

Phase One Report:

RainReady Chatham



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RainReady Chatham
*A Flood Risk Assessment
for Chatham, Chicago*



PREPARED BY
THE CENTER FOR NEIGHBORHOOD TECHNOLOGY
AND THE U.S. ARMY CORPS OF ENGINEERS

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TABLE OF CONTENTS

1	<i>RAINREADY CHATHAM</i>
2	<i>CHATHAM</i>
3	<i>FLOOD RISK</i>
6	<i>SOURCES OF FLOODING</i>
8	<i>CAUSES OF FLOODING</i>
12	<i>EXISTING PLANS AND PROGRAMS</i>
15	<i>NEXT STEPS</i>
16	<i>APPENDIX</i>

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ABOUT CNT

RainReadySM is an initiative of the Center for Neighborhood Technology (CNT). As an award-winning innovations laboratory for urban sustainability, CNT is dedicated to taking on big challenges, starting in small places. CNT helps make neighborhoods, cities, and regions work better, for everyone.

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INTRODUCTION

Chatham, a neighborhood on Chicago's South Side, has been susceptible to flooding since the area known colloquially as Hogs Swamp was first developed in the 1860s. Today, many Chatham residents and business owners experience chronic basement flooding, which is caused by backups in the city sewer system and seepage through below-ground floors and walls, both of which contribute to mold problems and structural damage. Flooding is also common in yards and streets.

Flood-related damages in Chatham are among the worst in Cook County. From 2007-2011, more than \$50 million in damage claims were paid out to residents in the Chatham ZIP codes of 60619 and 60620. The ZIP code 60619 was found to have both the highest number of payouts and the largest dollar value of damage payouts in the county (*The Prevalence and Cost of Urban Flooding*, CNT 2013).

One reason for this vulnerability is the neighborhood's relative position in the sewer network. Chatham sits at the top of two distinct "sewersheds," a network of underground pipes designed to collect and carry stormwater and household water to treatment plants located north and south of Chatham. This sewer configuration, combined with the neighborhood's low elevation and undersized infrastructure, makes Chatham unusually susceptible to basement backups during big storms. Heavy rain in downstream communities frequently overwhelms the aging sewer network, making it difficult for water to get out of Chatham.

However, Chatham sewers have the advantage of not conveying water from any upstream communities. This configuration grants Chatham unusual control over its own flooding. The prevalence of basement backup can be reduced by increasing the amount of rain and snow that is absorbed into the ground using plants, trees, dry wells, and rain barrels. These types of solutions are collectively referred to here as *green infrastructure*.

The path forward for a RainReady Chatham will require solutions at multiple scales. Major investments are needed to upgrade and maintain the sewer network (*grey infrastructure*). Community-wide green infrastructure is necessary for reducing the amount of stormwater runoff entering the sewer system. Individual homes and buildings critically need to be upgraded with plumbing, landscaping and building improvements to reduce their flood risks. This multi-level approach will require substantial educational and financial investment.

The good news is that many of these solutions can bring wider economic benefits to the community: trees, parkway landscaping, and parks absorb water and improve quality of life. Through the RainReady process, flood victims, technical experts, and municipal leaders are already working together to create a shared vision for reducing Chatham's flood risk. This report represents the first phase of this work. The Phase Two report, including a RainReady plan of action that will guide residents and community leaders through implementation of the shared vision, will be published at the end of 2015.

The approach being taken by Chatham can be replicated across the City of Chicago, where hundreds of thousands of residents are at significant risk of flooding. Climate change projections predict that this problem will become more severe in the coming years, as Chicago can soon expect two to three times the number of heavy precipitation events annually (*City of Chicago Climate Action Plan*, 2008). Chatham's process for RainReady planning can be a model for similar efforts across Chicago's South Side and beyond.

RAINREADY CHATHAM

In January 2015, the Center for Neighborhood Technology (CNT), the U.S. Army Corps of Engineers (USACE), and a group of neighborhood flood victims joined together to launch RainReady Chatham. To determine the scope and primary sources of flooding in the neighborhood, USACE completed a flood risk assessment. The analysis included a review of the following materials:

- RainReady community survey, administered March-May 2015 (Center for Neighborhood Technology)
- Citizen-reported flood data from the Gross Gatherings of 2013 (Center for Neighborhood Technology)
- *The Prevalence and Cost of Urban Flooding* (Center for Neighborhood Technology 2013)
- Topographic maps (United States Geological Survey)
- 311 non-emergency calls to the City of Chicago
- Historic development 1938-2009
- LIDAR Flow Path data (City of Chicago)
- Tunnel and Reservoir Plan and Sewer Interceptor Map (Metropolitan Water Reclamation District of Chicago)
- Soil Map (USGS, 1938)
- Building stock and rates of vacancy (City of Chicago)

We also completed a review of existing planning documents and programs designed to reduce flood risk in the community. This included the following materials:

- City of Chicago Capital Improvement Program (2014-2018)
- City of Chicago Rain Blocker Program (2015)
- City of Chicago Basement Flooding Program (2015)
- *City of Chicago Green Stormwater Infrastructure Strategy* (2014)
- *City of Chicago Department of Transportation Sustainable Urban Infrastructure Guidelines* (2013)
- *Illinois Department of Transportation Storm Water Management Plan*
- MWRD Phase II Study Area - City of Chicago Project Overview
- 8th Ward Sewer Flow Map (2015)
- 8th Ward Sewer Capital Improvement Program (2008-2015) and Sewer Cleaning Program (2011-2015)
- *City of Chicago 87th/Cottage Grove Redevelopment Project Area Plan* (2002)
- *Our Community and Flooding, Resource Coordination Policy Committee* (1998)
- *Greater Chatham Initiative* (DRAFT 2015)
- *State Street Complete Streets Project Overview* (2015)

This report provides a summary of the initial flood risk assessment, as well as an overview of existing policies and programs.



CHATHAM

Chatham occupies a special niche in the regional economy of Chicago’s South Side, serving as a long-time home to middle-income African American residents and businesses (Greater Chatham Initiative 2015). The vitality of this community has suffered in the wake of the 2008 recession, the housing crisis, and the ongoing flood emergency. Since 2008, the unemployment rate has risen to 15.32%, more than double the Cook County average

of 6.2%. The median household income is \$36,910, compared to the Cook County median household income of \$54,548 (2010 U.S. Census). Community leaders believe Chatham is at a critical moment in its trajectory, and residents and civic leaders must join together to bolster the economic, cultural, and infrastructural vitality of the community and become a “beacon for the South Side” (Greater Chatham Initiative 2015).



FLOOD RISK

The scope and severity of flooding in Chatham is well-documented. In an analysis of flood damage payouts from private insurance companies and federal disaster relief funds, the Chatham ZIP code 60619 ranked the highest among all 169 Cook County ZIP codes, both in the number of claims paid out and the total value of damages paid to residents. The neighboring Chatham ZIP code of 60620 was ranked fourth and ninth in claims and payouts, respectively. In these two ZIP codes, more than \$50 million in damages were paid out from 16,790 claims between 2007-2011 (*Prevalence and Cost of Urban Flooding*, Center for Neighborhood Technology 2013).

