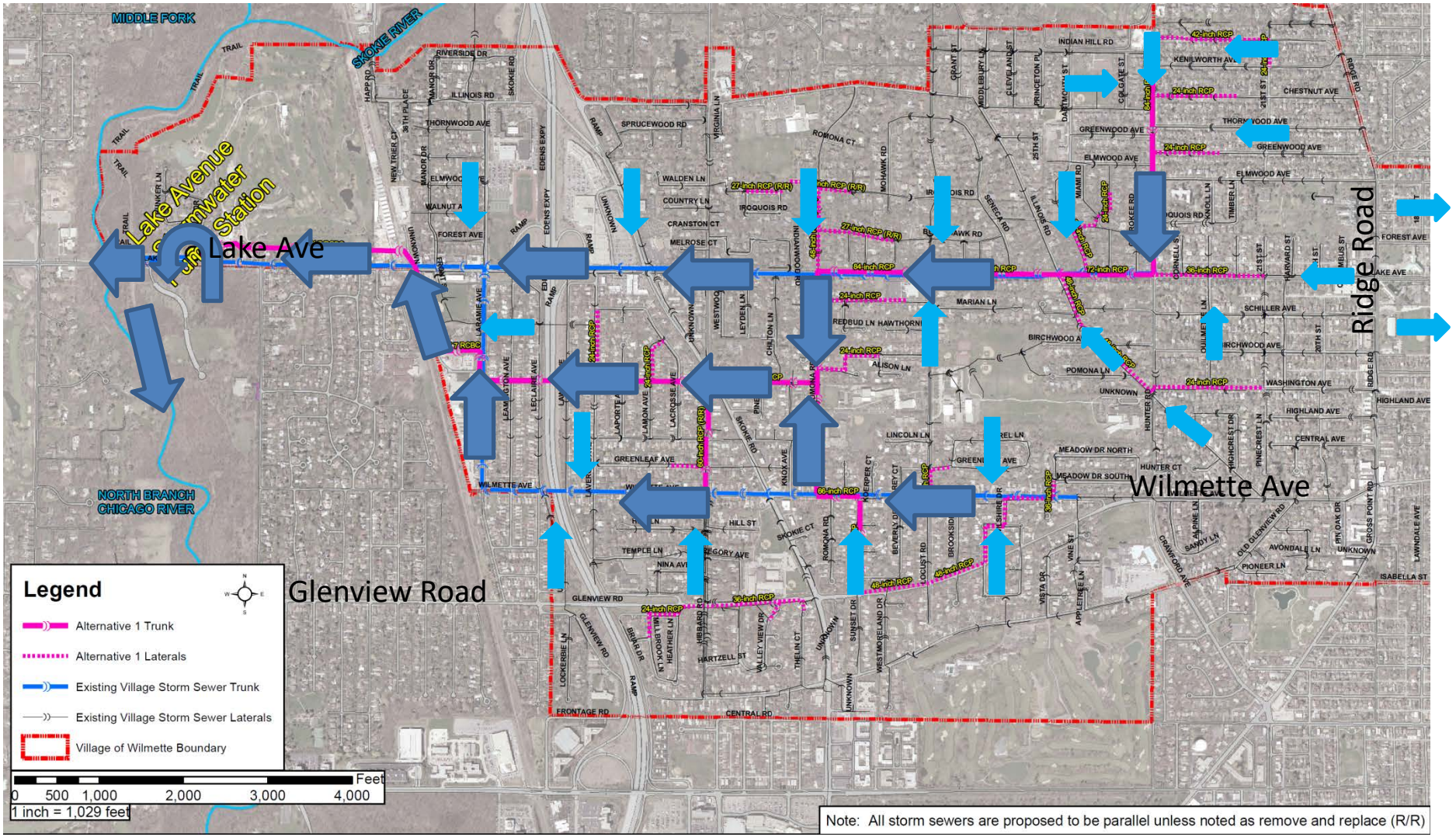
- Limitations
  - Vegetation requires establishment and maintenance
  - Reliance on infiltration – soils and weather constraints
  - Roadway jurisdictions and requirements
  - Capacity limitations
    - A single 0.15 acre lot in Wilmette would generate up to 15,000 gallons of runoff during the April 2013 storm event
      - 235 rain barrels (55 gallons each)
      - Roof Only = 110 rain barrels
    - Significant flood reduction requires ± 50 acre-ft of storage
    - 1 acre-ft of flood storage equals:
      - 5,925 rain barrels (55 gallons each)
      - 8,250 feet of green alleys (0.08 acre-feet per 660 ft block)
      - 2,520 feet of roadway with pervious pavement
    - Model results indicate <0.2 ft of flood reduction for 10-year storm event

