

**CHICAGO PARK DISTRICT
&
CHICAGO DEPARTMENT OF TRANSPORTATION**

**LAKE MICHIGAN HIGH WATER LEVEL
SHORELINE ASSESSMENT**

541 N. Fairbanks
Chicago, IL 60611

FINAL REPORT

PREPARED BY:

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Project Number: 12153

July 15, 2020

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Executive Summary

On January 10-12, 2020, the City of Chicago was subject to a damaging Lake Michigan storm, with high winds and large waves. Several transportation corridors were either partially or fully closed, and several private property owners located close to the lakefront suffered damage. In addition, areas owned by the Chicago Park District were subject to overtopping, flooding, erosion and damage. The Chicago Park District and their partner, Chicago Department of Transportation (collectively, the “City”), retained SmithGroup to perform a rapid-response inspection and assessment of the Lakefront.

Between January 21, 2020 and January 28, 2020 assessment teams with the City of Chicago (Department of Buildings, OEMC, CDOT or other departments) attempted to access and assess approximately 80 buildings, the majority of which were private properties predominantly in the 7th, 48th, and 49th Wards. The primary desired output of the inspections was to provide enough information to the City in order to identify the most vulnerable properties located on the lakefront and to respond effectively in the event of future storms.

Assessment of the architectural integrity and structure of buildings was primarily based on visual observations and verbal information. While on site, the teams observed the site surrounding the building and the interior of any areas that sustained damage or are vulnerable to damage, such as below grade parking adjacent to lake levels. Assessment of the vulnerability of building mechanical, electrical, plumbing and fire protection/life safety (MEP) systems due to flooding based on visual observation and verbal information gathered from personnel leading each walkthrough. The focus was to determine the potential for damage to MEP systems and the consequences to the building and occupants in the event of flooding in these spaces.

Combining an assessment of the coastal conditions, recent history of flooding, and the building ratings generated an overall vulnerability index, which highlights those properties where the risks of lakefront flooding are greatest. Table ES-1 “Private Property Lakefront Vulnerability” shows a listing, by Ward from south to north, of the individual private buildings included in the assessment. Public buildings, along with those owned and maintained by Loyola University, are not shown on Table ES-1. One of the primary risks to the publicly-owned facilities (Park District fieldhouses and concessions, and the Department of Water Management’s water purification plants – none of which are inhabited) is the continued high water levels, which can impact day-to-day operations.

In addition to the building assessments, between January 29, 2020 and January 30, 2020, approximately 10 miles of Chicago Park District owned lakefront was assessed to collect information related to the nature and extent of damage sustained during the January 11, 2020 storm. Over \$15,000,000 in damage to the lakefront parks was documented.

Lastly, potential options to increase resilience were researched and summarized along with a description of the general applicability of each, relative order of magnitude costs were investigated. The typologies were organized by scale ranging from an individual building at the smallest scale to options that could be deployed across an entire neighborhood.

Table ES-1 – Private Property Lakefront Vulnerability



PROPERTY ADDRESS	NUMBER OF UNITS ¹	VULNERABILITY INDEX ²	Jan 11, 2020 FLOODING	SENIORS ³ / ASSISTANCE ?	ROW ⁴ FLOODING ?	MEP ^{5,6} EXPOSURE	OTHER CONSIDERATIONS
WARD 7 (Lakefront Boundary: 83rd Street - 71st Street)							
2567 E 72ND PLACE	SFH	10	Yes		Yes	High	Entire first floor flooded during 01/11/20 storm
2666 E. 73RD STREET	24 UNITS	9	Yes	Yes		High	Waves have broken windows and flooded ground floor
7337 S. SOUTH SHORE DRIVE	360 UNITS	9	Yes			High	Overtopping water enters parking garage
7321 S. SOUTH SHORE DRIVE	OVER 10 UNITS	7	Yes			High	Serious damage to shoreline protection on 01/11/20
7251 S. SOUTH SHORE DRIVE	239 UNITS	6	Yes			Moderate	Water in elevator pit during 01/11/20 storm
7447 S. SOUTH SHORE DRIVE	OVER 10 UNITS	6	Yes			High	
7425 S. SOUTH SHORE DRIVE	104 UNITS	4	Yes				
7233 S. SOUTH SHORE DRIVE	SINGLE BUILDING	4	N/A			High	
2772 E 75TH STREET	OVER 10 UNITS	3	Yes	Yes	Yes		
2571 E. 71ST STREET	SFH	3	N/A				
7241 S. SOUTH SHORE DRIVE	SFH	3	N/A				
2564 E. 72ND PLACE	5-10 UNITS	2	N/A		Yes		
WARD 5 (Lakefront Boundary: 71st Street - 49th Street)							
La Rabida Children's Hospital	HOSPITAL	2	No	Yes	Yes	High	MEP room louvers exposed to the lake
6730 S. SOUTH SHORE DRIVE	OVER 10 UNITS	2	No		Yes		South Shore Drive subject to flooding at 67th Street
2355 E 67TH STREET	OVER 10 UNITS	2	No	Yes	Yes		South Shore Drive subject to flooding at 67th Street
6700 S. SOUTH SHORE DRIVE	OVER 10 UNITS	2	No	Yes	Yes		South Shore Drive subject to flooding at 67th Street
WARD 48 (Lakefront Boundary: Ainslie Street [4900 N] - Devon Avenue [6400 N])							
6101 N. SHERIDAN EAST	OVER 10 UNITS	6	Yes				Potential for flooded egress routes
6171 N SHERIDAN ROAD	312 UNITS	5	Yes				Parking garage subject to lakefront flooding
6121 N. SHERIDAN ROAD	31 UNITS	3	Yes				
6301 N. SHERIDAN ROAD	136 UNITS	3	No		Yes	High	Parking garage wall also serves as sea wall
5815 N. SHERIDAN ROAD	212 UNITS	3	Yes			Moderate	
6145-47 N. SHERIDAN ROAD	100 UNITS	2	No			High	
6129-35 N. SHERIDAN ROAD	OVER 10 UNITS	2	No			High	
6157 N. SHERIDAN ROAD	OVER 10 UNITS	2	No			High	
6325 N. SHERIDAN ROAD	OVER 10 UNITS	2	No			High	
5855 N. SHERIDAN ROAD	226 UNITS	2	No	Yes			
5831-37 N. SHERIDAN ROAD	OVER 10 UNITS	2	No			Moderate	
5959 N. SHERIDAN ROAD	PLACE OF WORSHIP	2	No				
6007 N. SHERIDAN ROAD	SFH	2	No				
6033 N. SHERIDAN ROAD	498 UNITS	2	No				
5801 N. SHERIDAN ROAD	OVER 10 UNITS	1	No		Yes	Moderate	
5901 N. SHERIDAN ROAD	OVER 10 UNITS	1	No	Yes	Yes		
WARD 49 (Lakefront Boundary: Devon Avenue [6400 N] - Chicago/Evanston City Limit)							
1200 W. SHERWIN	OVER 10 UNITS	8	Yes		Yes	High	Street end drains directly into underground garage
7601 N. EASTLAKE TERRACE	5-10 UNITS	6	Yes			High	Potential for flooded egress routes
1205 W. SHERWIN	OVER 10 UNITS	6	Yes		Yes	High	
7617 N. EASTLAKE TERRACE	5-10 UNITS	6	Yes			High	Basement level units on east side frequently flooded
7619 N. EASTLAKE TERRACE	OVER 10 UNITS	6	Yes			High	
1309-23 W. FARGO	2-4 UNITS	5	Yes				
1206 W. JARVIS	OVER 10 UNITS	5	Yes		Yes	Moderate	Basement level units on east side frequently flooded
7729-31 N. EASTLAKE TERRACE	10 UNITS	5	Yes			High	
7737 N. EASTLAKE TERRACE	10 UNITS	5	Yes			High	
7739 N. EASTLAKE TERRACE	10 UNITS	5	Yes				Under construction (major rehab) at time of inspection
7625 N. EASTLAKE TERRACE	OVER 10 UNITS	4	Yes			Moderate	Lakeside louvers for lower garage susceptible to flooding
1316 W. FARGO	OVER 10 UNITS	4	Yes				
1304 W. BIRCHWOOD	OVER 10 UNITS	4	Yes			Moderate	
1201 W. CHASE	OVER 10 UNITS	3	No			High	
1051-29 W. NORTH SHORE	OVER 10 UNITS	2	No			Moderate	
7609 N. EASTLAKE TERRACE	5-10 UNITS	2	No			Moderate	
1217-19 W. JARVIS	OVER 10 UNITS	2	No			Moderate	
1321 W. BIRCHWOOD	OVER 10 UNITS	2	No				
7501-07 N. EASTLAKE TERRACE	OVER 10 UNITS	2	No				
1004-1026 W LOYOLA	46 UNITS	1	No		Yes		
1050 W. COLUMBIA	OVER 10 UNITS	1	No		Yes	Moderate	
1200 W. CHASE	OVER 10 UNITS	N/A	No				No access to property
7631 N. EASTLAKE TERRACE	OVER 10 UNITS	N/A	N/A				Access Denied
7641 N. EASTLAKE TERRACE	OVER 10 UNITS	N/A	N/A				Access Denied
7649 N. EASTLAKE TERRACE	OVER 10 UNITS	N/A	N/A				Access Denied

NOTES:

1. SFH – Single Family Home (Number of Units Column)
2. Vulnerability Index combines estimated likelihood of lakefront flooding (previous history + FEMA wave runup analysis) and estimated consequence of lakefront flooding (building systems, structure and occupants) to produce an index of potential lakefront flooding risk.
3. Survey question asked if more than 50% of the residents were seniors and/or needed assistance during evacuation.
4. Right-of-Way (ROW) Flooding is building owner/occupant survey response to whether or not adjacent public streets have been impacted by lakefront flooding.
5. MEP – Refers to building systems (Mechanical, Electrical, Plumbing, Fire Protection)
6. MEP Exposure Rating:
 - High – All/most MEP equipment (electrical service/panels, boilers/water heaters, pumps, gas meter, fire pump/alarm panel, etc.) below grade, at risk of flood damage.
 - Moderate – Some MEP equipment below grade, at risk of flood damage.

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Introduction

On January 10-12, 2020, the City of Chicago was subject to a damaging Lake Michigan storm, with high winds and large waves. Several transportation corridors were either partially or fully closed, and several private property owners located close to the lakefront suffered damage. In addition, areas owned by the Chicago Park District were subject to overtopping, flooding, erosion and damage. The Chicago Park District and their partner, Chicago Department of Transportation (collectively, the “City”), retained SmithGroup to perform a rapid-response inspection and assessment of the Lakefront.



Photo 1 Street end flooding adjacent to private property during the January 11, 2020 storm

The January 11th, 2020 storm, which came during a period of very high Lake Michigan water levels, caused damage to some buildings in close proximity to the lakefront. The storm highlighted the vulnerability of those structures to future storms, when lake levels could potentially be still higher. The primary desired output of the inspections was to provide enough information to the City in order to identify the most vulnerable properties located on the lakefront and to respond effectively in the event of future storms. Secondary goals were an assessment of damage that occurred on Park District property during the January 11 storm, and a high-level review of potential resilience options suitable for different spatial scales.

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Building Assessments

SmithGroup organized inspection teams comprising Architectural/Building Structural, Civil/Coastal and Mechanical/Electrical/Plumbing (MEP) professionals to visit approximately 80 buildings that are located along the lakefront (predominantly in the 7th, 48th, and 49th Wards) to collect information related to the nature and extent of damage sustained and to assess future vulnerability.

Between January 21, 2020 and January 28, 2020 three assessment teams worked concurrently and with the City of Chicago (Department of Buildings, OEMC, CDOT or other departments) to access and assess private properties. Assessments of Park District or City of Chicago property were coordinated with relevant staff from those agencies. Teams used a customized survey tool on mobile devices to collect comparable information at each property.

Prior to conducting the inspections, the SmithGroup team created the survey, populated it with discipline-specific questions, and pilot tested the survey and inspection protocol at two of the identified buildings. The City provided the initial list of building addresses, to which additional buildings were added during the assessment. After the pilot test, the SmithGroup team reviewed the survey questions and the experience during the pilot test to refine the protocol.

The final survey tool contained a total of 72 unique questions, which included several types of questions ranging from Yes/No questions, multiple choice, pre-populated rating scale, and open text field to record observations and building owner/representative comments. Using multiple question types allowed for both standardized data to be collected at each location, as well as being adaptive to variety of building types from single family homes, to multiple unit condominium high rises. It also allowed opportunity for specific resident / management experience during the January 11th storm to be recorded. A copy of the survey questionnaire used by the assessment teams can be found in Appendix 1.

SmithGroup teams visually assessed the potential for lakefront flooding to cause potential life-threatening situations as well as damage and disruption. Wherever possible, SmithGroup asked questions of the building owner, management representative, or other building employee related to experience with lakefront flooding. The SmithGroup teams took photographs of relevant features of the buildings for the purpose of informing the City of potential vulnerability. The teams did not examine building documents, conduct code compliance inspections, or take detailed measurements of internal or external building features.

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Photo 2 SmithGroup inspection teams accessed a customized mobile device survey tool to record assessment data in the field.

General Flood Impact and Overall Risk

During the field survey, the team evaluated the “Flood Design Class” of each building, which is a nationally used rating scale for flood-resistant design considerations, and ranks buildings based on the primary function of the structure. The teams used a 1 – 5 rating scale, which was adopted from the ASCE 24-14¹ Flood Resistant Design and Construction rating scale (1 – 4). The modification was deemed appropriate given the preponderance of large, multi-unit buildings within the assessment boundary.