In 2013, the year floods caused Cook County to declare a Federal Disaster, at least 465 claims were paid to homeowners by private insurance providers alone. These damage payouts totaled more than \$3.3 million in damage payouts in 60619 and 60620. The highest single payout in 2013 was \$33,588. The median payout was \$5,250, and 14 payouts topped \$20,000 in damages (CNT 2015). Note that these figures reflect only private insurance data, and are therefore a conservative estimate of damages in Chatham.

Indeed, several publically available documents depict extreme vulnerability to flooding in Chatham. The *Great Lakes and Mississippi River Interbasin Study* suggests a 10-year flood risk in portions of Chatham, and a 25-year level in the rest of the neighborhood (USACE 2014). Chatham’s flood risk is among the highest in Chicago.

Residents report flood incidents widely across the neighborhood without any apparent geographical concentrations. In a RainReady survey completed by 208 Chatham residents, 84% of respondents reported flooding on their properties (Figure 1, red circles). At CNT’s Gross Gathering, a 2013 event for flood victims, community members reported street and structure flooding across the neighborhood (Figure 1, blue rectangles and green dots). Data collected from 311 non-emergency calls during the historic April 2013 floods (Figure 1, pink triangles, green circles) reflect the same reality: flooding in Chatham is widespread.

Moreover, flooding occurs frequently and with costly consequences. More than 40% of flooded survey respondents have experienced at least 10 flooding events

ZIP CODE	Rank in Total Amount of Claims out of 169 ZIP Codes	Rank in Total Number of Claims out of 169 ZIP Codes	Number of Claims	Amount of All Claims
60619	1	1	9,350	\$29,357,563.01
60620	9	4	7,440	\$20,940,290.26