Proposed Drainage Improvements

- Alternative 1 – Relief Storm Sewer System
- Alternative 2 –Centralized Storage at Community Playfield
- Alternative 3 – Neighborhood Stormwater Storage

Proposed Drainage Alternative 1

- Relief Storm Sewer System



Proposed Drainage Alternative 1

- Add relief storm sewers to match pump station capacity
  - Leave existing system in place
  - New system connects to existing system
  - Construction areas
    - Roadways
    - Village owned property and Wilmette Golf Club
    - Limited work on private property
- Large diameter pipes & long distance
- Addition of 6th Variable Frequency Drive (VFD) pump (backup) at pump station
  - Redundancy and efficiency purposes only

Proposed Drainage Alternative 1

- Trunk Storm Sewers (21,000 linear feet)
  - Wilmette Golf Club: 10’ x 7’ box culvert
  - Washington Street: 108” storm sewer
  - Lake Avenue: 84” storm sewer
  - Romona Road: 84” storm sewer
  - Hunter Road: 84” storm sewer
  - Hibbard Road: 60” storm sewer
- Lateral Storm Sewers (21,000 linear feet)

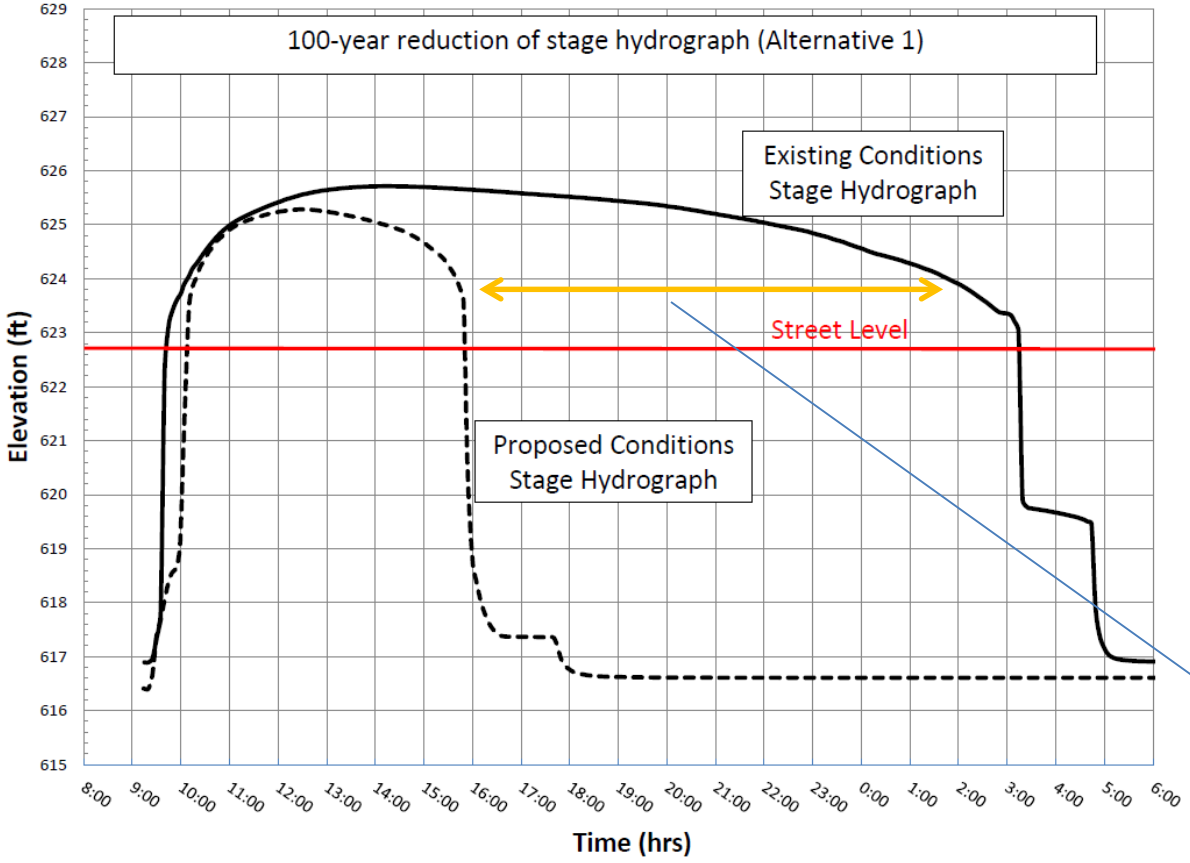
Proposed Drainage Alternative 1

- Project Benefits
  - 10-year flood elevation at or below street elevation at all locations
  - Increased pump station flexibility
  - Does not result in increased floodplain elevation on North Branch Chicago River
  - 100-year storm event street flooding depth reductions:

Location	Existing Flood Depth (ft)	Proposed Flood Depth (ft)	Reduction (ft)
Average All Study Areas	2.0	1.5	-0.5
Valley View Lane	1.4	1.2	-0.2
Beechwood Ave.	3.0	2.6	-0.4
Wilshire Dr.	2.4	2.3	-0.1

Proposed Drainage Alternative 1

- Project Benefits
  - 100-year flood duration reductions



Duration of street inundation reduced by 66%

Proposed Drainage Alternative 1

- Project Benefits
  - Reduction in depth and duration of street and yard flooding
  - Reduction in inflow/infiltration to sanitary system
  - Improved access during storm events
  - Reduction in structures impacted for 100-yr event:

Return Interval Storm Event	Number of Structures Impacted*		% Reduction
	Existing Conditions	Alternative 1	
10-year	120	0	100
25-year	280	60	79
50-year	480	190	60
100-year	700	370	47

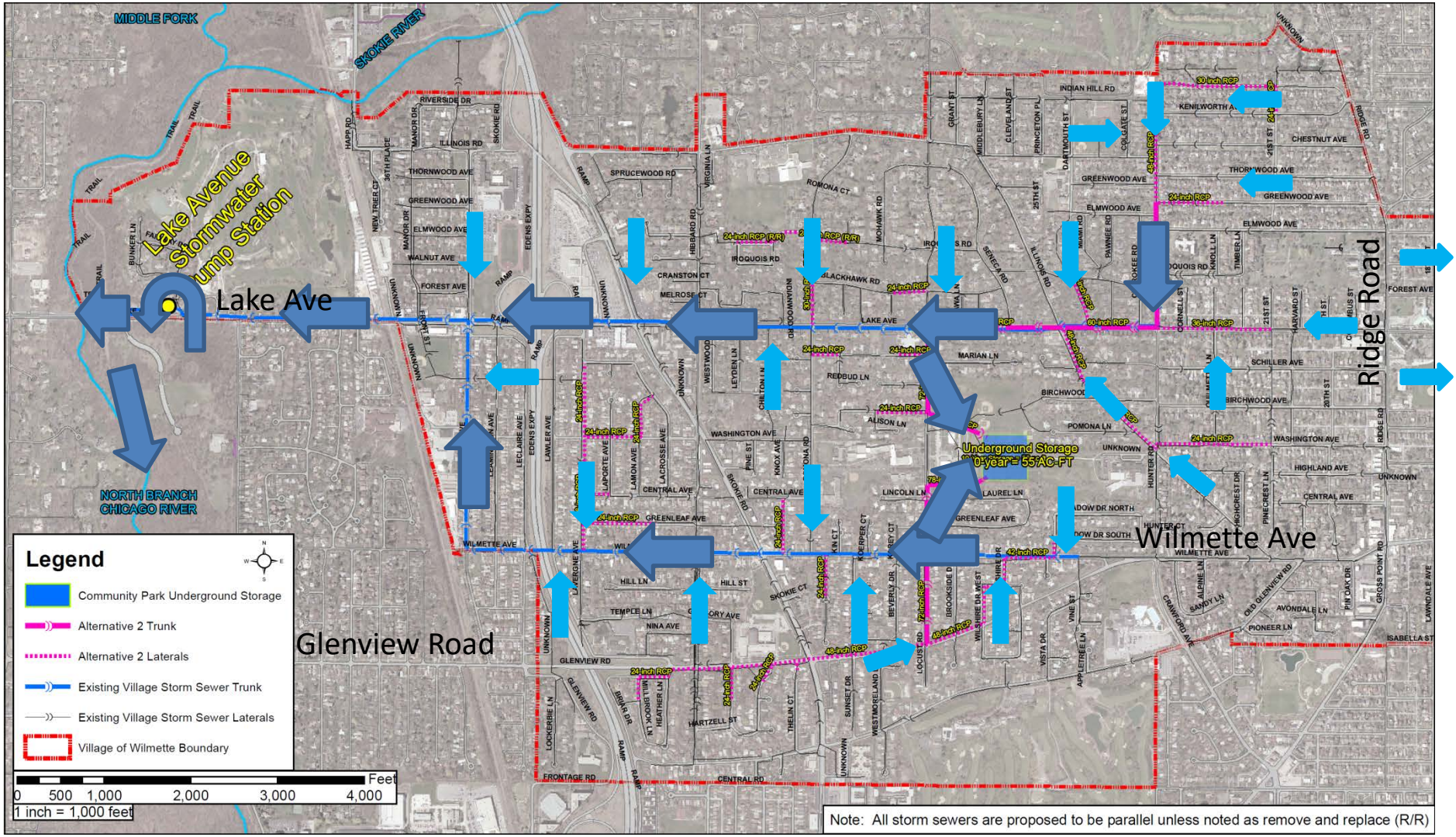
*Structure impacted when flood level is within 1 foot of highest lot elevation