¹ ASCE 24-14: The American Society of Civil Engineers (ASCE) 24-14 is a referenced standard in the 2015 International Building Code® (IBC) and the 2015 International Residential Code® (IRC). Building and structures within the scope of the IBC proposed to be constructed in flood hazard areas must be designed in accordance with ASCE 24-14. The IRC requires dwellings in floodways to be designed in accordance with ASCE 24-14 and includes an alternative that allows communities to require homes in any flood zone to be designed in accordance with ASCE 24-14. Highlights of ASCE 24-14 that complement the NFIP minimum requirements include: Building Performance; Flood-Damage Resistant Materials; Utilities and Service Equipment and Siting Considerations.

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Summary of General Flood Impact Rating (modified from ASCE 24-14)			
Risk Level	Flood Design Class (ASCE 24-14)	Building Type	Modified General Flood Impact Rating
Low	1	Unoccupied space, temporary structure, storage facility, parking	1
Moderate	2	Residential, commercial	2
Moderate-Plus	2 (no distinction in ASCE 24-14)	Residential >20 units	3
High	3	Potential for large groups to congregate: museum, school, place of worship, daycare center, senior living	4
Very High	4	Building serves emergency response function: police/fire, hospital, emergency shelter	5

Table 1 Comparison of ASCE Flood Design Class and Modified General Flood Impact Rating

Most properties surveyed fell into the category 2 – Moderate, or 3 – Moderate-Plus Risk category. Few properties were rated at the High or Very High level. Those that were included a senior living facility, La Rabida Children’s Hospital, several Loyola University classroom buildings, the City of Chicago’s two Water Purification Plants, and some Chicago Park District fieldhouses.

Further details regarding ASCE 24 can be found in Appendix 2. While useful for understanding the general flood impact for each building, this system is not sufficiently granular to understand the range of risks posed along Chicago’s lakefront, so SmithGroup adopted a project specific risk assessment rating system. This was based on the definition of risk as the product of the likelihood of an event occurring and the consequences resulting from that event happening, which is illustrated graphically in Figure 1.

For the purposes of this assessment, the potential consequence of flooding was estimated by considering the vulnerability of the building structure, occupants, and critical building system components. Each building was rated from 1 – 5 from a Structural/Architectural perspective and from 1 – 5 from a Mechanical, Electrical and Plumbing perspective. These two ratings were added to create an overall

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“Consequence” score with a maximum score (most vulnerable) of 10. Further details of both ratings are described in the subsequent sections.

Similarly, a measure of the likelihood of flooding was estimated for each building. This was developed using the sum of two separate measures: (A) whether or not the structure reported flooding during the January 11, 2020 storm (“Yes” = 5, “No” = 1); and (B) a site specific coastal analysis at each location (1 – 5) which utilized available elevation and wave run-up data, which is described in Section 4 – Coastal Flooding Assessment.

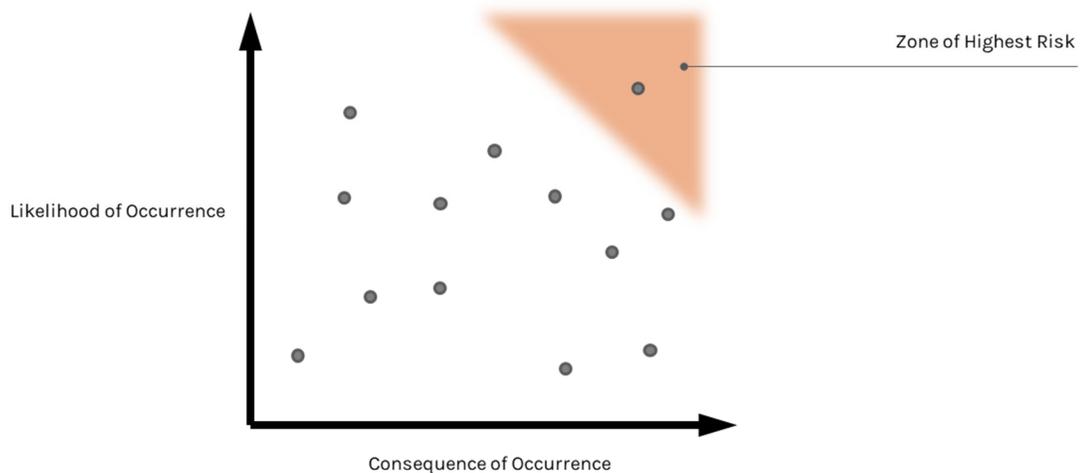


Figure 1 - Generalized graphical representation of risk as the product of likelihood of occurrence and consequence of occurrence.

Structural and Architectural Considerations

Assessment of the architectural integrity and structure of buildings was primarily based on visual observations. While on site, the teams observed the site surrounding the building and the interior of any areas that sustained damage or are vulnerable to damage, such as below grade parking adjacent to lake levels. Conditions that indicated evidence of water damage included spalling concrete, efflorescence, the presence of sand, exposed rebar, cracking and differential settlement. In addition to visual observations, the field teams collected the history of recent and past flooding as recounted by building managers, engineers, or owners / residents. This was crucial to understanding any recorded or potential damage to structures. The assessments, therefore, are a combination of observed and anecdotal evidence. This was categorized into a 1-5 rating scale.

- 1 = Low (no storm event damage)
- 2 = Moderate (damage to the interior with no loss of service or to a space of low consequence such as parking or storage)
- 3 = Moderate-High (more extensive damage to interior during storm event but quickly remediated)

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4 = High (standing water in the building, damage to utilities, broken windows/doors, obstructed access to/from building)

5 = Very High (extensive damage to building's exterior enclosure, extensive water inside the building, building is in danger of structural failure)



Photo 3 Storm damage to lakefront property, including broken windows, resulting in interior first floor flooding.

Mechanical, Electrical, Plumbing and Fire Protection Considerations

Assessment of the vulnerability of building mechanical, electrical, plumbing and fire protection/life safety (MEP) systems due to flooding in the building was based on visual observation and verbal information gathered from personnel leading each walkthrough. The primary focus was to determine the potential for damage to MEP systems and the consequences to the building and occupants in the event of flooding in these spaces. Primary tasks included identification of type of MEP systems/equipment at or below grade, availability of passive and active flood protection, such as mounting height and presence of sumps pumps, and assessing potential flood water entry points into these spaces via mechanical/plumbing systems, such as air louvers near or below grade facing the lake.

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An overall MEP rating was assigned to each building based on a 1 – 5 scale, as described below, taking into consideration the system importance or criticality from most to least in the following order: electrical and life safety systems, followed by heating and heating support system and domestic cold water systems, followed by all other remaining systems.

1 = Low (minimal potential impact to non-critical MEP systems only; no impact to critical systems)

2 = Moderate (up to moderate potential impact to various MEP systems; no potential impact to critical systems and/or higher potential impact limited only to low consequence spaces such as parking garage or storage)

3 = Moderate-High (potential impact to most MEP systems, including heating and/or domestic water; minimal potential impact to critical systems and/or severe potential impact limited only to low consequence spaces such as parking garage or storage)

4 = High (potential impact to all or most MEP systems including critical systems and/or has already experienced some flood damage to MEP systems in low consequence spaces such as parking garage or storage)

5 = Very High (potential impact to all MEP systems including severe impact to critical systems and/or has already experienced severe flood damage to MEPFP systems in occupied spaces of the building)



Photo 4 The building located on the left of this picture has louvers facing the lake, which could be a source of flooding.

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Civil and Site Considerations

The civil and site component of the property assessments was primarily concerned with documenting the type(s), condition and approximate height of the shore protection system at each location. As well as general information about the shoreline structures, the where possible teams recorded visible signs of damage, settling, or other issues. Building owners/representatives were asked about maintenance activities. Other observations included the evidence of recent erosion and/or overtopping flows, and an assessment of how the overall site drains. Another aspect of the civil inspection was to provide additional information to help inform the coastal vulnerability rating, and to serve as a check on the available elevation data.



Photo 5 Steel sheet pile and concrete seawall, with rubblemound revetment in the foreground.

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Coastal Flooding Assessment

SmithGroup used two primary publicly available datasets to assess coastal vulnerability at the building locations. First, the elevation of the shoreline protection was estimated from publicly available topographic information² (2012) on a per property basis. Using GIS tools and aerial photography, average elevations across the property were estimated to capture the level at which the majority of the shoreline would be overtopped. In some instances, there may be isolated low points within the shore protection structure that could lead to some earlier flooding. The second part of the analysis involved comparing the estimated average elevation of the shoreline protection to the FEMA Preliminary Flood Insurance Study (FIS) 2019 to estimate potential average freeboard³ for each property.

Although not yet formally adopted, and subject to further revisions, the 2019 preliminary flood inundation maps are different from the currently effective maps and offer a more realistic picture of flood risk. Based on the estimated values of freeboard above still water elevation and estimated values of freeboard above wave runup elevation, a rating system was established, as shown in Table 2, where a higher value rating is reflective of a property being more likely to experience flooding. Each property was assigned the greater of the stillwater and wave runup rating.

Likelihood of Flooding – Freeboard Rating System			
Likelihood of Flooding	1% Exceedance Stillwater Freeboard (Feet)	1% Exceedance Wave Runup Freeboard (Feet)	Freeboard Rating (1 – 5 scale)
Very Low	> 6 feet	> 1 foot	1
Low	Between 4 and 6 feet	Between 0 and -2 feet	2
Moderate	Between 2 and 4 feet	Between -2 and -4 feet	3
High	Less than 2 feet	Between -4 and -6 feet	4
Very High	Not Used	Less than -6 feet	5

Table 2 Derivation of the coastal vulnerability rating system.

² USACE National Coastal Mapping Program (2012)

³ Freeboard is the vertical distance between the crest of the shore protection and the elevation that waves can reach.

Rev. 07.15.20

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Lakefront Flooding Vulnerability

Private Property

The primary desired output of the inspections was to provide enough information to the City in order to identify the most vulnerable properties located on the lakefront and to respond effectively in the event of future storms. After the assessment were completed and ratings assigned to each buildings, an assessment of the overall relative vulnerability of the private buildings along Chicago’s lakefront could be examined. As stated earlier, risk is frequently defined as the product of the likelihood of an event occurring and the consequence of the event occurring. A measure of risk – referred to in this report as Vulnerability Index – was computed to allow for a comparison among properties.

The likelihood of flooding occurring was based on the freeboard rating, which was computed for each location and followed a standardized approach, was based on data from 2012. Since there are locations that may have undergone substantial changes since that time, the freeboard rating was supplemented by including extra weight for instances when flooding was reported.

$$\text{Likelihood of Flooding} = \text{January 11, 2020 flooding (Y/N)} + \text{Freeboard Rating} \\ (Y = 5, N = 1) \qquad (1 - 5)$$

with a maximum possible score of 10.

$$\text{Consequence of Flooding} = \text{Architectural/Structural Rating} + \text{MEP Rating} \\ (1 - 5) \qquad (1 - 5)$$

with a maximum possible score of 10.

Vulnerability Index was computed as the product of these two scores (maximum possible score = 100), which was then normalized to a 1 – 10 score, with 10 being the highest vulnerability.

These data are presented in the summary table on the next page, along with other pertinent information. The private properties are listed by ward, from south to north, and within each ward the properties are listed in descending vulnerability. These are also shown graphically in the maps for each ward that follow, with a gradient color scale used to indicate increasing vulnerability.

Appendix 3 contains a more detailed property report for each building, which contains responses to several of the survey questions, as well as summaries of observations from each discipline. All the survey response data are provided under separate transmittal in digital form.