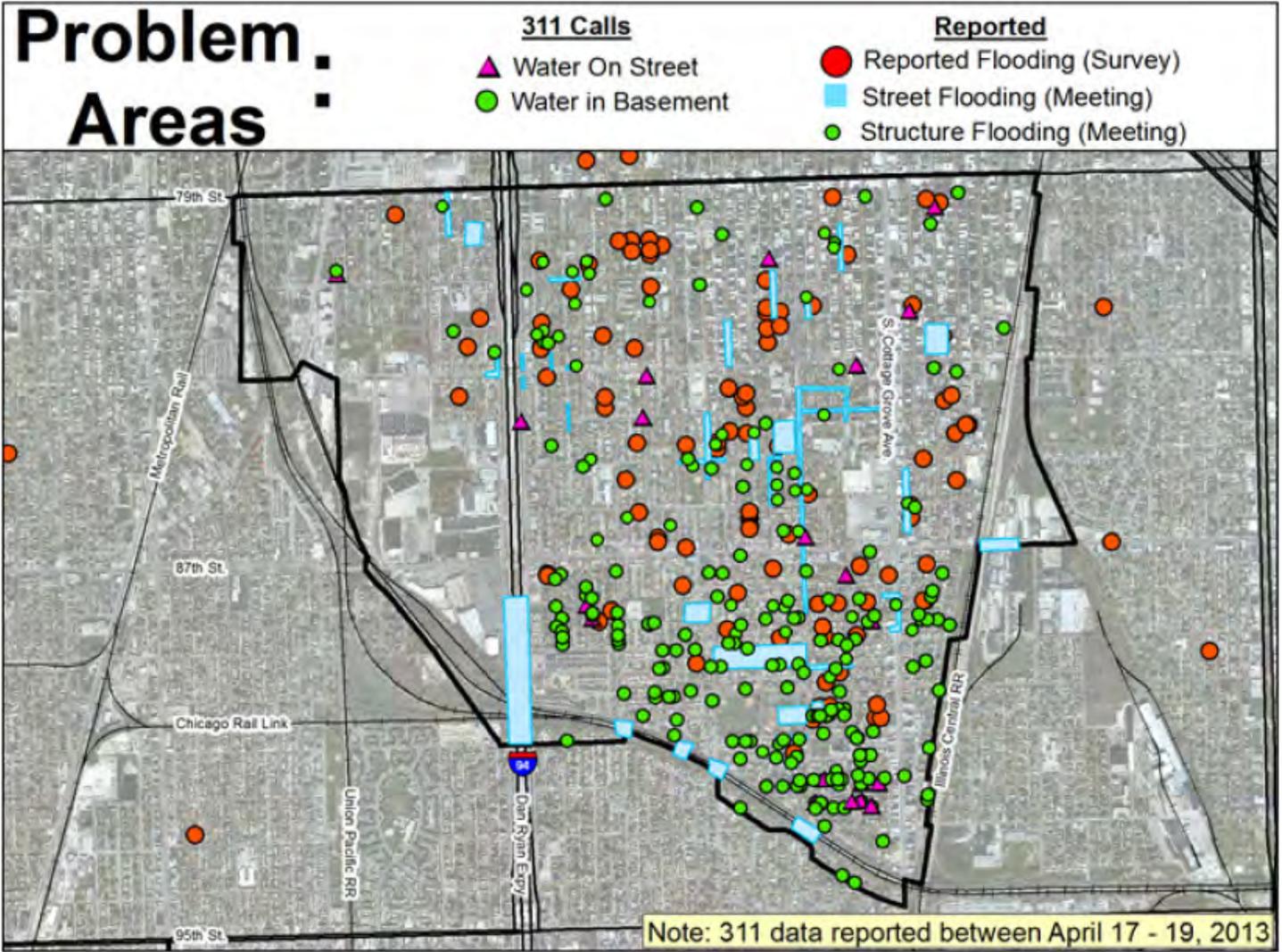


FIGURE 1: PROBLEM AREAS
 Map courtesy of the U.S. Army Corps of Engineers

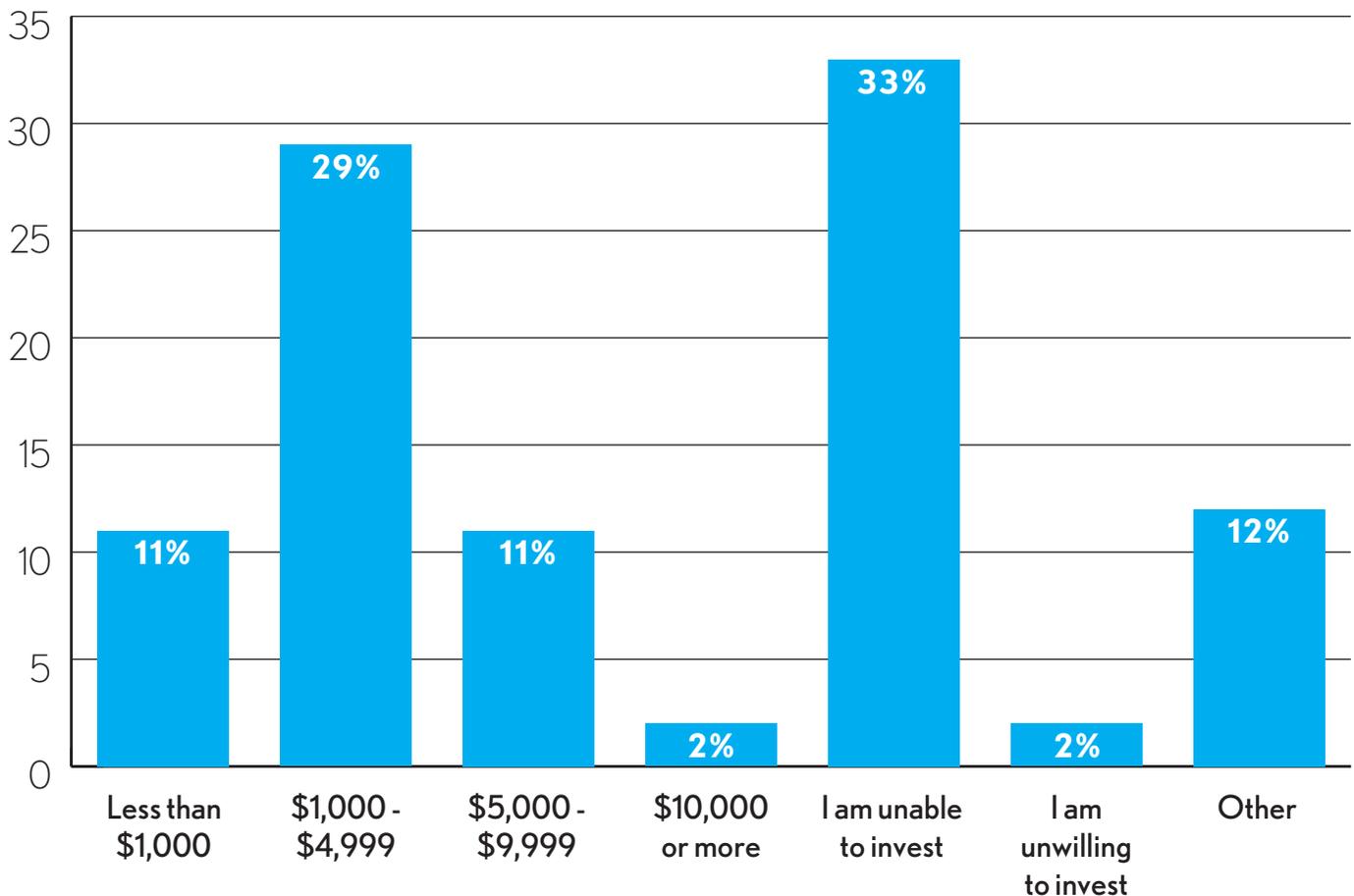
on their properties. 53% of these flood victims have accumulated more than \$10,000 in damages, with 25% reporting more than \$20,000 in damages. Still, residents seek a proactive solution. In spite of substantial financial losses from flooding, homeowners express a willingness to invest in flood prevention measures (see Figure 2). Indeed, many residents have already invested in costly flood prevention measures (Table 1) and continue to experience flooding in their homes. Homeowners need customized guidance on the appropriate solutions to reduce their risks of flooding.

Flood Prevention Measure	Respondents Implemented
Sump pump	64%
Overhead sewer	4.4%
Backwater valve	11%
Rain garden, rain barrel, or permeable pavement installed on property	16.5%
Building sewer checked for cracks or leaks	38%

TABLE 1: FLOOD PREVENTION MEASURES IMPLEMENTED BY RESPONDENTS

FIGURE 2: WILLINGNESS TO INVEST IN FLOOD PREVENTION MEASURES

Willingness to Invest in Flood Prevention Measures



SOURCES OF FLOODING

Flooding in Chatham, like the urban floods affecting much of Cook County, takes two primary forms: **sanitary sewer backup** and **foundation seepage**. It is also common for water to pool in the yard, enter the building through windows or doors, or overflow from the street. Residents frequently experience multiple types of flooding.

Table 2 and Figure 2, below, summarize the types of flooding reported by survey respondents.

Type of Flooding	Respondents Reporting
Basement backup	63%
Seepage	54%
Through windows and doors	20%
Pooling in the yard	29%
Street overflow	23%
Other	9%

TABLE 2: TYPES OF FLOODING REPORTED BY SURVEY RESPONDENTS

Sewer Backup

Sewer backup is common throughout the neighborhood, frequently affecting floor drains and toilets in basements, and manholes in public streets and alleys. This type of flooding occurs when local sewer networks are overwhelmed by a high-intensity storm, causing mixed rainwater and raw sewage to enter basements and streets through the lateral lines that connect each building to the mainline sewer running under city streets (Figure 2, below). Basement backup is not only a nuisance, but also a serious public health hazard when residents attempt to clean up raw sewage without necessary protection

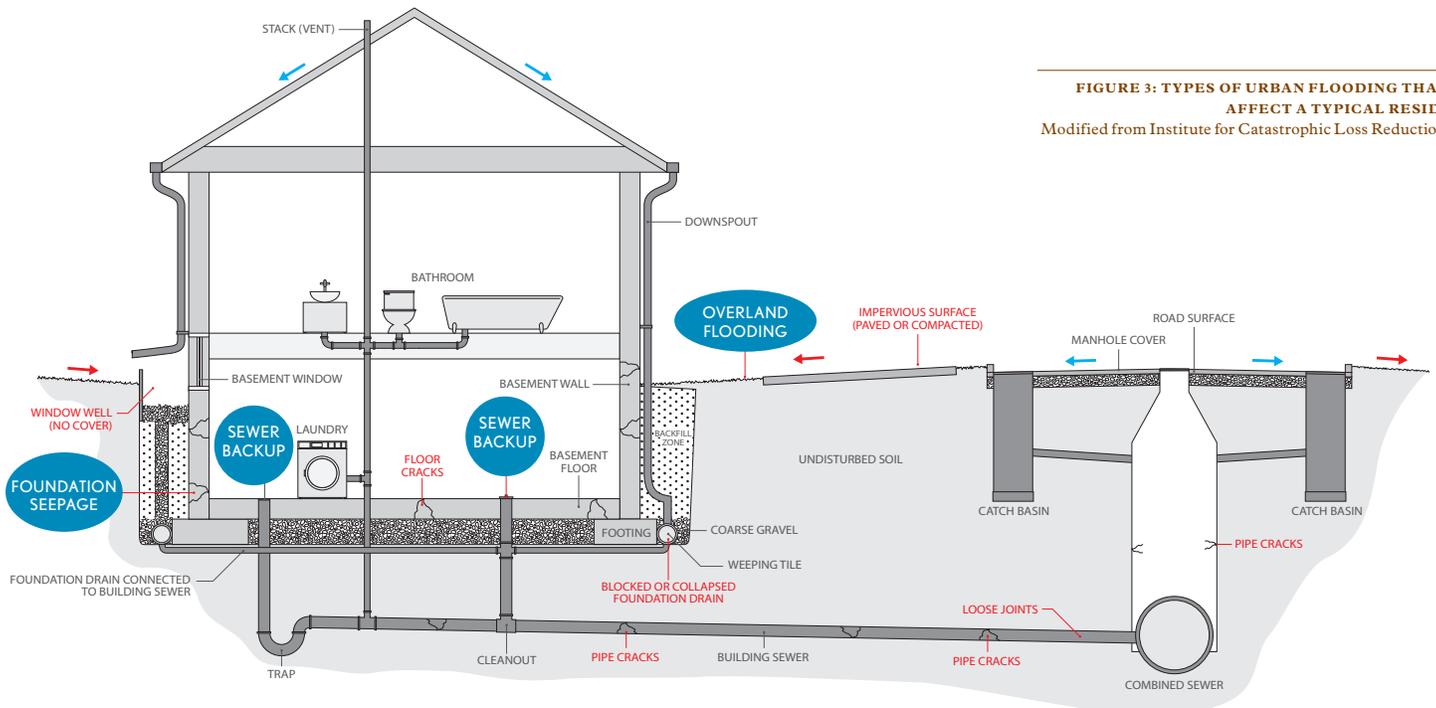


FIGURE 3: TYPES OF URBAN FLOODING THAT CAN AFFECT A TYPICAL RESIDENCE
Modified from Institute for Catastrophic Loss Reduction 2009

Foundation Seepage

Foundation seepage is the process through which water enters a basement through cracks in the foundation walls, floors, or at the cove joint, where the walls and floor meet. Left unaddressed, seepage can cause rot and the growth of mold and mildew. Over time, seepage can cause structural damage due to excess moisture. In Chatham, seepage is commonly caused by poorly draining soils and water that pools in the yard adjacent to the building foundation. 100% of survey respondents reporting seepage also experienced damage related to mold.