Proposed Drainage Alternative 1

- Project Costs
  - Engineer's Estimate = $75 Million
    - Contingency = 20%
    - Engineering costs included
    - 2014 Dollars
  - Other Costs
    - Long project duration
    - Significant traffic disruption
    - Utility conflicts
    - Golf course disruption

Proposed Drainage Alternative 2

- Centralized Storage at Community Playfield



Proposed Drainage Alternative 2

- Centralized Storage at Community Playfield
  - Storing water in system to reduce flowrates
  - 55 acre-ft (18 million gallons) of underground stormwater storage
  - Lift station required to dewater after storm
  - 6 acre footprint
  - Trunk line upgrades
  - Lateral sewer upgrades

Photo of Underground Storage Installation in Northbrook, IL

Proposed Drainage Alternative 2

- Trunk Storm Sewers (10,000 linear feet)
  - Locust Road: 72” storm sewer
  - Lake Avenue: 72” storm sewer
  - Romona Road: 84” storm sewer
  - Glenview Road: 60” storm sewer
- Lateral Storm Sewers (25,000 linear feet)
- Addition of 6th Variable Frequency Drive Pump (Backup)

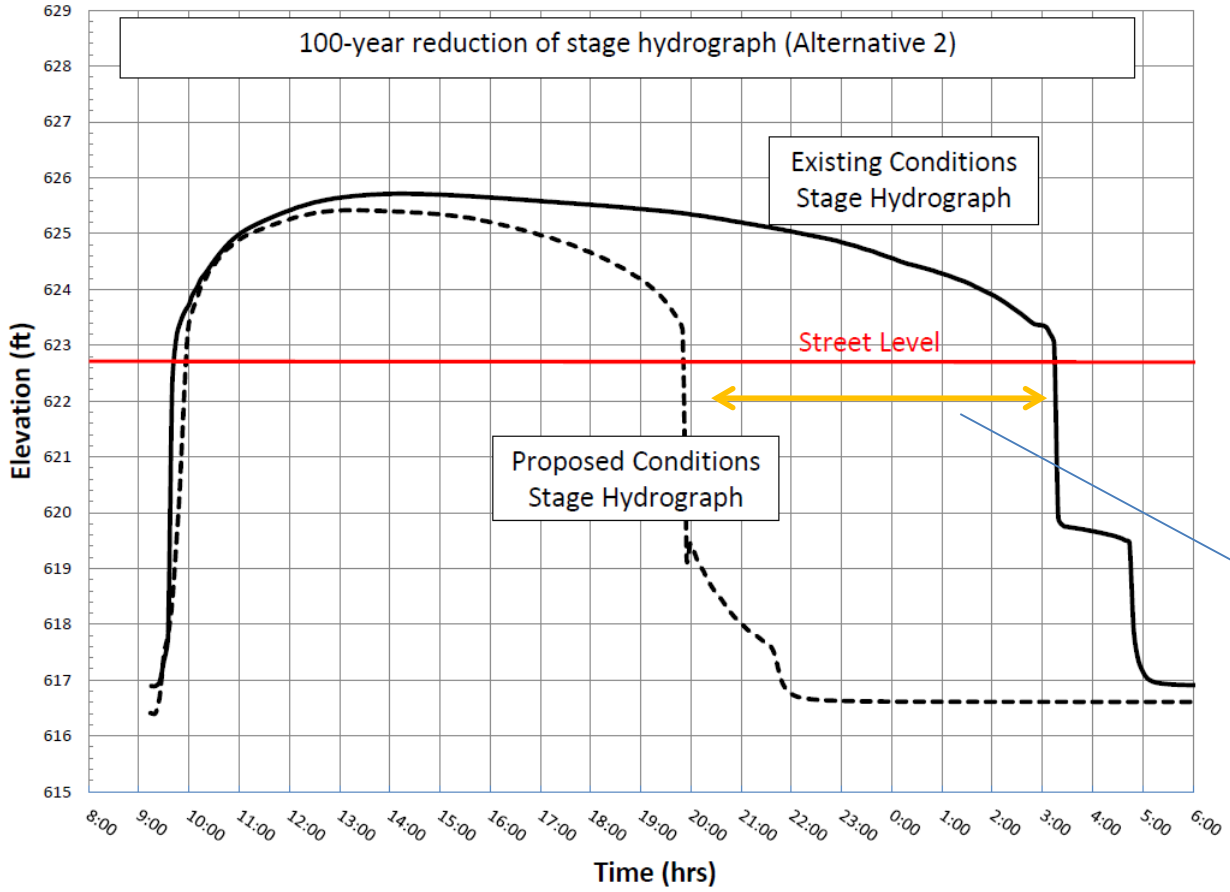
Proposed Drainage Alternative 2

- Project Benefits
  - 10-year flood elevation at or below street elevation at all locations
  - Increased pump station flexibility
  - Does not result in increased floodplain elevation on North Branch Chicago River
  - 100-year storm event street flooding depth reductions:

Location	Existing Flood Depth (ft)	Proposed Flood Depth (ft)	Reduction (ft)
Average All Study Areas	2.0	1.7	-0.3
Valley View Lane	1.4	1.3	-0.1
Beechwood Ave.	3.0	2.7	-0.3
Wilshire Dr.	2.4	2.2	-0.2

Proposed Drainage Alternative 2

- Project Benefits
  - 100-year flood duration reduction



Duration of street inundation reduced by 40%

Proposed Drainage Alternative 2

- Project Benefits
  - Reduction in depth and duration of street and yard flooding
  - Reduction in inflow/infiltration to sanitary system
  - Improved access during storm events
  - Reduction in structures impacted for 100-yr event:

Return Interval Storm Event	Number of Structures Impacted*		% Reduction
	Existing Conditions	Alternative 2	
10-year	120	0	100
25-year	280	90	67
50-year	480	240	50
100-year	700	490	30

*Structure impacted when flood level is within 1 foot of highest lot elevation

Proposed Drainage Alternative 2

- Project Costs
  - Engineer's Estimate = $70 Million
  - Other Costs
    - Long project duration
    - Significant park disruption
    - Roadway disruption
    - Utility conflicts

Proposed Drainage Alternative 3

- Neighborhood Stormwater Storage

Proposed Drainage Alternative 3

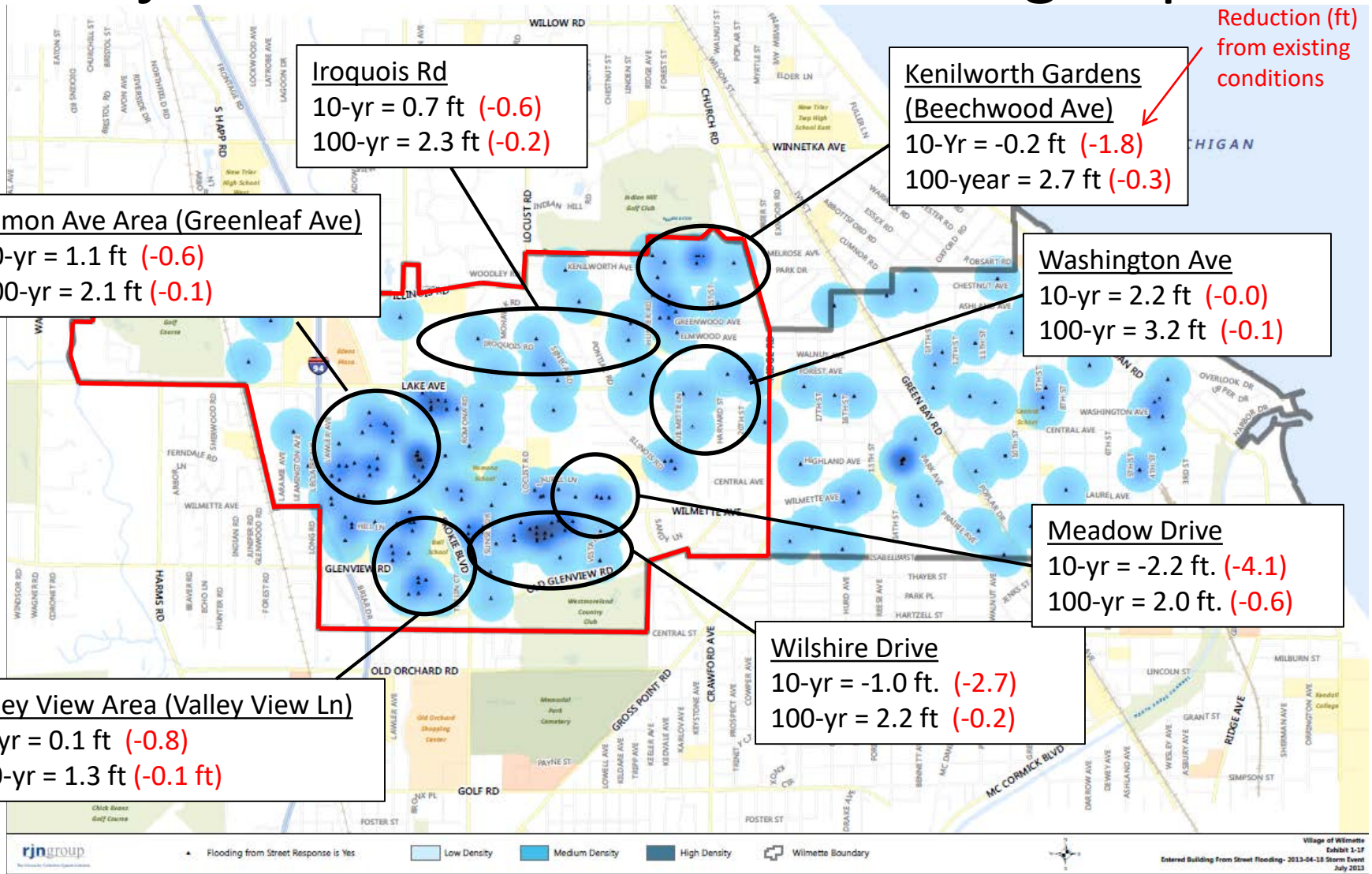
- Smaller underground storage at 3 parks
- Total storage volume = 32 acre-ft
  - Thornwood Park: 10 acre-ft
  - Centennial Park: 12 acre-ft
  - Community Rec Center: 10 acre-ft
- Less trunk and lateral storm sewers required
- Project can be more easily phased
- Does not provide 10-year level of protection to all residents
- Addition of 6th Variable Frequency Drive (VFD) pump (backup) at pump station
  - Redundancy and efficiency purposes only