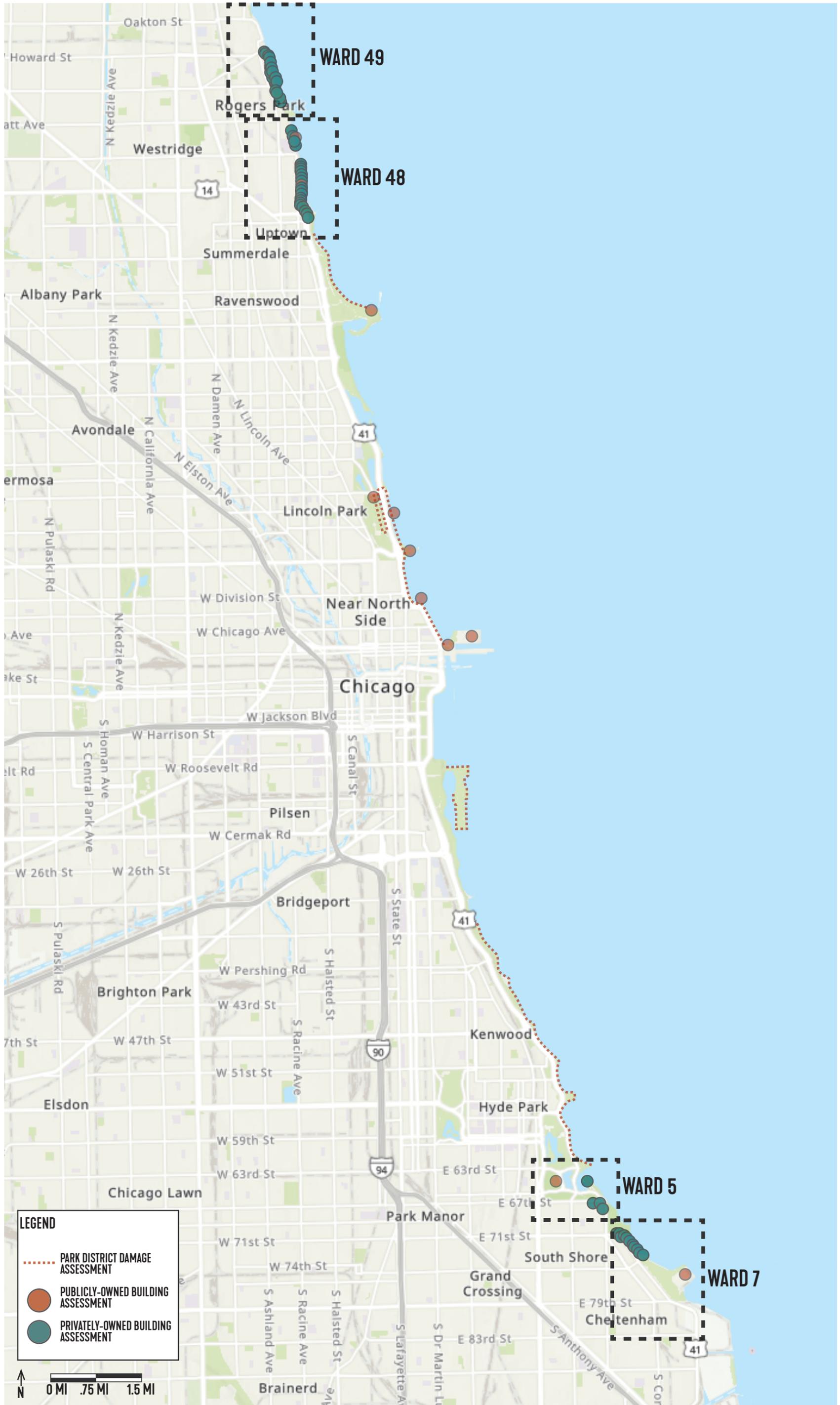
Private Property Lakefront Vulnerability

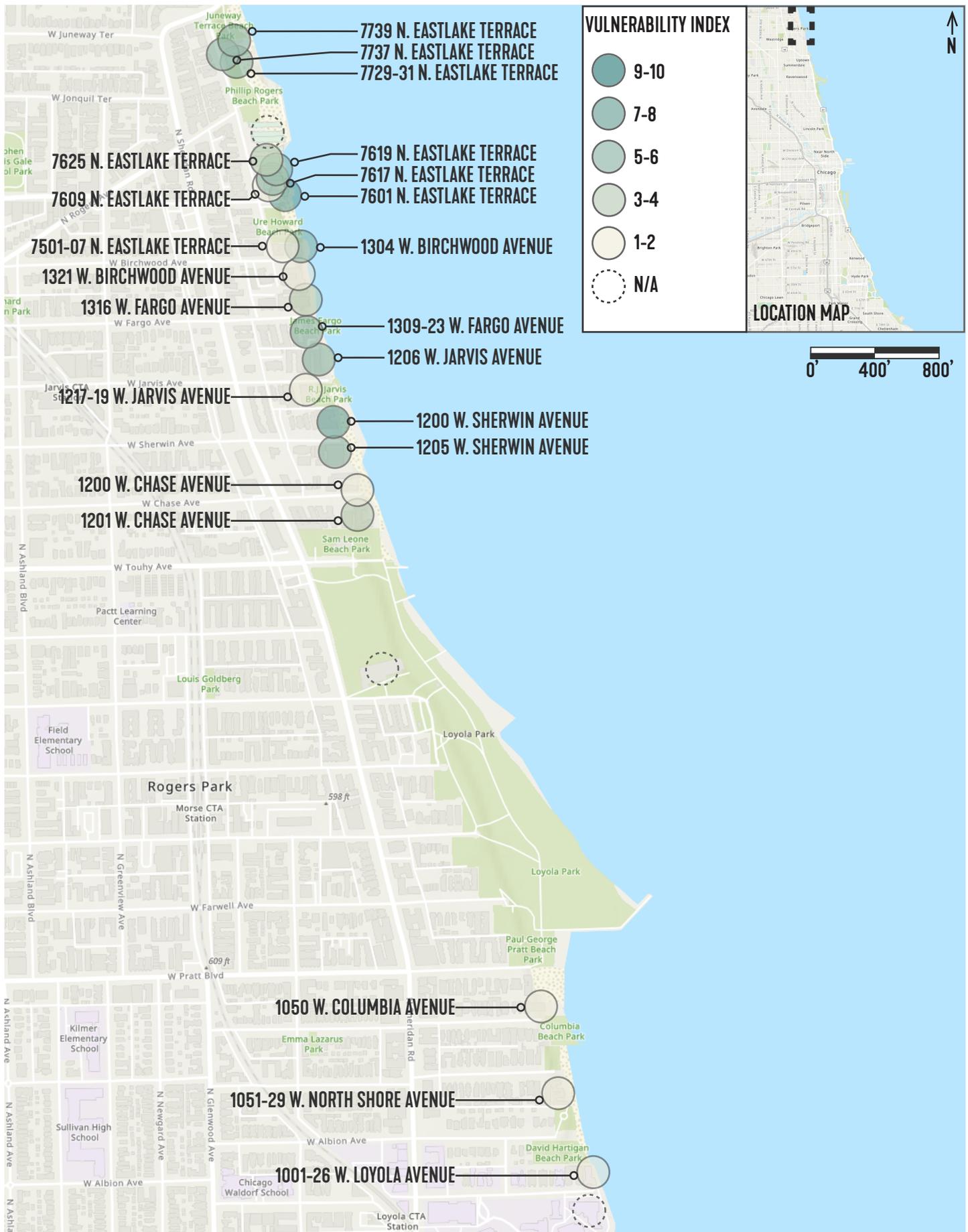


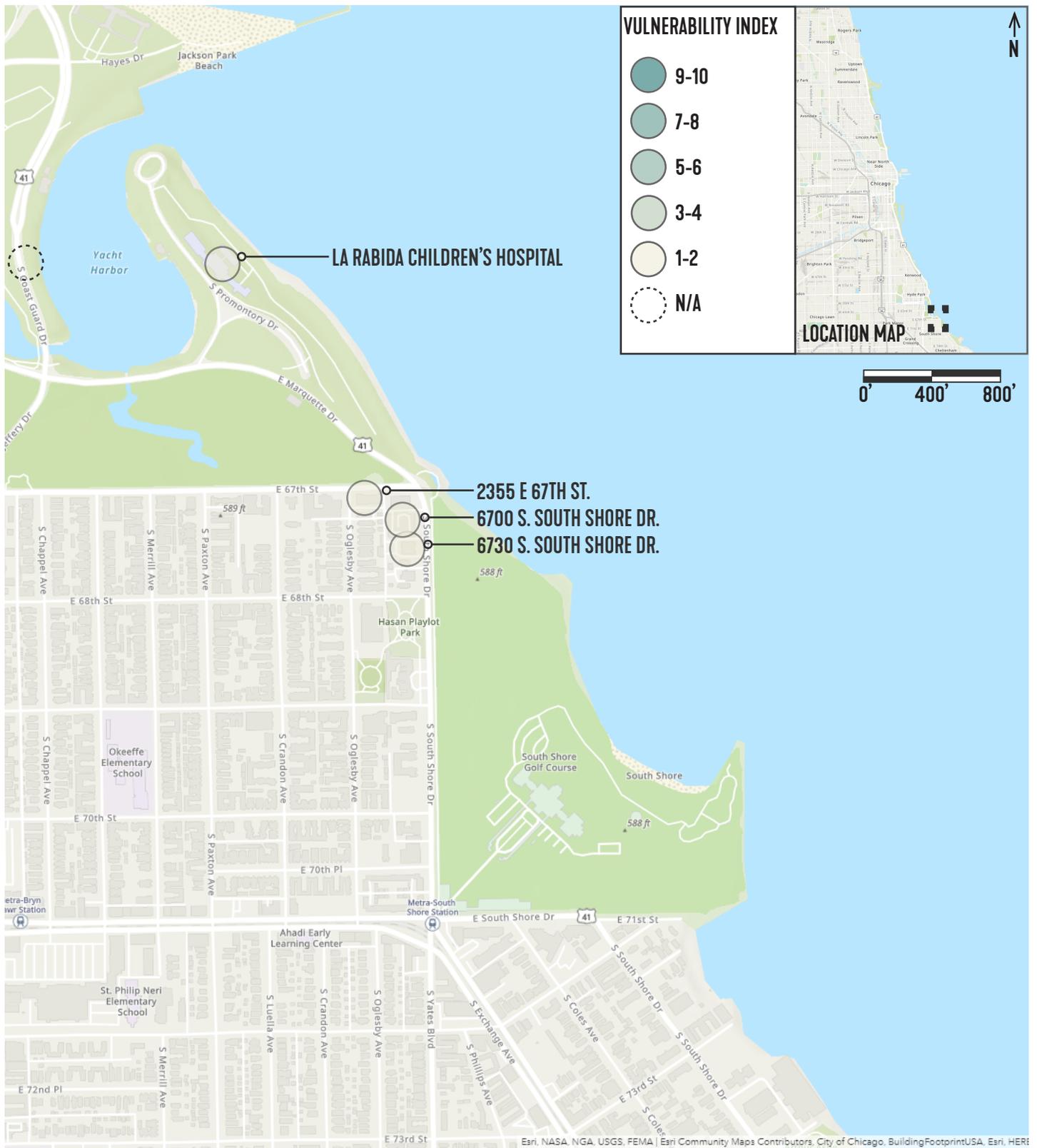
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WARD 49 (Lakefront Boundary: Devon Avenue [6400 N] - Chicago/Evanston City Limit)							
1200 W. SHERWIN	OVER 10 UNITS	8	Yes		Yes	High	Street end drains directly into underground garage
7601 N. EASTLAKE TERRACE	5-10 UNITS	6	Yes			High	Potential for flooded egress routes
1205 W. SHERWIN	OVER 10 UNITS	6	Yes		Yes	High	
7617 N. EASTLAKE TERRACE	5-10 UNITS	6	Yes			High	Basement level units on east side frequently flooded
7619 N. EASTLAKE TERRACE	OVER 10 UNITS	6	Yes			High	
1309-23 W. FARGO	2-4 UNITS	5	Yes				
1206 W. JARVIS	OVER 10 UNITS	5	Yes		Yes	Moderate	Basement level units on east side frequently flooded
7729-31 N. EASTLAKE TERRACE	10 UNITS	5	Yes			High	
7737 N. EASTLAKE TERRACE	10 UNITS	5	Yes			High	
7739 N. EASTLAKE TERRACE	10 UNITS	5	Yes				Under construction (major rehab) at time of inspection
7625 N. EASTLAKE TERRACE	OVER 10 UNITS	4	Yes			Moderate	Lakeside louvers for lower garage susceptible to flooding
1316 W. FARGO	OVER 10 UNITS	4	Yes				
1304 W. BIRCHWOOD	OVER 10 UNITS	4	Yes			Moderate	
1201 W. CHASE	OVER 10 UNITS	3	No			High	
1051-29 W. NORTH SHORE	OVER 10 UNITS	2	No			Moderate	
7609 N. EASTLAKE TERRACE	5-10 UNITS	2	No			Moderate	
1217-19 W. JARVIS	OVER 10 UNITS	2	No			Moderate	
1321 W. BIRCHWOOD	OVER 10 UNITS	2	No				
7501-07 N. EASTLAKE TERRACE	OVER 10 UNITS	2	No				
1004-1026 W LOYOLA	46 UNITS	1	No		Yes		
1050 W. COLUMBIA	OVER 10 UNITS	1	No		Yes	Moderate	
1200 W. CHASE	OVER 10 UNITS	N/A	No				No access to property
7631 N. EASTLAKE TERRACE	OVER 10 UNITS	N/A	N/A				Access Denied
7641 N. EASTLAKE TERRACE	OVER 10 UNITS	N/A	N/A				Access Denied
7649 N. EASTLAKE TERRACE	OVER 10 UNITS	N/A	N/A				Access Denied