Photo Credit: Angela Schmeidel Randall/Flickr, Creative Commons License

CAUSES OF FLOODING

The primary contributors to urban flooding in Chatham are familiar to much of the Chicago region: a low-lying topography, an aging sewer system, a changing climate, and development that paved over much of the city's once open marshland.

While flooding in Chicago is certainly nothing new - records show that Chicago's earliest European explorers, Father Marquette and Louis Joliet, were forced to move their encampment due to flooding in 1673 (*Our Community and Flooding*, Illinois Department of Natural Resources 1998) - the scope and severity experienced by Chatham residents inspire a new urgency to pursue collaborative solutions.

These contributors include:

Topography and Development

The Chatham neighborhood, located in an area once known as Hogs Swamp, is one of the lowest points in

Chicago (Figure 4). The depression in elevation can cause water to pool in the streets (see section on the Dan Ryan Expressway on page 11) and contribute to backup in the sewer system where pumps struggle to overcome gravity.

In the second half of the 20th century, uncontrolled urban development occurred within natural floodplains, paving over wetlands and low-lying areas to meet demand for residential and commercial development (*Our Community and Flooding*, Illinois Department of Natural Resources 1998). Chatham changed rapidly from open, permeable grasslands into impervious residential and commercial development (Figures 5-7). As a result, there were fewer opportunities for storage and infiltration of stormwater, and the volume of runoff from paved streets, driveways, and roofs increased proportionately. Today, over 50% of the neighborhood is comprised of impervious surfaces (Geosyntec 2015).

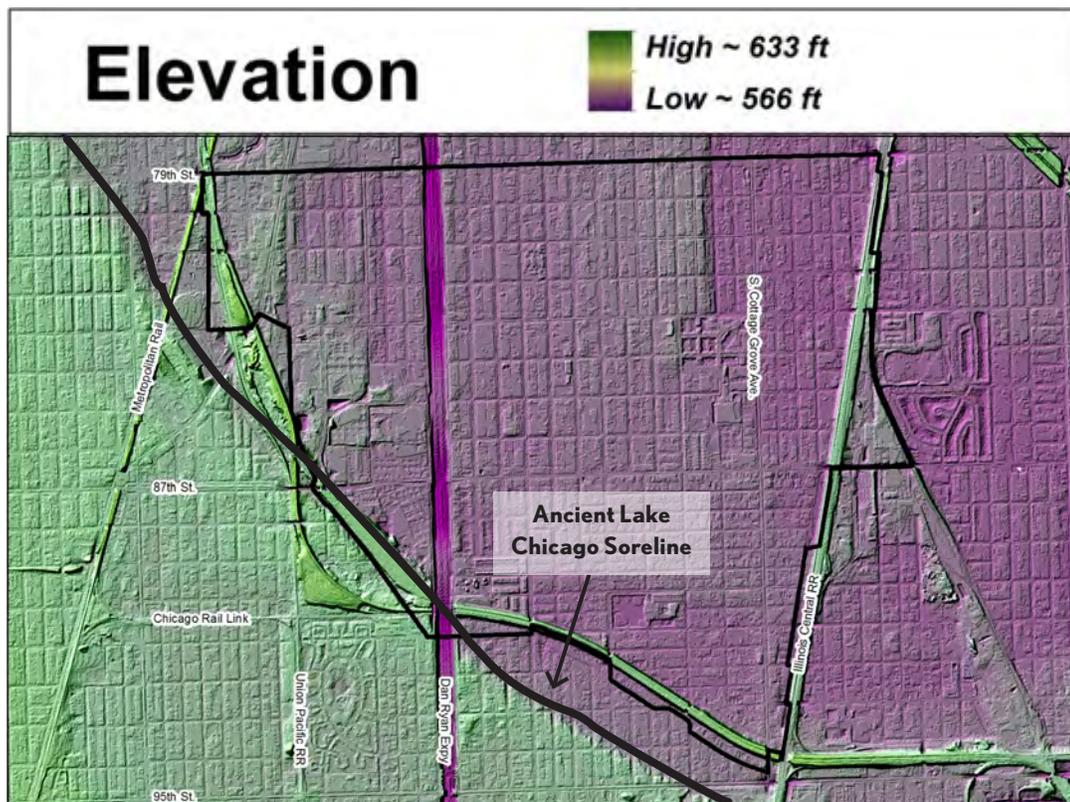


FIGURE 4: ELEVATION
Map courtesy of the U.S.
Army Corps of Engineers

Historic Aerial Photos - 1938



Historic Aerial Photos - 1978



Current Conditions - 2009 Aerial Photos



Changing Climate

In part, the recent rise in flooding across Cook County, as well as around the world, can be attributed to an increase in precipitation, particularly the high-intensity, short-duration storms associated with global climate change. Climate change is also affecting the total volume of water falling on Midwest cities. According to the Illinois State Water Survey, average annual rainfall in Chicago has increased over the last 20 years (Figure 8, MWRD). The climate is changing, and Chatham residents are experiencing a “new normal” in weather patterns.

Aging Sewer System

Chicago began the construction of its sewer system in 1856 (Combined Sewers, City of Chicago website 2015). The pipes serving Chatham are roughly the same age as its building stock: between 50 and 75 years old (Figure 14 in Appendix: “Approximate age of structure on parcel”). Since then, both the number of households contributing wastewater to the system and the percentage of impervious surfaces in the area have increased substantially (Combined Sewers, City of Chicago website 2015). Paired with the increasing frequency of high-intensity storms, the original network of sewer pipes in Chatham is no longer sufficient to serve demand. A 2002 redevelopment study that focused on the Cottage Grove corridor in Chatham and Greater Grand

Average Annual Rainfall in Chicago: 1991-2011
Illinois State Water Survey Cook County Precipitation Network Station 10