Proposed Drainage Alternative 3

- Trunk Storm Sewers (2,700 linear feet)
  - Wilmette Ave: 60” storm sewer
  - Hill Lane: 76” x 48” elliptical storm sewer
  - Hunter Road: 60” storm sewer
- Lateral Storm Sewers (11,500 linear feet)

Proposed Drainage Alternative 3

- Project Benefits – Street Flooding Depths



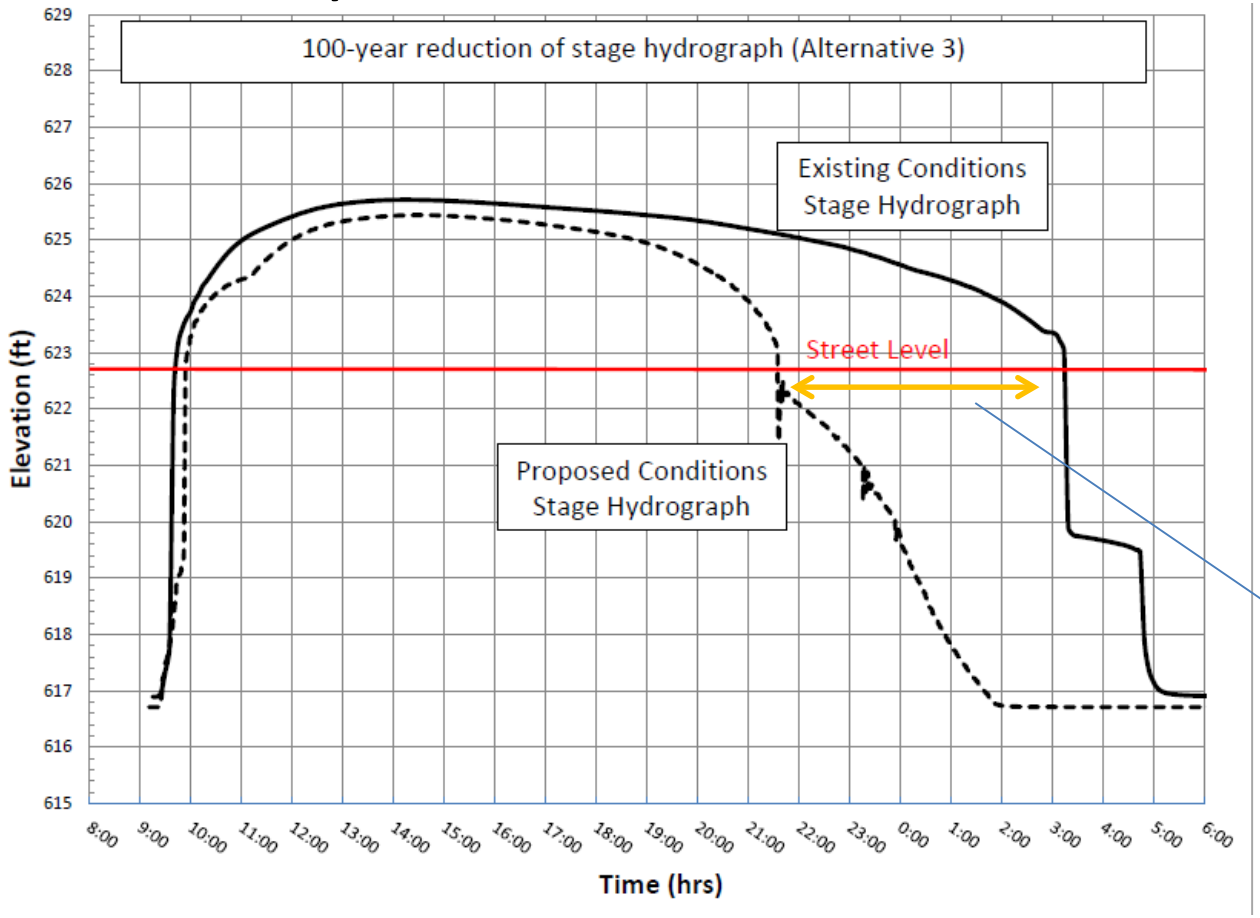
Proposed Drainage Alternative 3

- Project Benefits
  - 10-year flood elevation at or below street elevation at locations adjacent to storage
  - Increased pump station flexibility
  - Does not result in increased floodplain elevation on North Branch Chicago River
  - 100-year storm event street flooding depth reductions:

Location	Existing Flood Depth (ft)	Proposed Flood Depth (ft)	Reduction (ft)
Average All Study Areas	2.0	1.8	-0.2
Valley View Lane	1.4	1.3	-0.1
Beechwood Ave.	3.0	2.7	-0.3
Wilshire Dr.	2.4	2.2	-0.2

Proposed Drainage Alternative 3

- Project Benefits
  - 100-year flood duration reductions



Duration of street inundation reduced by 30%

Proposed Drainage Alternative 3

- Project Benefits
  - Reduction in depth and duration of street and yard flooding
  - Reduction in inflow/infiltration to sanitary system
  - Improved access during storm events
  - Reduction in structures impacted for 100-yr event:

Return Interval Storm Event	Number of Structures Impacted*		% Reduction
	Existing Conditions	Alternative 3	
10-year	120	50	58
25-year	280	160	43
50-year	480	320	33
100-year	700	570	19

*Structure impacted when flood level is within 1 foot of highest lot elevation