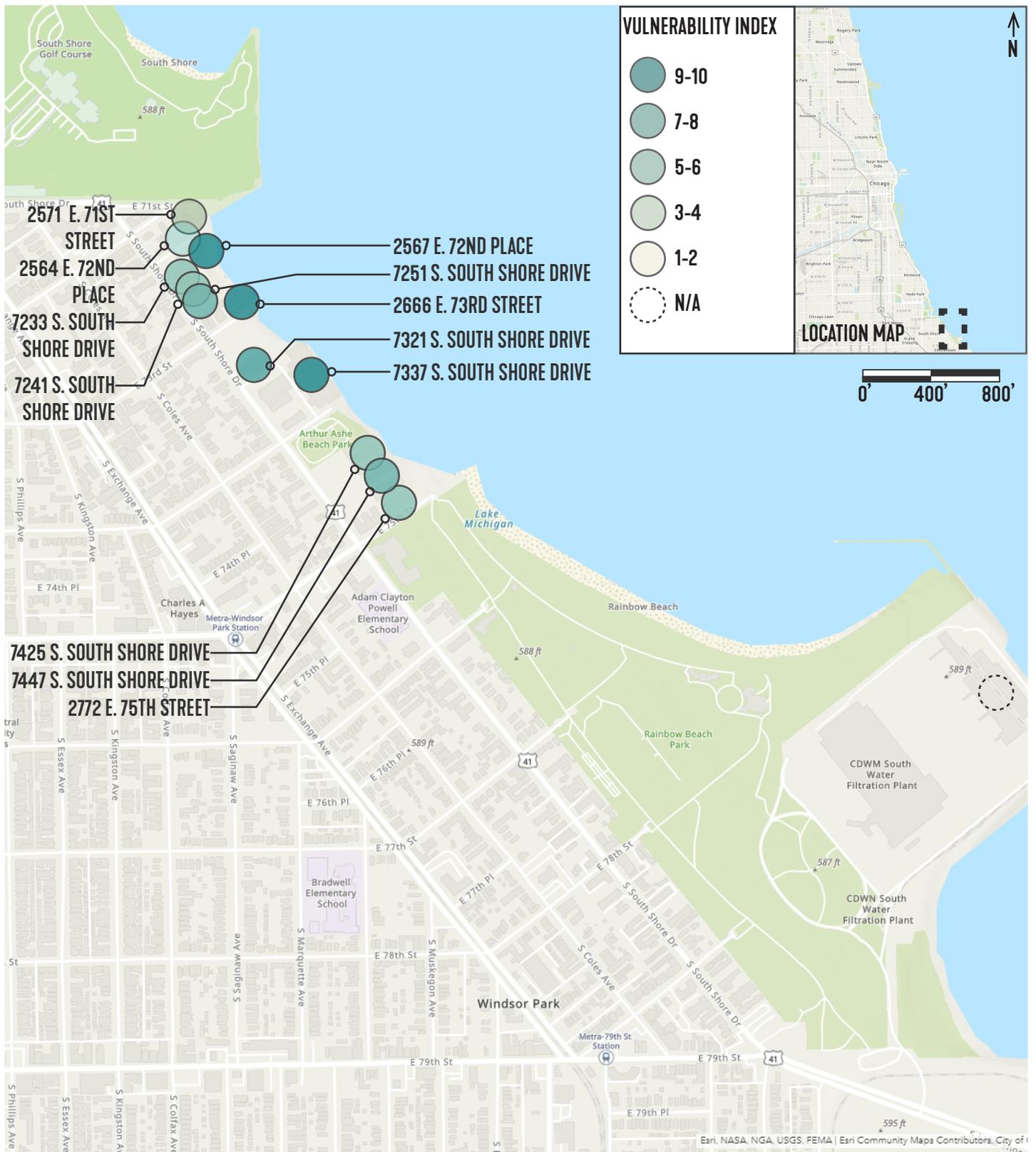
NOTES:

1. SFH – Single Family Home (Number of Units Column)
2. Vulnerability Index combines estimated likelihood of lakefront flooding (previous history + FEMA wave runup analysis) and estimated consequence of lakefront flooding (building systems, structure and occupants) to produce an index of potential lakefront flooding risk.
3. Survey question asked if more than 50% of the residents were seniors and/or needed assistance during evacuation.
4. Right-of-Way (ROW) Flooding is building owner/occupant survey response to whether or not adjacent public streets have been impacted by lakefront flooding.
5. MEP – Refers to building systems (Mechanical, Electrical, Plumbing, Fire Protection)
6. MEP Exposure Rating:
 - High – All/most MEP equipment (electrical service/panels, boilers/water heaters, pumps, gas meter, fire pump/alarm panel, etc.) below grade, at risk of flood damage.
 - Moderate – Some MEP equipment below grade, at risk of flood damage.









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Loyola University Facilities

Several Loyola University Lakeshore Campus buildings were also assessed as part of this study. Vulnerability Index was not computed for these buildings as they are collectively managed by the University staff. However, summary data reports for each building were compiled, and can be found in Appendix 3 after the private building reports.

Publicly-Owned Facilities

The City of Chicago Department of Water Management and Chicago Park District buildings located on the lakefront were also assessed as part of this study. Vulnerability Index was not computed for these buildings as they are collectively managed by City staff. However, summary data reports for each building were compiled, and can be found in Appendix 3 after the private building reports.

Both Water Purification Plants (WPP) are protected from some of the largest waves by offshore breakwaters. At Eugene Sawyer WPP the offshore breakwater is a rubblemound breakwater, which was recently rehabilitated (1997) as part of the Chicago Shoreline Protection Project and has been routinely inspected and maintained. Apart from erosion at the south west corner of the facility and damage to a security fence, the ESWPP appeared to fare relatively well during the January 11th storm.



Photo 6 Erosion and fence damage as a result of the January 11, 2020 storm adjacent to the Eugene Sawyer Water Purification Plant

The Jardine WPP suffered more overtopping and on-site erosion, particularly along the north wall, which is believed to be as a result of the relatively low elevation of the Federal breakwater, which has

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experienced a backlog of deferred maintenance. Interviews with on-site staff indicate that the continued high water levels pose a threat, not only from the potential of overtopping, but also due to seepage through the protective earthen embankment.

LAKES MICHIGAN-HURON WATER LEVELS - FEBRUARY 2020

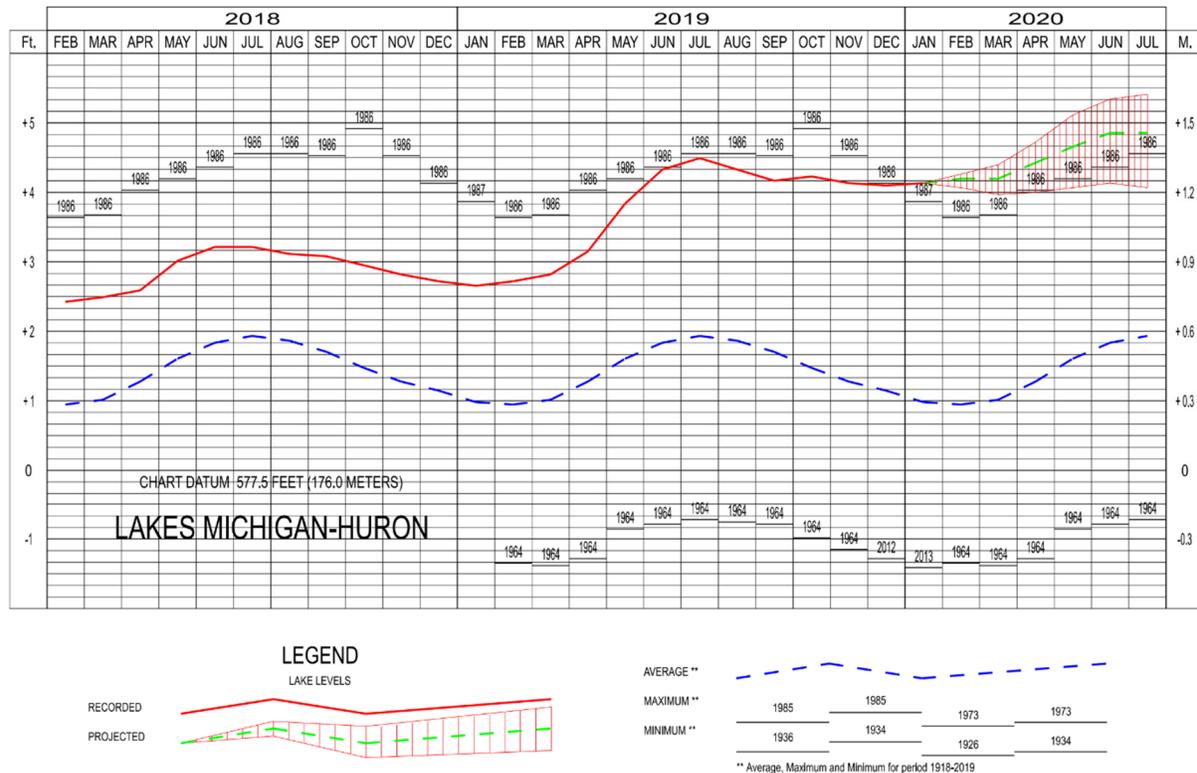


Figure 2 - Recent monthly averages and 6-month prediction for Lake Michigan water levels (USACE)

For the Park District buildings, which are primarily located some distance inland, except for some of the concession and bathroom facilities, continued high water levels are creating an ongoing threat to day-to-day operations, and forecasted high water levels in the summer of 2020 are likely to exacerbate these challenges. Figure 2 shows the US Army Corps of Engineers (USACE) forecast⁴ through June 2020. One of the striking things about this forecast, is that monthly average levels are anticipated to exceed 2019’s unusually high levels, which caused several issues for concessionaires. It is also important to note that daily average water levels (which are subject to transient weather patterns) were as high as 6 – 12 inches above the monthly average in 2019, so there is a very strong likelihood of summer 2020 stillwater levels exceeding 6.0 ft Low Water Datum (LWD). Two of the most at-risk facilities are the Jackson Park

⁴ <https://www.lre.usace.army.mil/Missions/Great-Lakes-Information/Great-Lakes-Water-Levels/Water-Level-Forecast/Monthly-Bulletin-of-Great-Lakes-Water-Levels/>

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Coast Guard Building (on the Jackson Park Outer Harbor) and the Lincoln Park Boat Club (on the Lincoln Park South Lagoon), both of which are currently inundated due to high water. Likewise the concession facilities at Ohio Street Beach and Oak Street Beach are likely to be routinely impacted during the summer of 2020, and the North Avenue Restroom facility has been impacted by winter storms.



Photo 7 Erosion and storm damage to the lakefront trail at the historic North Avenue washroom facility.

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Public Property Damage Assessments

In addition to the building inspection teams, SmithGroup also mobilized inspection teams comprising Civil Engineering / Landscape Architect professionals to visit 18 segments of the Chicago Park District owned lakefront to collect information related to the nature and extent of damage sustained during the January 11, 2020 storm.

Between January 29, 2020 and January 30, 2020 three teams covered approximately 10 miles of Chicago Park District property. The segments visited included:

Hollywood to Balmoral (Lincoln Park)
Foster Avenue Beach (Lincoln Park)
Foster to Lawrence (Lincoln Park)
South Lagoon (Lincoln Park)
Fullerton to Armitage (Lincoln Park)
North Avenue to Division
Oak Street to Ohio Street
Ohio Street Beach
Solidarity Drive
12th Street Beach
Northerly Island
Oakwood Beach (Burnham Park)
41st Street to 45th Street (Burnham Park)
45th Street to 51st Street, Morgan Shoal (Burnham Park)
58th Street to 61st Street (Jackson Park)
63rd Street Beach (Jackson Park)
54th Street to 56th Street, Promontory Point (Burnham Park)
71st to 75th Street (Arthur Ashe Park)

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CATEGORY G INITIAL DAMAGE AND ASSESSMENT COST TABULATION: LOCATION DETAIL					
SEGMENT 10: FOSTER AVE. BEACH					
DRONE PHOTO (AUGUST 2019)		FIELD PHOTO (JANUARY 2020)			
					
					
DESCRIPTION					
ITEM 1: Erosion in vicinity of Beach House, undermining of accessible walk. Requires riprap placement to prevent further damage and undermining					
ITEM 2: Severe erosion at north end of beach. Requires riprap placement to prevent further damage and undermining of LFT.					
					
No.	Description	Unit	Unit Cost	Quantity	Estimated Cost
1	Lakefront Trail (Total Replacement)	LF	\$ 20213		\$ -
2	Lakefront Trail (Shoulder Repair, both sides)	LF	\$ 56.00		\$ -
3	Parkland Repair (0" to 1-ft deep)	SF	\$ 3.09		\$ -
4	Parkland Repair (1-ft deep to 3-feet deep)	SF	\$ 3.99		\$ -
5	Parkland Repair (>3-ft deep)	SF	\$ 5.16		\$ -
6	Parkland Repair (at Drainage Gap Locations, incl. Geo-	SF	\$ 10.05		\$ -
7	Concrete Patch Repairs (< 6 inches)	SF	\$ 88.89		\$ -
8	Concrete Patch Repairs (> 6 inches)	SF	\$ 127.78		\$ -
9	Debris Removal (from Pavement)	SF	\$ 6.88		\$ -
10	Debris Removal (from Parkland, incl. turf repair)	SF	\$ 9.97		\$ -
11	Concrete Trail Repair (Shoreline Structure)	CY	\$ 473.55		\$ -
12	Paved Revetment Rehabilitation (up to 30 feet wide)	LF	\$ 1,657.78		\$ -
13	Armor Stone Revetment Rehabilitation	LF	\$ 6,600.00		\$ -
14	Lagoon Retaining Wall	LF	\$ 750.00		\$ -
15	Park Furniture (Benches, Other Ornamental Features)	Each	\$ 1,000.00		\$ -
16	Park Furniture (Ornamental Fencing)	LF	\$ 120.00		\$ -
17	Rip Rap	LF	\$ 1,657.78	150.00	\$ 248,667.00
Segment Infrastructure Total					\$ 248,667.00
RETURN TO INDEX					

Figure 3 Example damage assessment documentation for segment of lakefront illustrating use of pre- and post-storm photography

Before mobilizing, the damage assessment teams reviewed drone footage (from August 2019) to understand the extent of any pre-existing damage conditions, and while in the field took photos and made

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measurements of areas, volumes, lengths etc., of visible, above water damage that was evident during a rapid walkthrough of each area. No underwater inspections were carried out, nor was any intrusive sampling, or non-destructive testing conducted.

Once returned from the field visits, each team reviewed the damage photographs side by side with still screen captures from the drone footage to confirm that the observations were reflective of recent damage. In some instances, areas that were thought to have been damaged during January 11, 2020 storm had in fact, been pre-existing. Where this was the case, those items were discarded from the damage assessment. Figure 2 illustrates the side by side photograph comparisons highlighting specific damage from the January 11, 2020 storm.