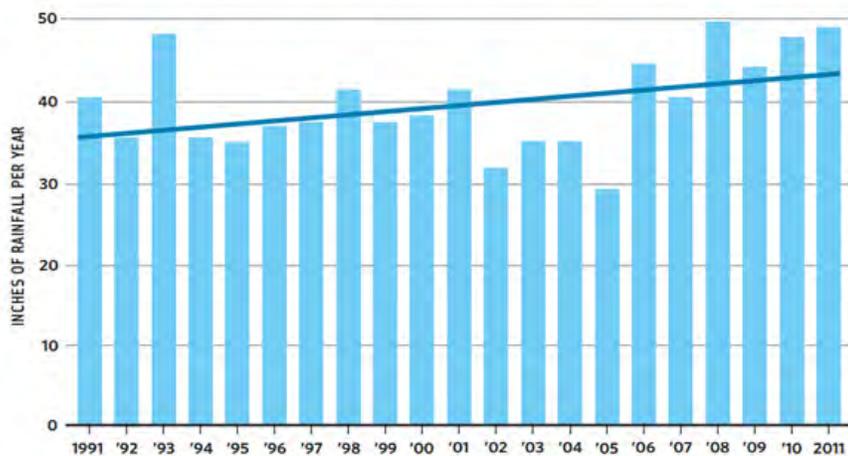


FIGURE 8: AVERAGE ANNUAL RAINFALL IN CHICAGO: 1991-2011
Courtesy of MWRD, Illinois State Water Survey

Crossing determined that 93% of buildings are serviced by inadequate utilities (*87th/Cottage Grove Redevelopment Project Area Tax Increment Financing District Eligibility Study*, City of Chicago 2002).

Moreover, these systems require regular cleaning and repair. The City of Chicago spends \$50 million annually maintaining 4,400 miles of sewer lines and 340,000 related structures (Combined Sewers, City of Chicago website 2015).

For this report, we were unable to get detailed information from the City about the maintenance and repair requirements of the sewer system in Chatham, or the allocation of services to complete this work.

Dan Ryan Flooding

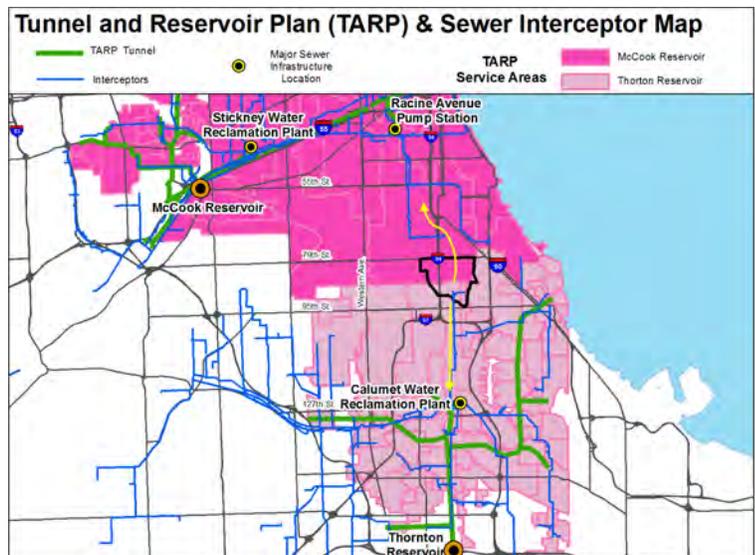
Historically, the Dan Ryan Expressway (I-94) flooded during extreme rain events, requiring the roadway to be closed to traffic. In 2003, the Illinois Department of Transportation (IDOT) completed construction of a new drainage system for the Dan Ryan, including increased underground storage, new pumps, and improved conveyance to the existing outfall sewer. Residents and public officials have reported that I-94 no longer floods.

Top of the Sewershed

Chatham sits at the top of two distinct sewersheds, networks of underground pipes designed to collect and carry stormwater and household water out of the community for treatment. After leaving Chatham, combined sewer water travels through downstream communities before entering the large interceptor sewers that carry water to the Stickney Water Reclamation Plant in the north and Calumet Water Reclamation Plant in the south (Figure 9). During periods of heavy rain, precipitation falling in downstream communities can fill the City sewer network to capacity. Since water in Chatham is the last to feed into the sewer system, it can sometimes be blocked from leaving the neighborhood. This causes stormwater runoff and household water from Chatham to back up into basements and public streets.

There is an unusual benefit of this configuration, however. Chatham sewers do not convey water from any other community upstream. This configuration grants Chatham unusual control over its own flooding. If Chatham can reduce the volume of water running off streets, driveways, roofs, and parking lots in the neighborhood, it can have a significant impact on reducing its flooding problems.

FIGURE 9: TUNNEL AND RESERVOIR PLAN (TARP) AND SEWER INTERCEPTOR MAP
Map courtesy of the U.S. Army Corps of Engineers



EXISTING PLANS AND PROGRAMS

RAINBLOCKER PROGRAM

In 1998, the City introduced a program to reduce basement backup by using city streets as temporary storage during heavy storms. Inlet restrictor valves, or “rainblockers,” are installed at catch basins on city streets, where they regulate the flow of water from the street into the main sewer line. During a big storm, the rainblocker allows less water through the drain, reducing peak demand on the sewer and temporarily filling the street with water. Water is slowly drained from the street into the sewer system.

Rainblockers are most effective at reducing basement backup when building downspouts have been disconnected from city sewers. The City encourages residents to direct water from their downspout into private green infrastructure, or public alleys and streets where the water can be stored by rainblockers. Rainblockers have some disadvantages, however. Sometimes water will overflow from streets, making its way back into homes via doors or below-grade windows. Street flooding can also cause damage to cars and create public safety concerns. Strategically installed green infrastructure can reduce these risks by capturing and infiltrating runoff into the ground.

Rainblockers were originally installed in Chatham, but most have been removed at the request of residents who were concerned about street flooding.

RESIDENTIAL IMPROVEMENTS

Just as public sewers require maintenance, private sewers must be regularly cleaned, repaired, and monitored. Many homeowners are unaware that private lateral lines, the pipes that connect household plumbing to City-owned sewers, are the financial and legal responsibility of the homeowner. The City’s Private Drain Program provides a free service to homeowners who can show they have broken drain tiles in the lateral lines between the sidewalk and the mainline sewer. A licensed sewer contractor must first rod and/or make a video inspection of the drain line (Private Drain Program, City of Chicago website 2015). This type of inspection can help to identify repairs that may be needed to reduce basement backup.

CNT’s RainReady Home initiative piloted a program to conduct risk assessments of individual households, help homeowners prioritize solutions to reduce their risk, and partner with local contractors to complete the work. The assessments were offered free of charge, but the homeowner was responsible for the cost of construction. This program has been successful in reducing flood risk among participants who could afford to implement the recommendations, and could be considered for a publically financed expansion to help reduce household flood risk across Chatham.



BASEMENT FLOODING PARTNERSHIP

The City manages a Basement Flooding Partnership through which communities receive technical support to address localized flooding. The City will inspect and clear catch basins and local sewers, and walk the neighborhood to review problem areas and provide guidance to community members on landscaping solutions.

Communities must demonstrate interest from 70% of residents to be considered for this program (Basement Flooding Partnership, City of Chicago website 2015).

CHICAGO GREEN INFRASTRUCTURE STORMWATER STRATEGY

In 2014, the City of Chicago Department of Water Management (DWM) allocated \$50 million for green infrastructure over the next five years. The funds will be invested in existing and future capital projects, leveraging partnerships with the Department of Transportation (DOT) and Park District, rather than standalone stormwater infrastructure projects.