Proposed Drainage Alternative 3

- Project Costs
  - Engineer's Estimate = $44 Million
  - Other Costs
    - Multiple & significant park disruption
    - Roadway disruption
    - Utility conflicts
    - Does not provide significant flood reduction to all locations

Summary of Projects

- Short Term Projects
  - Residential flood-proofing
  - High capacity inlets
  - Connection to Glenview system
- Green Infrastructure
  - Village owned property
  - Privately owned property
  - Ordinance requirements
- Long Term Capital Projects
  - Alternative 1 – Relief Sewer System
  - Alternative 2 – Centralized Storage at Community Playfield
  - Alternative 3 – Neighborhood Stormwater Storage

Capital Projects - Benefits and Costs

	Design Storm	Existing	Alternative 1 Relief Storm Sewer System	Alternative 2 Centralized Stormwater Storage at Community Playfield	Alternative 3 Neighborhood Stormwater Storage
Benefits	Number of structures impacted by flooding (% reduction)				
	10-year	120	0 (100%)	0 (100%)	50 (58%)
	25-year	280	60 (79%)	90 (67%)	160 (43%)
	50-year	480	190 (60%)	240 (50%)	320 (33%)
	100-year	700	370 (47%)	490 (30%)	570 (19%)
	Street Flooding Depth in feet (Minimum - Maximum)				
	10-year	0.3 - 2.2	0.0	0.0	0.0 - 2.2
	25-year	0.5 - 2.7	0.0 - 1.7	0.1 - 1.8	0.3 - 2.6
	50-year	0.6 - 3.0	0.0 - 2.2	0.5 - 2.3	0.5 - 2.9
	100-year	0.6 - 3.3	0.0 - 2.6	0.6 - 2.7	0.6 - 3.2
Costs	Total Cost	--	$75 Million	$70 million	$44 million
	Cost per Structure Protected for 100-year event	--	$227,273	$333,333	338,462