In addition to quantifying the damage, unit rates for the most commonly identified damage types were derived using similar previous projects. These unit rates, together with the field measurements were used to estimate costs for the required repairs to bring the structures, beaches and parkland back to pre-storm conditions. The unit rates used in this exercise are also illustrated in Figure 2.

Damage estimates computed by SmithGroup were then compiled along with damage estimates from other sources, including CDOT, Chicago Park District, Westrec, and others. These estimates are illustrated in Figure 3.

CATEGORY G INITIAL DAMAGE AND ASSESSMENT COST TABULATION (INFRASTRUCTURE)				
SG SEGMENT NO.	FACILITY/LOCATION	DESCRIPTION OF DAMAGE (LABOR, EQUIPMENT, MATERIAL OR CONTRACT)	ESTIMATED COST OF REPAIR	COMPILED BY:
1	Juneway to Howard	SEE CDOT ESTIMATES	\$ 525,748.00	CDOT
4	Lunt to Pratt	SEE CPD TRADES ESTIMATES	\$ 10,000.00	CPD
5	Pratt to Loyola	SEE CPD TRADES ESTIMATES	\$ 3,000.00	CPD
7	Rosemont to Thorndale	SEE CDOT ESTIMATES	\$ 488,000.00	CDOT
8	Thorndale to Hollywood	SEE CPD TRADES ESTIMATES	\$ 3,000.00	CPD
9	Hollywood to Balmoral	Infrastructure Damage Estimate (See UNIT cost breakdown)	\$ 82,889.00	SG
10	Foster Avenue Beach	Infrastructure Damage Estimate (See UNIT cost breakdown)	\$ 248,667.00	SG
11	Foster to Lawrence	Infrastructure Damage Estimate (See UNIT cost breakdown)	\$ 42,734.11	SG
12	Montrose Beach	SEE CPD TRADES ESTIMATES	\$ 20,000.00	CPD
18	Diversey Harbor	SEE WESTREC ESTIMATE	\$ 20,000.00	WESTREC
20	South Lagoon	Infrastructure Damage Estimate (See UNIT cost breakdown)	\$ 4,698,968.04	SG
21	Fullerton to Armitage	Infrastructure Damage Estimate (See UNIT cost breakdown)	\$ 488,694.58	SG
22	North Avenue Beach	N/A		
23	North Avenue to Division	Infrastructure Damage Estimate (See UNIT cost breakdown)	\$ 19,424.58	SG
24	Oak Street Beach	SEE CPD TRADES ESTIMATES	\$ 10,000.00	CPD
25	Oak Street to Ohio Street	Infrastructure Damage Estimate (See UNIT cost breakdown)	\$ 442,823.80	SG
26	Ohio Street Beach	SEE CPD TRADES ESTIMATES	\$ 18,000.00	CPD
32	Solidarity Drive	Infrastructure Damage Estimate (See UNIT cost breakdown)	\$ 2,715.14	SG
33	12th Street Beach	SEE CPD TRADES ESTIMATES	\$ 5,000.00	CPD
34	Northerly Island	Infrastructure Damage Estimate (See UNIT cost breakdown)	\$ 11,008.59	SG
38	31st Street Beach	SEE CPD TRADES ESTIMATES	\$ 4,000.00	CPD
39	31st Street Harbor	SEE WESTREC ESTIMATE	\$ 30,000.00	WESTREC
41	Oakwood Beach	Infrastructure Damage Estimate (See UNIT cost breakdown)	\$ 1,488,175.42	SG
42	41st Street to 45th Street	Infrastructure Damage Estimate (See UNIT cost breakdown)	\$ 639,427.90	SG
43	45th Street to 51st Street (Morgan Shoal)	Infrastructure Damage Estimate (See UNIT cost breakdown)	\$ 8,266,213.72	SG
45	4th Street to 56th Street (Promontory Point)	Infrastructure Damage Estimate (See UNIT cost breakdown)	\$ 5,304.96	SG
46	57th Street Beach	SEE CPD TRADES ESTIMATES	\$ 10,000.00	CPD
47	58th Street to 61st Street	Infrastructure Damage Estimate (See UNIT cost breakdown)	\$ 14,268.44	SG
49	63rd Street Beach	Infrastructure Damage Estimate (See UNIT cost breakdown)	\$ 493,968.31	SG / CPD
50	Jackson Park Outer Harbor	SEE WESTREC ESTIMATE	\$ 50,000.00	WESTREC
52	63rd Street to 67th Street	N/A		
53	South Shore Cultural Center	SEE CPD TRADES ESTIMATES	\$ 12,000.00	CPD
54	71st Street to 75th Street	Infrastructure Damage Estimate (See UNIT cost breakdown)	\$ 360,248.89	SG
55	75th Street to 78th Street (Rainbow Beach)	SEE CPD TRADES ESTIMATES	\$ 6,000.00	CPD
62	95th Street to 102nd Street	SEE CPD TRADES ESTIMATES	\$ 8,000.00	CPD
63	102nd Street to State Line	CALUMET HARBOR YACHT CLUB	\$ 150,000.00	Provided to CPD

Figure 4 Excerpt from the Chicago Park District damage assessment illustrating the source for the various estimates. Segments without estimated damages are not shown.

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Resilience Options

SmithGroup identified potential options that could be deployed in 2020 or beyond to increase resilience at the various study locations. Since the lakefront properties are each unique in the building materials, age and condition, unique solutions for all 80 buildings were not considered. However, based on the types of issues recorded, potential resilience typologies were researched that could be customized for use in a variety of settings. Along with a description of the general applicability of each, relative order of magnitude costs were investigated. The typologies were organized by scale ranging from an individual building at the smallest scale to options that could be deployed across an entire neighborhood. A summary of the resilience typologies can be found in Table 3, and details can be found in Appendix 4.

Summary of Resilience Typologies			
Typology	Applicable Scale	Description	Relative Order of Magnitude Cost
Temporary Wall (Seasonal Deployment)	Building	Wall temporarily installed to protect buildings from flooding and wave overtopping	\$\$
Wet Floodproofing	Building	Structure is retrofit to allow water to enter building during flooding so that hydrostatic pressure is equalized and damage to the structure is minimized	\$\$\$\$\$
Sealing Building Openings	Building	Exterior building openings are permanently or temporarily sealed to protect interior of buildings from flooding and wave overtopping	\$
Deployable Wall (Permanent Deployment)	Building / Multiple Buildings	Wall permanently installed which rises from the existing subgrade during a flood event. Protects buildings from flooding and wave overtopping	\$\$
Architectural Wall	Site	Wall setback from the shoreline edge that provides protection from wave overtopping and creates secondary benefit of an amenity	\$\$
Beach Fill	Site / Multiple Sites	Coarse grained sediments added to the shoreline to combat erosion, provides protection from high water levels and wave overtopping, and creates secondary benefits for recreation and habitat.	\$\$\$\$\$
Revetment	Site / Multiple Sites / Neighborhood	Sloping structure placed on shoreline to combat erosion and provides protection from high water levels and wave overtopping	\$\$\$
Breakwater	Site / Multiple Sites / Neighborhood	Permanent or temporary offshore structure that can be shoreline connected or detached. Protects the shoreline from wave overtopping	\$\$\$\$

Table 3 Summary of resilience options that could be deployed across a variety of spatial scales

Other Findings

The primary driver for the assessments described in this report was the need for the City to better understand the scope of existing lakefront building vulnerabilities. Through the course of the field assessments, data gathering and survey responses, some other findings were observed, which are described below.

Shore Protection Maintenance. Only two of the privately owned properties that were surveyed indicated that an operation and maintenance plan existed and had been activated for the buildings' shore protection system. While some buildings did report carrying out inspections of the property seawall, there appears to be a deficit of regular maintenance occurring on the structures that are intended to reduce or prevent flooding.



Photo 8 Building representatives at this 48th Ward property reported having recently completed a shore protection operation and maintenance inspection

Population Vulnerability. While the survey did ascertain which buildings had at least 50% of the population requiring assistance to evacuate, it is important to consider the vulnerabilities and potential impact to occupants that could not be measured through this rapid-response high-level field survey. The

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survey did not account for the vulnerability of residents of a property that may be dependent on electricity to supply medical needs such as power for their oxygen tank or keep insulin stored at the right temperature. To the general population, loss of power for several hours (or even several days) may pose an inconvenience, but for some it may be life-threatening. Similarly, a family that has the financial means or support network to endure water damage is less vulnerable than a family who depends on fixed incomes and does not have the financial means to recover from an unforeseen setback. These social factors were not explored in this survey of building structures and site conditions but should be considered in the larger context of addressing population risk.

Evacuation Plans. Few building managers, engineers, or owners reported having no emergency evacuation plan. However, one building manager did point out that their evacuation plan is to go to the building next door, and vice versa. In the event of a large-scale flood-storm event, this approach could be impractical if both structures experience flooding. The presence of an emergency evacuation plan cannot verify that it is appropriately applicable to a flood event, or that its contents are widely known by all building occupants.

Flood Insurance. Some, but by no means all, of the buildings surveyed reported maintaining flood insurance. With the preliminary mapping proposed in FEMA’s FIS several buildings in the study area would be within the mapped flood zone, whereas on the currently effective maps they are not. It appears that many building owners/residents may not be aware of the proposed FEMA changes, and how that may impact flood insurance requirements.

Compounding Issues. Often, sand displaced by lake water compounded damages. Floor drains were reported to be clogged by sand, creating water build up inside basement areas or parking structures. This was noted and factored into the building structure vulnerability rating where standing water levels on the site limited access to/from the structure. In some instances, residents reported stormwater backing up in the street due to insufficient drainage infrastructure or streets sloping towards the building, resulting in water infiltration into the building.

Foundation Concerns. Visible observations can only tell one portion of the story. Visible efflorescence on a concrete wall may be an indicator of general aging and wear of a structure, or an indicator of damages from wave or moisture inundation over longer periods of time. The experience of building managers, engineers, and owners assisted in piecing together the incurred and potential structural damage. As extreme weather events are unpredictable and the structural elements most vulnerable to soil washout – the foundations – are generally hidden from visual inspection, these assessments could not accurately predict precisely how much longer any given structure will remain serviceable.



APPENDIX 1
SURVEY QUESTIONNAIRE

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Chicago Lakefront Assessment

(untitled)

1. Ward? *

- 5
- 7
- 48
- 49
- Other - Write In (Required)

2. Address? *

- 2564 E. 72ND PLACE
- 2571 E. 71ST STREET
- 2666 E. 73RD STREET
- 7233 S. SOUTH SHORE DRIVE
- 7241 S. SOUTH SHORE DRIVE
- 7251 S. SOUTH SHORE DRIVE
- 7321 S. SOUTH SHORE DRIVE
- 7337 S. SOUTH SHORE DRIVE
- 7425 S. SOUTH SHORE DRIVE
- Other - Write In (Required)

3. Address? *

- 5801 N. SHERIDAN ROAD
- 5815 N. SHERIDAN ROAD
- 5831-37 N. SHERIDAN ROAD
- 5855 N. SHERIDAN ROAD
- 5901 N. SHERIDAN ROAD
- 5959 N. SHERIDAN ROAD
- 5965 N. SHERIDAN ROAD
- 6007 N. SHERIDAN ROAD
- 6033 N. SHERIDAN ROAD
- 6101 N. SHERIDAN EAST
- 6101 N. SHERIDAN ROAD
- 6121 N. SHERIDAN ROAD
- 6129-35 N. SHERIDAN ROAD
- 6145-47 N. SHERIDAN ROAD
- 6157 N. SHERIDAN ROAD
- 6171 N SHERIDAN ROAD
- 6205 N. SHERIDAN ROAD
- 6249-59 N. SHERIDAN ROAD
- 6301 N. SHERIDAN ROAD
- 6325 N. SHERIDAN ROAD
- 6331 N. SHERIDAN ROAD
- 6339 N. SHERIDAN ROAD
- Other - Write In (Required)

4. Address? *

- 1000-1002 W. LOYOLA
- 1001 W. LOYOLA
- 1050 W. COLUMBIA
- 1051-29 W. NORTH SHORE
- 1200 W. CHASE
- 1200 W. SHERWIN
- 1201 W. CHASE
- 1205 W. SHERWIN
- 1206 W. JARVIS
- 1217-19 W. JARVIS
- 1304 W. BIRCHWOOD
- 1309-23 W. FARGO
- 1316 W. FARGO
- 1321 W. BIRCHWOOD
- 7501-07 N. EASTLAKE
- 7601 N. EASTLAKE
- 7609 N. EASTLAKE
- 7617 N. EASTLAKE
- 7619 N. EASTLAKE
- 7625 N. EASTLAKE
- 7631 N. EASTLAKE
- 7641 N. EASTLAKE
- 7649 N. EASTLAKE
- 7729-31 N. EASTLAKE
- 7737 N. EASTLAKE

7739 N. EASTLAKE

Other - Write In (Required)

5. Address?

6. Initial Notes

7. Discipline?

MEP FP

Civil

Architecture

Waterfront

Mechanical

8. Where is the following located?

	N/A	On Housekeeping pad/stand	Inside below grade	Inside at grade	Outside on grade	flooding protection
AHU (i.e. AHU, RTU, FCU, HP, Furnace)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Air Cooled Condensing Unit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Insulated Duct Installed low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Boiler	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chiller	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pumps	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tanks (esp. pneumatic, fuel, cylinders)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="text" value="Enter another opti"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

9. HVAC Equipment Notes

10. Where are the following?

	Above Grade	Below Grade	N/A
air louvers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
pipe vents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
combustion air	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
instrumentation, relays or control panels	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
electrical baseboard, electrical radiant heating	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