The Chicago Green Infrastructure Stormwater Strategy emphasizes a period of modest experimentation and monitoring to inform new maintenance procedures and design specifications for implementation across the city. The City will complete a Green Infrastructure Study using its trunk sewer model, “Infoworks,” to perform cost-benefit analyses of various green and grey infrastructure scenarios. Specific opportunity areas identified include: permeable pavement parking lanes, parkway bioswales and tree plantings, and green alleys.

The first round of projects funded through DWM’s Green Infrastructure Stormwater Strategy included a project in Chatham: the Cottage Grove Avenue Project.

COTTAGE GROVE AVENUE PROJECT

CDOT and DWM have partnered to install green infrastructure in conjunction with the transportation improvement project on Cottage Grove Avenue from 77th Street to 83rd Street. This project includes \$1.2 million in green infrastructure amenities, including permeable pavers, native plants, and tree pits. CDOT estimates that the project will divert over 113,000 gallons of stormwater over a typical two-hour five-year storm. Work is expected to begin in 2016.



Photo source: City of Chicago “Landscaped Medians”

GREY INFRASTRUCTURE INVESTMENT

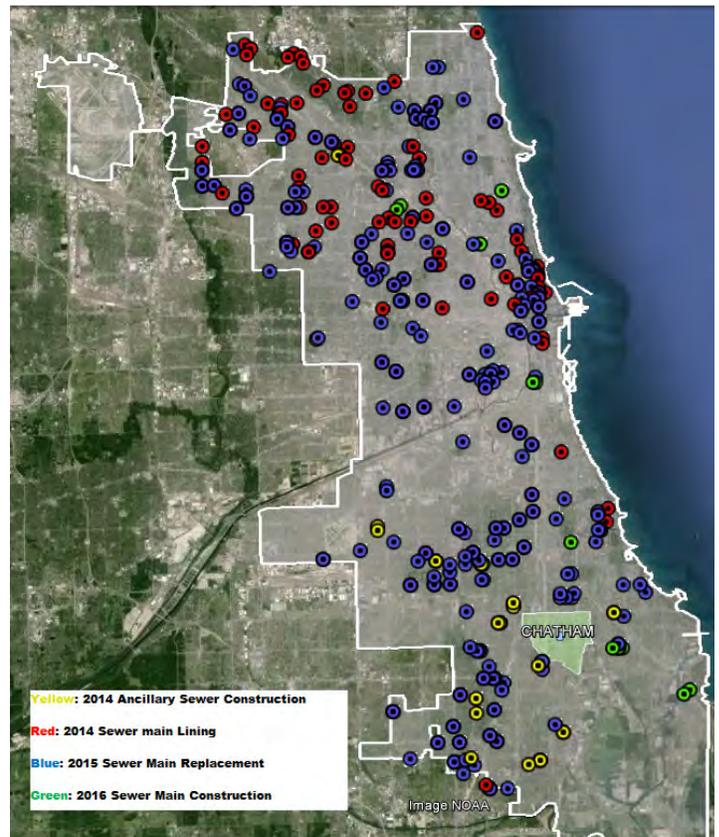
In addition to green infrastructure investment, the scale of flooding currently experienced in Chatham also needs to be addressed through strategic investment in grey infrastructure. In 2012, the City of Chicago’s Department of Water Management (DWM) announced a goal of rebuilding or relining 750 miles of sewer mains, relining 140,000 sewer structures, and upgrading four pumping stations across Chicago in the next ten years. Approximately \$1.6 billion has been allocated from the City’s Capital Improvement Program for this program’s 2014–2018 work (2014–2018 Capital Improvement Program). Construction costs are typically \$5–6 million per mile for sewer replacement. These improvements will be funded through water and sewer fees, as well as water and sewer revenue bonds.

These priority investments were selected based on physical inspection, maintenance and repair records, and the City’s trunk sewer model, Infoworks (2014–2018 Capital Improvement Program; Chicago Green Stormwater Infrastructure Strategy 2014); however, additional information on this analysis is not publically available at this time.

Note that none of these projects are scheduled to occur in Chatham (Figure 10), though Chatham has the potential to benefit from sewer improvement projects located downstream in the sewershed. We have not yet received more detailed information from the City regarding its process for determining future maintenance and sewer replacements.

FIGURE 10: PLANNED SEWER REPLACEMENT AND MAINTENANCE FROM THE CITY OF CHICAGO CAPITAL IMPROVEMENT PROGRAM, 2014 - 2018

Map courtesy of CNT



NEXT STEPS

Urban flooding is one of the most serious resilience challenges confronting the Chicagoland region. A city built on a swamp with diminishing impervious surfaces and a century of deferred infrastructure maintenance is now facing serious challenges from high-intensity storms and record-breaking precipitation. The City is confronting this challenge across the urban center, where hundreds of thousands of residents are at risk of flood damage. The need for greater resilience in social networks and physical infrastructure is significant.

Just as the cause of flooding in Chatham is complex and multifaceted, the solution must also approach risk

reduction at multiple scales. CNT's RainReady program is devising a strategy in partnership with the City of Chicago to bring multiple benefits to the community, leveraging stormwater investments to advance economic revitalization efforts, improve air quality and aesthetics, and support new transportation options. This strategy will form the basis of the RainReady Chatham Plan, expected to be complete later in 2015.

RainReady Chatham is convening these parties in pursuit of a shared vision to reduce the negative impacts of flooding and create a replicable model for building community resilience on the South Side of Chicago.