Unquantified Benefits

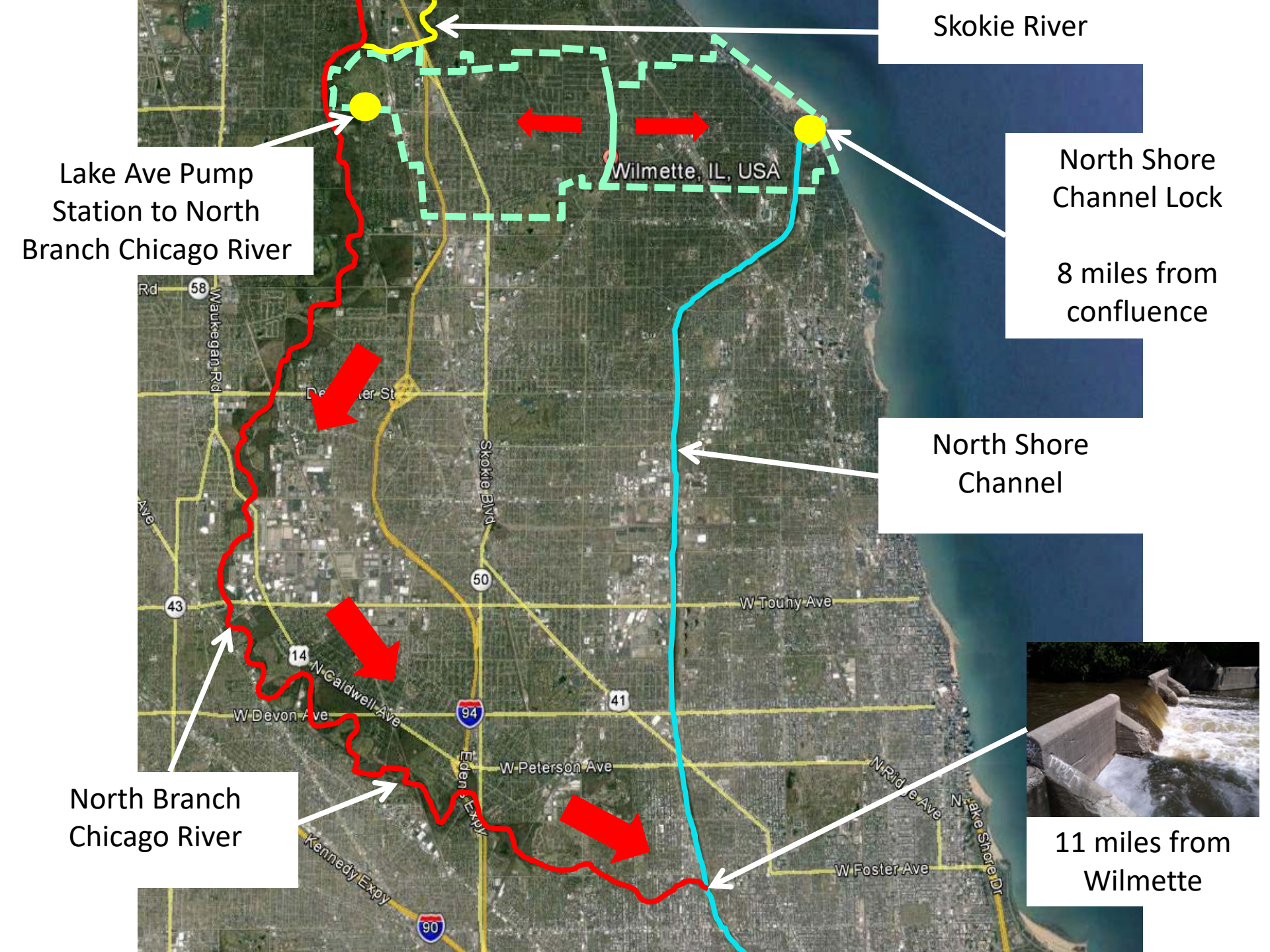
- Reduction in:
  - Duration of street flooding
  - Infiltration into sanitary sewer system
  - Inflow into sanitary system
  - Basement seepage
  - Yard flooding
- Improved access during storm events
- Increased property values

Possible Funding Sources

- Cash Reserves Pay-As-You-Go Funding
- Bonding
- Special Service Area (SSA)
- Stormwater Utility Fee
  - Palatine
  - Winnetka
  - Rolling Meadows
- Metropolitan Water Reclamation District
  - Potential to fund trunk storm sewer lines and flood storage
  - Competitive process & limited resources
  - Benefit-Cost analysis required
- Federal Emergency Management Agency
  - Cook County Hazard Mitigation Plan required
  - Benefit/Cost ratio must be ≥ 1
  - Competitive process & limited resources

End of Presentation

Questions


Skokie River
Lake Ave Pump Station to North Branch Chicago River
Wilmette, IL, USA
North Shore Channel Lock
8 miles from confluence
North Shore Channel
Waukegan Rd
Skokie Blvd
W Touhy Ave
N Caldwell Ave
W Devon Ave
W Peterson Ave
Eden Expy
Kennedy Expy
N Ridge Ave
N Lake Shore Dr
W Foster Ave
North Branch Chicago River
11 miles from Wilmette