11. Where is the gas service meter?

- Inside below grade
- Inside at grade
- Inside above first floor
- Outside on grade

12. Mechanical Additional Notes

13. Where are the following located?

	N/A	On housekeeping pad or wall mounted	Inside below grade	Inside at grade	Outside on grade	flooding protection
transformer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
backup power source	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
backup power fuel location	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
service entrance equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
electric panels	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="text" value="Enter another"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

14. Is there risk of electrocution due to flooding along the path of egress?

- Yes
- No

15. What type of fuel does the backup system use?

- Diesel
- Gas
- Battery
- Alternate Service
- Other - Write In

16. Electrical Additional Notes

Plumbing

17. Where are the following located:

	N/A	on housekeeping pad	inside at grade	inside below grade	inside above grade	flooding protection
booster pump	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
water heater	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
elevator pump	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
sewage ejector	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
sump pump	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

18. What kind of pump is there for the following:

	submersible	top mounted
sewage ejector	<input type="checkbox"/>	<input type="checkbox"/>
sump pump	<input type="checkbox"/>	<input type="checkbox"/>

19. What kind of water heater is present?

- Gas
- Electric
- Steam
- N/A

20. Where does the elevator terminate in the building?

- At grade
- Below grade (basement)
- N/A

21. Is there an elevator pit pump?

- Yes
- No
- Unknown

22. Plumbing Additional Notes

23. Where are the following located?

	N/A	Inside below grade	Inside at grade	Inside above grade
Fire Pump	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Main Fire Alarm Control Panel	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="text" value="Enter another option"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

24. Provide description of fire alarm panels or components located below grade (e.g. red electrical boxes or panels):

25. Fire Protection Additional Notes

26. What is General Flood impact of user occupants?

<p>1 - Low (Unoccupied, Temporary Structure, Storage Facility, Parking)</p> <p style="text-align: center;"><input type="radio"/></p>	<p>2 - Moderate (Residential, Commercial)</p> <p style="text-align: center;"><input type="radio"/></p>	<p>3 - Moderate + (Residential with >20 units)</p> <p style="text-align: center;"><input type="radio"/></p>	<p>4 - High (Potential for large groups of people, museum, school, place of worship, Day Care Center)</p> <p style="text-align: center;"><input type="radio"/></p>	<p>5 - Very High (Building houses emergency response function, Police/Fire, Hospital, Emergency Shelter)</p> <p style="text-align: center;"><input type="radio"/></p>
--	--	--	--	---

27. Answer the following:

	Yes	No	Unable to answer
Does the building have flood insurance?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Does more than half of the population need assistance in case of an emergency?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

28. General Flood Risk & Population Notes

29. Did the structure experience flood damage during January 11, 2020 storm?

Yes

No

30. What was the approximate extent of the damage?

- 5 + units were made uninhabitable
- 2-5 units were made uninhabitable
- One unit was made uninhabitable
- water damage to portions of interior with loss of service for period of time
- water damage to portions of interior with no loss of service
- water damage to exterior, but no water ingress

31. How many days did the flooding last?

32. What is the approximate extent of the damage?

- < \$10,000
- Between \$10,000 and \$50,000
- Between \$50,000 and \$100,000
- Between \$100,000 and \$250,000
- Over \$250,000
- Unknown, follow up needed

33. With past flood do you typically file an insurance claim?

- Yes
- No
- Unknown

34. What is the function/occupancy of the affected areas?

- residential unit
- retail
- parking
- residential amenity
- MEP FP
- Storage
- Other - Write In

35. Has the structure experienced previous flood damage?

Yes

No

36. Excluding the January 11 flood, when was approximate time of last flood damage?

- It has never flooded
- One event in past year
- Multiple events in past year
- typically one per year
- typically multiple per year
- Experienced significant flooding in late 1980s

37. What changes were made in response to the flooding in the late 1980s?

38. History of Flooding Notes

39. Floors:

Above grade

Below grade

40. Is the building a designated historic building?

Yes

No

41. What is the Building structure type?

Cast in place concrete

structural steel

light framing structure

bearing wall

heavy timber

Other - Write In

42. What is the architectural cladding?

- Glass/curtain wall
- masonry
- precast concrete
- siding
- metal panel
- Other - Write In

43. When was the building constructed?

44. Answer the following:

	Yes	No
Would lakeshore flooding hinder access into the building?	<input type="radio"/>	<input type="radio"/>
Does the building have an evacuation plan?	<input type="radio"/>	<input type="radio"/>
Is there a fire escape?	<input type="radio"/>	<input type="radio"/>

45. How many total means of egress are there?

46. If there is a flood how many of the means of egress would be unusable?

47. What is the location of the unusable exits?

- East facing (lake side)
- North facing
- South facing
- West facing

48. Building Construction Notes

49. Building Contact information:

50. What type of shore protection does the property have?

- Rubblemound armor stone revetment Concrete seawall
- Steel Sheet bulkhead Vegetated dune None
- Rubble mound with sheet pile wall rubble mound with concrete wall
- Other or combination- Write In

51. Shore protection type notes:

52. Shore protection:

	Yes	No
Is the shore protection attached to the structure foundation?	<input type="radio"/>	<input type="radio"/>
Are there signs of damage to the shore protection? (displaced stones, scraps, collapse, loss of section, etc)	<input type="radio"/>	<input type="radio"/>
Are there signs of recent overtopping? (ice buildup on shore line vegetation, debris, etc)	<input type="radio"/>	<input type="radio"/>
Are any outfall/stormwater infrastructure visible?	<input type="radio"/>	<input type="radio"/>

53. What is the scale of the damage present?

- Major
- Moderate
- Minor

54. Describe the damage/signs of overtopping present

55. Does the building have an active Operation and Maintenance Plan for the shore protection?

- Yes, last O&M action was within last 12 months
- Yes, last O&M action was 1-5 years ago
- Yes, last O&M was between 5-20 years ago
- Yes, last O&M action was over 20 years ago
- No O&M plan exists (or not known)

56. Has the right of way been obstructed during a flood?

- Yes
- No

57. What is approximate elevation of crest short protection?

- Crest is > 6 feet above grade
- Crest is 4 – 6 feet above grade
- Crest is 2 – 4 feet above grade
- Crest is 0 – 2 feet above grade
- Crest is below grade

58. Shore Protection Notes

Other External Features

59. Are external utility connections visible?

- Yes
- No

60. Are external utility connections exposed to wave overtopping?

- Yes No

61. Utility Connection Notes

62. What external facilities does the building have?

- Garage Storage Building None

Other - Write In

63. Are the external facilities exposed to wave overtopping?

- Yes
 No

64. Could any of the following be underwater?

- Fire Hydrants Fire Department Connections

65. Could the fire department access route be inaccessible due to flood?

- Yes No

66. Other External Features Notes

Foundation + Site Grading

67. What is the structures foundation type?

- Slab on Grade Masonry Wall Concrete Wall

- Pile Foundation Not discernable

- Other - Write In (Required)

68. Do any of the following show signs of erosion?

	Yes	No
Foundation	<input type="radio"/>	<input type="radio"/>
Site Grading	<input type="radio"/>	<input type="radio"/>
Sink Holes	<input type="radio"/>	<input type="radio"/>
Roadways	<input type="radio"/>	<input type="radio"/>
<input type="text" value="Enter another option"/>	<input type="radio"/>	<input type="radio"/>

69. What is the level of erosion at the foundation?

Major

Moderate

Minor

70. Was the damage private or public?

Public

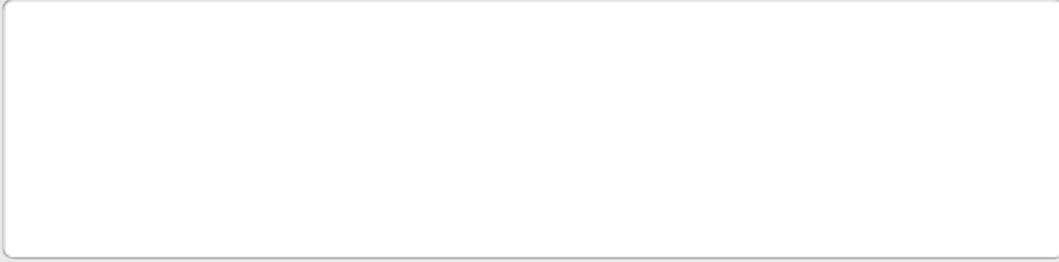
Private

71. Does site grading encourage ponding of overtopping water against structure foundation?

Yes

No

72. Foundation + Site Grading Notes

A large, empty rectangular box with a thin black border, intended for handwritten notes or drawings related to the section header.



**APPENDIX 2
ASCE 24-14 – FLOOD
RESISTANT DESIGN AND
CONSTRUCTION**

SMITHGROUP

HIGHLIGHTS OF ASCE 24-14 *Flood Resistant Design and Construction*

Published by the American Society of Civil Engineers (ASCE), *Flood Resistant Design and Construction*, ASCE 24, is a referenced standard in the *International Codes*[®] (I-Codes[®]). ASCE 24 states the minimum requirements and expected performance for the siting and design and construction of buildings and structures in flood hazard areas that are subject to building code requirements. Types of buildings and structures are described in ASCE 24-14, Table 1-1 (see page 5 of these Highlights), and include commercial, residential, industrial, educational, healthcare, critical facilities, and other occupancy types. Buildings and structures designed according to ASCE 24 are better able to resist flood loads and flood damage.



FEMA deems ASCE 24 to meet or exceed the minimum National Flood Insurance Program (NFIP) requirements for buildings and structures. ASCE 24 includes additional specificity, some additional requirements, and some limitations that are not in NFIP regulations.

Buildings and structures within the scope of the IBC and proposed to be located in any flood hazard area must be designed in accordance with ASCE 24. The 2015 I-Codes reference ASCE 24-14, while the 2006 through 2012 I-Codes reference ASCE 24-05. The *International Residential Code*[®] requires dwellings in floodways to be designed in accordance with ASCE 24, and the 2015 edition of the IRC allows use of ASCE 24 for dwellings in any flood hazard area (the 2012 and 2009 editions allow use of ASCE 24 in Coastal High Hazard Areas).

Highlights of ASCE 24-14 that complement the NFIP minimum requirements are described below.

A summary of significant technical revisions from ASCE 24-05 to ASCE 24-14 is reproduced on page 6 of these Highlights.

Building Performance

- Flood loads and other loads and load combinations are specified in ASCE 7-10, *Minimum Design Loads for Buildings and Other Structures*. Performance of foundations exposed to flooding is specified in ASCE 24. Soil characteristics and underlying strata, including soil consolidation, expansion or movement, erosion and scour, liquefaction and subsidence must be considered, as applicable.
- Flood Design Classes replace Occupancy/Risk Categories for the purpose of establishing elevations of lowest floors, flood-resistant materials, equipment and floodproofing. The 2015 *International Building Code* requires designers to identify the Flood Design Class assigned in accordance with ASCE 24-14.
- Elevation and Freeboard (additional height above the NFIP's base flood elevation) are specified as a function of the Flood Design Class and the nature of the flood hazard areas (see table on page 4 of these Highlights). Essential facilities (Flood Design Class 4) must be elevated or protected to the BFE + 2 ft or 500-year flood elevation, whichever is higher.
- Elevation requirements in Zone V and Coastal A Zones are independent of orientation of the lowest horizontal structural member (relative to direction of wave approach) as a factor in determining the required freeboard (ASCE 24-05 made elevation a function of orientation of the lowest horizontal structural member relative to the direction of wave approach).

ASCE 24 uses 'design flood' and 'design flood elevation' to acknowledge that some communities adopt flood hazard maps that depict flood hazard areas in addition to Special Flood Hazard Areas shown on FEMA's Flood Insurance Rate Maps (FIRM).

The design flood elevation (DFE) equals the base flood elevation (BFE) in communities that regulate based on FIRMs. The DFE is always equal to or higher than the BFE.

- Fill is required to be stable under conditions of flooding, including rapid rise and rapid drawdown, prolonged inundation, and erosion and scour. Compaction of structural fill is specified unless otherwise required by the building code or in a geotechnical or engineering report. Fill side slopes must be no steeper than 1:1.5.
- Two methods are specified to meet the requirements for flood openings in walls of enclosures below elevated buildings, to allow for the automatic entry and exit of floodwater: nonengineered openings that do not require certification (1 sq in per sq ft of enclosed area) and engineered openings that must be certified by a registered design professional. The performance of engineered openings must account for the presence of louvers, blades, screens, grilles, faceplates, or other covers and devices and must ensure that the difference between the exterior and interior floodwater levels does not exceed 1 foot. Installation of all flood openings must be in at least two walls and must be no more than 1 foot above the higher of the interior grade or floor and the finished exterior grade immediately under each opening.
- All breakaway walls in all flood hazard areas must have flood openings (ASCE 24-05 did not require flood openings in Zone V breakaway walls).
- Provisions are included for attached and detached decks and porches, and for garages, carports, and accessory storage structures.
- Provisions are listed for concrete slabs-on-grade, depending on the purpose and location of the slabs.
- Stairways and ramps must be designed and constructed to resist flood loads and to minimize transfer of flood loads to foundations, or to break away without causing damage to the main structure, or to be retractable/able to be raised.
- Where stairways are located inside areas enclosed with breakaway walls, exterior doors are required at the main building entry at the top of the stairs, to minimize entry of wind-driven rain and wave splash after breakaway walls have failed.
- In Coastal High Hazard Areas (Zone V) and Coastal A Zones:
 - Coastal A Zones are treated like Coastal High Hazard Areas if FEMA has delineated a Limit of Moderate Wave Action, or if the community has designated a Coastal A Zone.
 - Buildings must be supported on piles, drilled shafts, caissons, or other deep foundations (including columns, and shear walls) and foundation depth must take into account erosion and local scour.
 - Stem walls supporting floors and backfilled with soil or gravel are allowed in Coastal A Zones if designs provide for the effects of local scour and erosion.
 - Requirements are included for shallow foundations in circumstances where soil conditions prevent deep foundations.
 - Provisions are provided for pile foundations, attachment to piles, and different types of piles (wood, steel H, concrete-filled steel pipe, prestressed concrete, precast concrete, cast-in-place concrete).
 - Provisions are provided for pile design (capacity, capacity of supporting soils, minimum penetration, spacing, connections, splicing, and mixed and multiple types of piles).
 - Provisions are provided for footings, mats, rafts, slabs-on-grade, pile caps, grade beams, bracing, and shear walls.
 - Walls designed to break away must not produce debris that is capable of damaging structures.
 - Erosion control structures (bulkheads, seawalls, revetments) must not be attached to buildings or direct floodwater into or increase flood forces or erosion impacts on structures.
 - Pools must be elevated, or designed to breakaway without producing damaging debris, or designed to remain in the ground without obstructing flow that causes damage. Pools must be structurally independent of buildings and structures unless pools are located in or on elevated floors or roofs that are above the design flood elevation.