APPENDIX

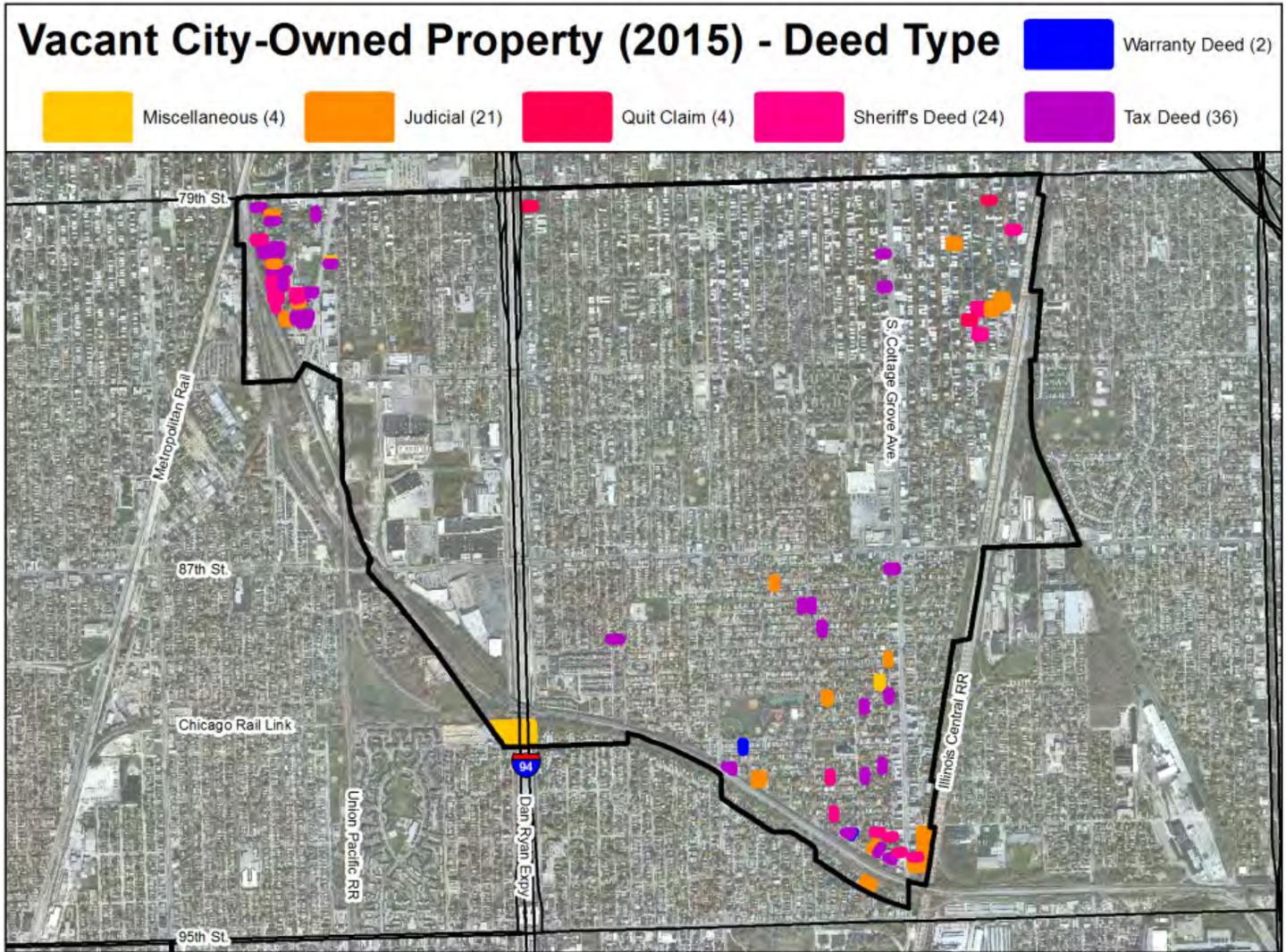


FIGURE A-1: VACANT CITY-OWNED PROPERTY
Map courtesy of the U.S. Army Corps of Engineers

1932 USGS Soil Map

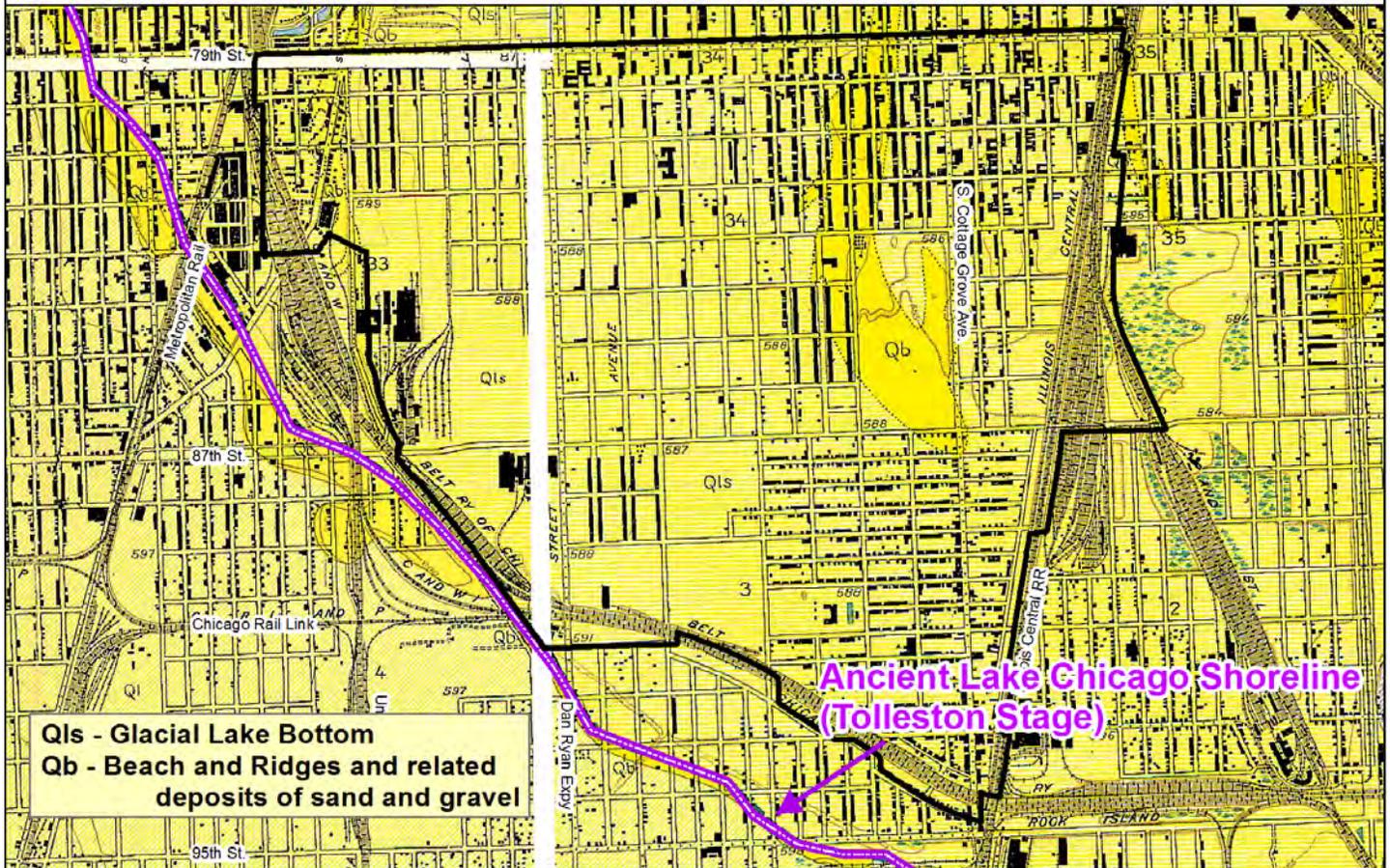


FIGURE A-2: 1932 USGS SOIL MAP
Map courtesy of the U.S. Army Corps of Engineers

Approximate age of structure on parcel

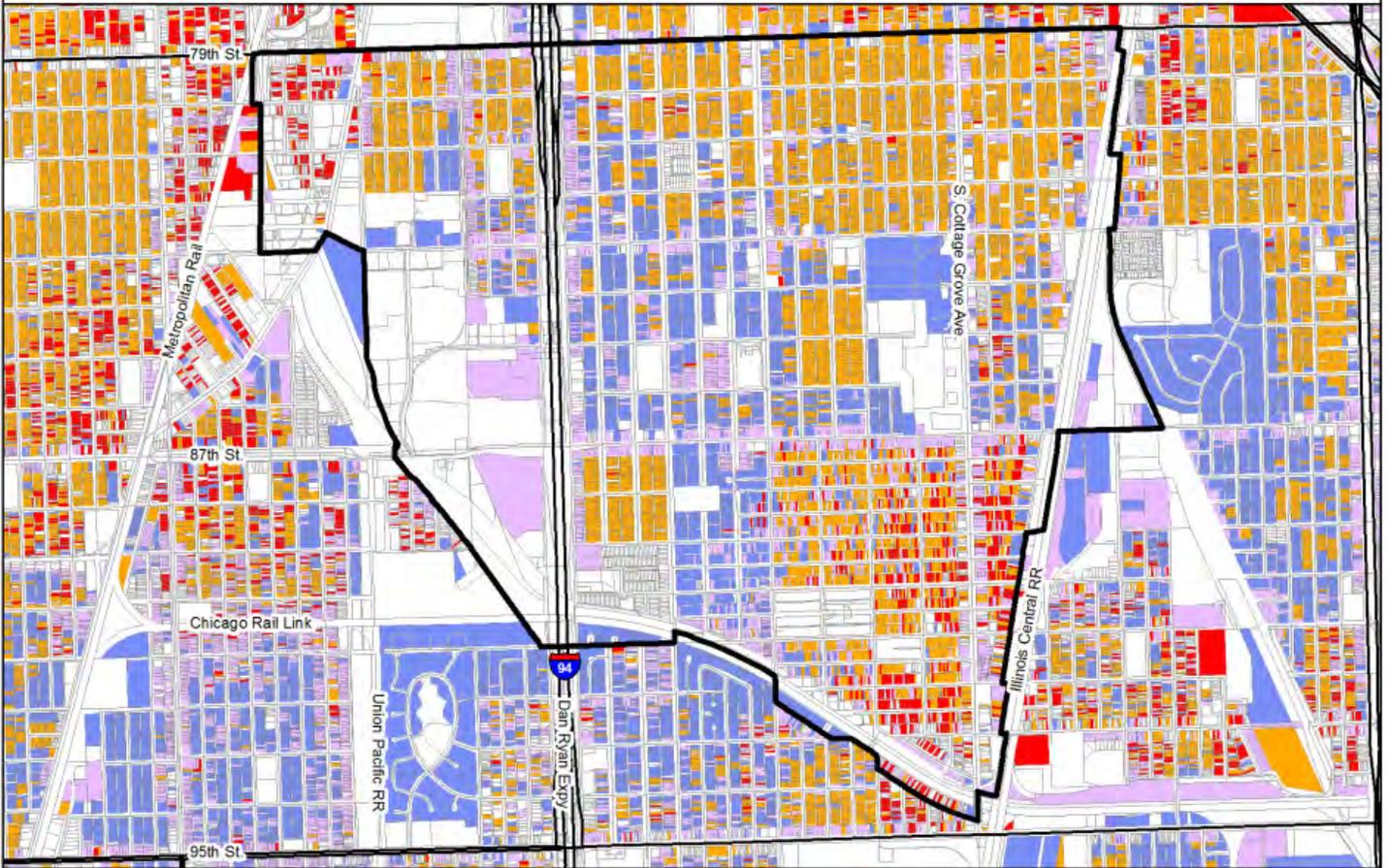
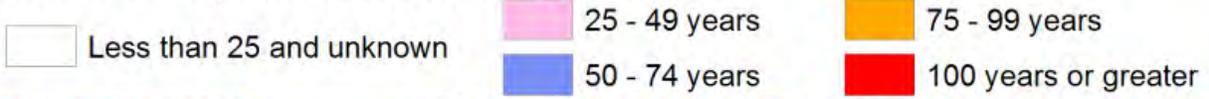


FIGURE A-3: APPROXIMATE AGE OF STRUCTURE ON PARCEL
Map courtesy of the U.S. Army Corps of Engineers

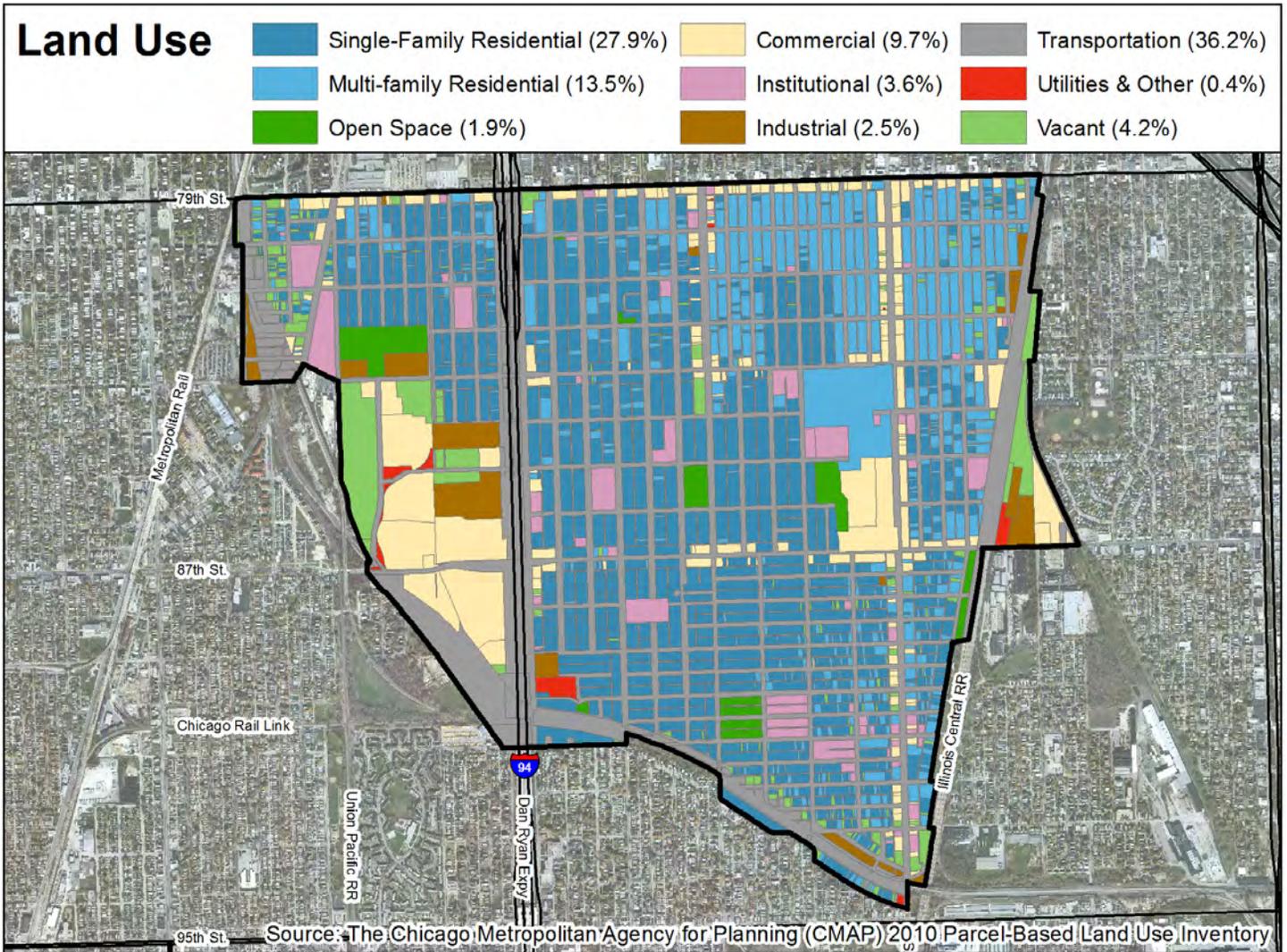


FIGURE A-4: LAND USE
 Map courtesy of the U.S. Army Corps of Engineers