- Dry floodproofed nonresidential buildings and non-residential portions of mixed-use buildings:
 - The terms “mixed use” and “residential portions of mixed use” now are defined in Commentary.
 - Dry floodproofing measures are not permitted in Coastal High Hazard Areas, Coastal A Zones, High Risk Flood Hazard Areas, where flood velocities exceed 5 ft/sec, and where conformance with certain human intervention limits cannot be achieved.
 - At least one exit door or emergency escape/rescue opening must be provided above the elevation specified for dry floodproofing.
 - If dry floodproofing measures specified require human intervention to activate or implement, there must be a minimum warning time of 12 hours unless a community warning system provides a warning time sufficient to accomplish certain activities. If removable shields are approved as part of design, flood emergency plans must address specified elements and actions and must be posted in at least two conspicuous locations.

Flood Damage-Resistant Materials

- Flood damage-resistant materials must be used below specified elevations (see table on page 4).
- Metal connectors and fasteners exposed to salt water, salt spray or other corrosive agents must be stainless steel or equivalent corrosion resistant material, or hot-dipped galvanized after fabrication.
- Where preservative treated wood is required, treatment must be in accordance with AWPA requirements.

Attendant Utilities and Equipment

- Attendant utilities and equipment must be at or above specified elevations (see table on page 4), or must be specifically designed, constructed, and installed to prevent floodwaters from entering or accumulating within components.
- Fuel supply lines must be equipped with float operated automatic shut-off valves.
- Where required to meet life safety provisions of the code, certain exterior electrical components may be installed below the design flood elevation, provided they are installed on a non-breakaway structural element on the landward or downstream side of structures.
- Tanks that are below the design flood elevation and that are attached to or beneath buildings must be installed and anchored to resist at least 1.5 times the potential buoyant and other flood forces assumed to act on empty tanks.
- Elevator cabs that descend below the design flood elevation must be equipped with controls that prevent the cab from descending into floodwaters. Elevator shafts must be designed to resist flood loads, but are not required to have flood openings or breakaway walls.

Siting Considerations

- New buildings must not be built (1) seaward of the reach of mean high tide, or (2) in areas subject to flash flooding (floodwaters rise to 3 feet or more above banks in less than 2 hours). Unless protected, new buildings must not be built (1) in erosion-prone areas (determined by analysis); or (2) in mudslide areas (determined by analysis); or (3) in certain portions of alluvial fan areas; or (4) in high velocity flow areas (faster than 10 ft/sec); or (5) in ice jam and debris areas.
- Buildings in proximity to flood protective works (dams, levees, floodwalls, diversions, channels, flood control structures) must not have adverse effects on, or conflict with, maintenance and repairs of those protective works.

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See next page for description of Flood Design Classes →

		Flood Design Class 1	Flood Design Class 2	Flood Design Class 3	Flood Design Class 4
Minimum Elevation* of Lowest Floor (Zone A: ASCE 24-14 Table 2-1)	Zone A not identified as Coastal A Zone	DFE	BFE +1 ft or DFE, whichever is higher	BFE +1 ft or DFE, whichever is higher	BFE +2 ft or DFE, or 500-year flood elevation, whichever is higher
Minimum Elevation of Bottom of Lowest Horizontal Structural Member (Zone V: ASCE 24-14 Table 4-1)	Coastal High Hazard Areas (Zone V) and Coastal A Zone	DFE	BFE +1 ft or DFE, whichever is higher	BFE +2 ft or DFE, whichever is higher	BFE +2 ft or DFE, or 500-year flood elevation, whichever is higher
Minimum Elevation Below Which Flood-Damage-Resistant Materials Shall be Used (Table ASCE 24-14 5-1)	Zone A not identified as Coastal A Zone	DFE	BFE +1 ft or DFE, whichever is higher	BFE +1 ft or DFE, whichever is higher	BFE +2 ft or DFE, or 500-year flood elevation, whichever is higher
	Coastal High Hazard Areas (Zone V) and Coastal A Zone	DFE	BFE +1 ft or DFE, whichever is higher	BFE +2 ft or DFE, whichever is higher	BFE +2 ft or DFE, or 500-year flood elevation, whichever is higher
Minimum Elevation** of Utilities and Equipment (ASCE 24-14 Table 7-1)	Zone A not identified as Coastal A Zone	DFE	BFE +1 ft or DFE, whichever is higher	BFE +1 ft or DFE, whichever is higher	BFE +2 ft or DFE, or 500-year flood elevation, whichever is higher
	Coastal High Hazard Areas (Zone V) and Coastal A Zone	DFE	BFE +1 ft or DFE, whichever is higher	BFE +2 ft or DFE, whichever is higher	BFE +2 ft or DFE, or 500-year flood elevation, whichever is higher
Minimum Elevation of Dry Floodproofing of non-residential structures and non-residential portions of mixed-use buildings (ASCE 24-14 Table 6-1)	Zone A not identified as Coastal A Zone	BFE +1 ft or DFE, whichever is higher	BFE +1 ft or DFE, whichever is higher	BFE +1 ft or DFE, whichever is higher	BFE +2 ft or DFE, or 500-year flood elevation, whichever is higher
	Coastal High Hazard Areas (Zone V) and Coastal A Zone	Not permitted	Not permitted	Not permitted	Not permitted
Minimum Elevation of Wet Floodproofing*** (ASCE 24-14 Table 6-1)	Zone A not identified as Coastal A Zone; Coastal A Zone; Coastal High Hazard Areas (Zone V)	BFE +1 ft or DFE, whichever is higher	BFE +1 ft or DFE, whichever is higher	BFE +1 ft or DFE, whichever is higher	BFE +2 ft or DFE, or 500-year flood elevation, whichever is higher
<p>* Flood Design Class 1 structures shall be allowed below the minimum elevation if the structure meets the wet floodproofing requirements of ASCE 24-14 Section 6.3. ** Unless otherwise permitted by ASCE 24-14 Chapter 7 *** Only if permitted by ASCE 24-14 Section 6.3.1</p>					

ASCE 24-14 Table 1-1 Flood Design Class of Buildings and Structures	
Use or Occupancy of Buildings and Structures	Flood Design Class
Buildings and structures that normally are unoccupied and pose minimal risk to the public or minimal disruption to the community should they be damaged or fail due to flooding. Flood Design Class 1 includes (1) temporary structures that are in place for less than 180 days, (2) accessory storage buildings and minor storage facilities (does not include commercial storage facilities), (3) small structures used for parking of vehicles, and (4) certain agricultural structures. [Note (a)]	1
Buildings and structures that pose a moderate risk to the public or moderate disruption to the community should they be damaged or fail due to flooding, except those listed as Flood Design Classes 1, 3, and 4. Flood Design Class 2 includes the vast majority of buildings and structures that are not specifically assigned another Flood Design Class, including most residential, commercial, and industrial buildings.	2
Buildings and structures that pose a high risk to the public or significant disruption to the community should they be damaged, be unable to perform their intended functions after flooding, or fail due to flooding. Flood Design Class 3 includes (1) buildings and structures in which a large number of persons may assemble in one place, such as theaters, lecture halls, concert halls, and religious institutions with large areas used for worship; (2) museums; (3) community centers and other recreational facilities; (4) athletic facilities with seating for spectators; (5) elementary schools, secondary schools, and buildings with college or adult education classrooms; (6) jails, correctional facilities, and detention facilities; (7) healthcare facilities not having surgery or emergency treatment capabilities; (8) care facilities where residents have limited mobility or ability, including nursing homes but not including care facilities for five or fewer persons; (9) preschool and child care facilities not located in one- and two-family dwellings; (10) buildings and structures associated with power generating stations, water and sewage treatment plants, telecommunication facilities, and other utilities which, if their operations were interrupted by a flood, would cause significant disruption in day-to-day life or significant economic losses in a community; and (11) buildings and other structures not included in Flood Design Class 4 (including but not limited to facilities that manufacture, process, handle, store, use, or dispose of such substances as hazardous fuels, hazardous chemicals, hazardous waste, or explosives) containing toxic or explosive substances where the quantity of the material exceeds a threshold quantity established by the authority having jurisdiction and is sufficient to pose a threat to the public if released. [Note (b)]	3
Buildings and structures that contain essential facilities and services necessary for emergency response and recovery, or that pose a substantial risk to the community at large in the event of failure, disruption of function, or damage by flooding. Flood Design Class 4 includes (1) hospitals and health care facilities having surgery or emergency treatment facilities; (2) fire, rescue, ambulance, and police stations and emergency vehicle garages; (3) designated emergency shelters; (4) designated emergency preparedness, communication, and operation centers and other facilities required for emergency response; (5) power generating stations and other public utility facilities required in emergencies; (6) critical aviation facilities such as control towers, air traffic control centers, and hangars for aircraft used in emergency response; (7) ancillary structures such as communication towers, electrical substations, fuel or water storage tanks, or other structures necessary to allow continued functioning of a Flood Design Class 4 facility during and after an emergency; and (8) buildings and other structures (including, but not limited to, facilities that manufacture, process, handle, store, use, or dispose of such substances as hazardous fuels, hazardous chemicals, or hazardous waste) containing sufficient quantities of highly toxic substances where the quantity of the material exceeds a threshold quantity established by the authority having jurisdiction and is sufficient to pose a threat to the public if released. [Note (b)]	4
<p>[Note (a)] Certain agricultural structures may be exempt from some of the provisions of this standard; see ASCE 24-14 Section C1.4.3.</p> <p>[Note (b)] Buildings and other structures containing toxic, highly toxic, or explosive substances shall be eligible for assignment to a lower Flood Design Class if it can be demonstrated to the satisfaction of the authority having jurisdiction by a hazard assessment as described in ASCE 7-10 Section 1.5.3 of <i>Minimum Design Loads for Buildings and Other Structures</i> that a release of the substances is commensurate with the risk associated with that Flood Design Class.</p>	

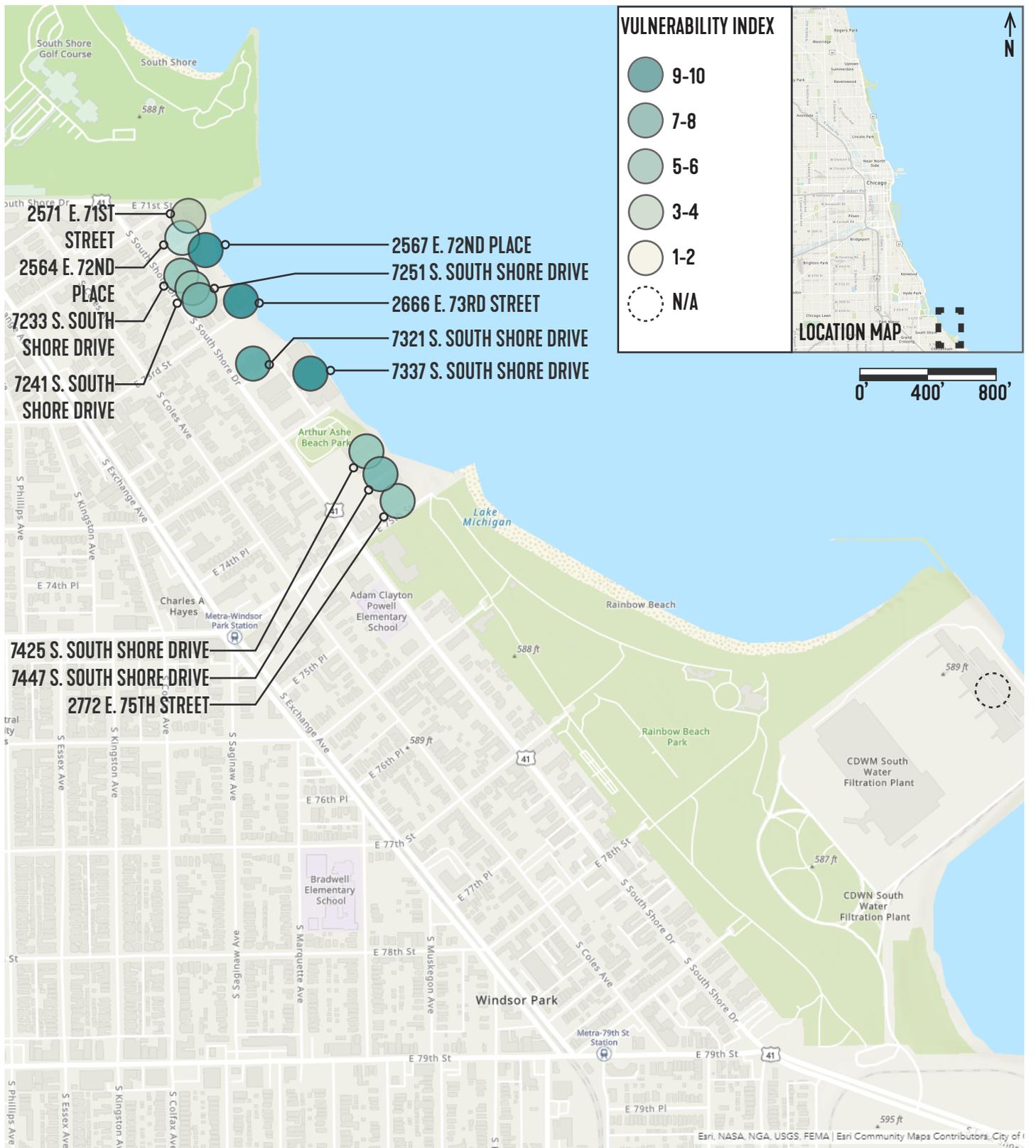
Significant Technical Revisions

ASCE 24-14 lists a number of significant technical revisions from the 2005 edition:

1. Defines *Flood Design Class* rather than use Risk/Occupancy Classification assigned under ASCE 7 and requires each building or structure governed by the standard to be assigned to Flood Design Class 1, 2, 3, or 4. Uses the assigned Flood Design Class to apply elevation requirements specified in Chapters 2, 4, 5, 6 and 7. Flood Design Class 4 buildings and facilities are equivalent to Occupancy Category/Risk Category IV buildings, which ASCE 7-10 identifies as essential facilities.
2. Adds definitions for *Mixed Use* and *Residential Portions of Mixed Use* in commentary to clarify limitations on use of dry floodproofing measures.
3. Changes the Coastal A Zone determination requirement from the designer's responsibility to one depending on either: 1) delineation of a Limit of Moderate Wave Action (LiMWA) on a Flood Insurance Rate Map, or 2) designation by the Authority Having Jurisdiction.
4. Separates specifications for flood openings from the installation requirements. Requires the presence of louvers, blades, screens, faceplates, or other covers and devices to be accounted for in determining net open area for non-engineered openings and in determining the performance of engineered openings. Revises coefficient of discharge table for engineered flood openings. Adds commentary regarding selection of coefficient of discharge and for grouping or stacking of flood openings.
5. For Flood Design Class 4 buildings, requires the minimum lowest floor elevation (or floodproofing level of protection) to be the higher of: the Base Flood Elevation plus freeboard specified in Chapters 2, 4 and 6, the Design Flood Elevation, or the 500-year flood elevation. The 500-year flood elevation requirement is new.
6. Clarifies text pertaining to alluvial fan high risk flood hazard areas.
7. In coastal high hazard areas (V Zone) and Coastal A Zones (if delineated):
 - a. Makes explicit that designs must account for local scour and erosion
 - b. Provides for shallow foundations in Coastal A Zones under certain circumstances
 - c. Requires flood openings in breakaway walls
 - d. Eliminates orientation of the lowest horizontal structural member as a factor to determine elevation for lowest floors, equipment, and flood damage-resistant materials
 - e. Requires exterior doors at the top of stairways that are located inside enclosed areas with breakaway walls
 - f. Consolidates requirements for all nonstructural concrete slabs
 - g. Allows substantial improvement of existing buildings seaward of the reach of mean high tide in V zones (makes ASCE 24 consistent with NFIP) and Coastal A Zones.
8. Updates flood damage-resistant material requirements.
9. Clarifies emergency escape and rescue opening requirements for dry floodproofed buildings.
10. Clarifies requirements for garages, carports, and accessory storage structures. Adds new section for multistory parking structures.
11. Consolidates requirements for tanks and more clearly distinguishes between requirements based on flood hazard area.



**APPENDIX 3
INDIVIDUAL PROPERTY
REPORTS**



Ownership	Private
Number of Units	Unknown
Vulnerability Index	3
01/11/20 Flooding	Yes
Construction Date	1960s
Floors Above Grade	5
Floors Below Grade	0
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	1	Structure Type	Cast in place concrete
Building Evac. Plan	No	Cladding Type	Masonry
Flood Access Impact	Yes	# of Egress Impacted	2
Min. 50% Assistance	Yes	Elevator Termination	At grade
Occupancy Notes	None		
Building Construction	None		
Flooding Impact History	No previous flooding. 1/11/20 flooding noted.		

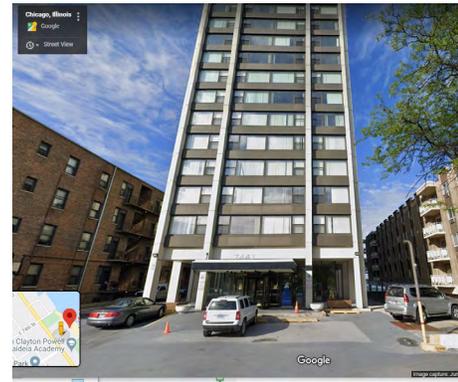
BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	3
Building System Notes	All electric building (no gas service). All major MEPFP equipment is at grade with some risk of flood damage due to lake water wave action capable to reach near lobby entrance. Risk of electrocution from electric baseboard in lobby at egress.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	3	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Concrete Wall
Shore Protection	Concrete seawall	Crest Over Shore Protection	2 - 4 feet above grade
Shore Protection Notes	100' of beach 2' concrete seawall. Concrete seawall varies in height. No weep holes in seawall. 2 CB 30' west of seawall, drainage for overtop. Rubblemound adjacent to beach. DWM placed jersey barriers south of property. Indicates ROW was obstructed.		

Ownership	Private
Number of Units	N/A
Vulnerability Index	6
01/11/20 Flooding	Yes
Construction Date	1968
Floors Above Grade	34
Floors Below Grade	1
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	2	Structure Type	Cast in place concrete
Building Evac. Plan	No	Cladding Type	Glass curtain wall
Flood Access Impact	Yes	# of Egress Impacted	2
Min. 50% Assistance	No	Elevator Termination	Below grade (basement)
Occupancy Notes	None		
Building Construction	None		
Flooding Impact History	Previous flooding, typically one per year. 1/11/20 Ground water issues in boiler room during. Water entered through basement door. Door has been taped shut.		

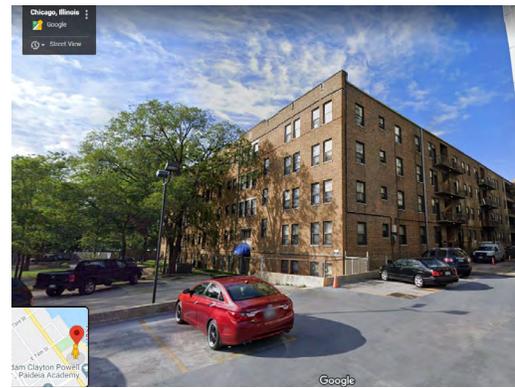
BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	5
Building System Notes	All major MEPFP equipment below grade at risk of flood damage. Housekeeping pad height varied (2" - 6"). Risk of electrocution from floor mounted Unit Heater at egress. Recent flooding in storage room, which shares a common corridors to MEPFP spaces (some lower in elevation). Exhaust Fans and Hot Water Unit Heaters in enclosed parking garage below grade.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	3	O&M Shore Protection	Unknown
Wave Overtopping	Unknown	Foundation Type	Concrete Wall
Shore Protection	Rubble mound with sheet pile wall	Crest Over Shore Protection	Unknown
Shore Protection Notes	50' of beach 2' high rubblemound in front of sheet pile 3' wide concrete wall in front of 5' high concrete wall.		

Ownership	Private
Number of Units	104 Units
Vulnerability Index	4
01/11/20 Flooding	Yes
Construction Date	1926
Floors Above Grade	4.5
Floors Below Grade	Unknown
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	2	Structure Type	Cast in place concrete
Building Evac. Plan	Yes	Cladding Type	Masonry
Flood Access Impact	No	# of Egress Impacted	Unknown
Min. 50% Assistance	No	Elevator Termination	Unknown
Occupancy Notes	Mostly older folks but mobile		
Building Construction	Courtyard building, opening to lake. Access to courtyards is through 2 building pass-throughs from parking lot fronting the street. Combo cast-in-place and bearing wall construction		
Flooding Impact History	Lake level has eliminated private beach. Water gets into the basement through exterior stairs at north elevation.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	3
Building System Notes	Heating boiler is below grade. Transformer is outside on grade. Electrical service and/or electrical panels is below grade. Domestic Water Heater is below grade. Flood protection limited to sump pump(s) at lowest level.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	3	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Not discernable
Shore Protection	Concrete seawall	Crest Over Shore Protection	2 - 4 feet above grade
Shore Protection Notes	There are some large concrete blocks out from the seawall. Assuming concrete wall may be attached to structure at northeast corner of structure based on proximity of structure to sea wall. Ice buildup on land behind the sea wall suggests overtopping. It was indicated that water surged up over the sea wall up to a height of around 18" against the building. Pieces of the concrete sea wall broke off, but cannot verify as all is covered in ice. Pavement and patio behind the sea wall were damaged and undermined. Pavement damage was visible. There was also a beach but it is now underwater.		

Ownership	Private
Number of Units	360 Units
Vulnerability Index	9
01/11/20 Flooding	Yes
Construction Date	1958
Floors Above Grade	13
Floors Below Grade	1
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	4	Structure Type	Cast in place concrete
Building Evac. Plan	Yes	Cladding Type	Glass window walls / Concrete panels
Flood Access Impact	No	# of Egress Impacted	Unknown
Min. 50% Assistance	No	Elevator Termination	At grade
Occupancy Notes	About 30% seniors, 5% mobility-impaired		
Building Construction	First floor is storage, retail and parking. Second floor is amenity space. Units start on 3rd floor.		
Flooding Impact History	Flooding of basement parking area on 12/19/19; 10 inches of water in basement parking area. Has also flooded in the past, including in 1987. Basement did not flood on 1/11/20; the waves overtopped but the water froze before it could reach the basement. Standing water in sub grade level parking lot. Water enters at northeast corner of exterior parking lot where waves crash over corrugated wall and backflows into parking lot. Water rises to 9" and can backup and effect MEP in sub-basement mech room.		

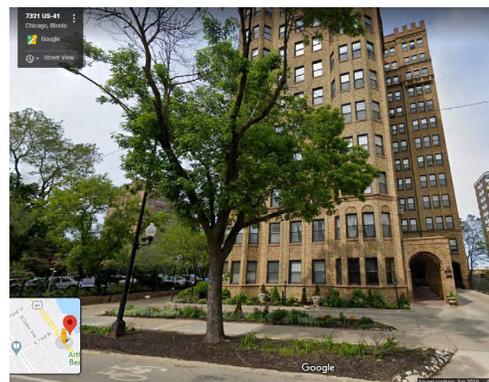
BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	5
Building System Notes	Gas service outside on grade. Electrical service and/or electrical panels is below grade. Domestic Booster Pump is below grade. Domestic Water Heater is below grade. Flood protection limited to sump pump(s) at lowest level. Elevator Pit Pump is below grade. Fire Pump is at grade. Fire Alarm Panel is above grade.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	5	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Not discernable
Shore Protection	Unknown	Crest Over Shore Protection	> 6 feet above grade
Shore Protection Notes	N to S: Approx. 30 LF of concrete wall with sheetpile backing. The rest is sheetpile w/ poured concrete basement wall directly behind it. Enclosed parking garage with surface deck borders the lake. Crest elev >6 ft relative to top of parking deck. Assuming sheetpile may be attached to structure based on proximity. Ice buildup on top of railing at sea wall. Ice buildup on deck immediately behind sea wall.		

Ownership	Private
Number of Units	Over 10 Units
Vulnerability Index	7
01/11/20 Flooding	Unknown
Construction Date	Unknown
Floors Above Grade	Unknown
Floors Below Grade	Unknown
Flood Insurance	Unknown



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	2	Structure Type	Unknown
Building Evac. Plan	Unknown	Cladding Type	Unknown
Flood Access Impact	Unknown	# of Egress Impacted	Unknown
Min. 50% Assistance	Unknown	Elevator Termination	Unknown
Occupancy Notes	None		
Building Construction	None		
Flooding Impact History	Exterior erosion on lake front property and some water seepage in basement. Basement shows signs of water seepage but no active water penetration at time of inspection. Water has seeped into the basement at East side of building.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	5
Building System Notes	All major MEPFP equipment (electrical service/panels, boilers/water heaters, pumps, gas meter/pressure booster, fire pump) below grade potentially at risk of flood damage. Recent flood damage to building. Louvers low above grade and light wells with windows are vulnerable to flooding from the lake. Flood protection limited to sump pump(s) in mechanical room. Combustion air intake low at grade, but on other side of building.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	5	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Unknown
Shore Protection	Steel Sheet bulkhead	Crest Over Shore Protection	4 - 6 feet above grade
Shore Protection Notes	Major erosion at East and Northeast portion of property. Water from lake overflow has damaged the break wall at rear of property causing erosion. Engineer is currently working on a temporary repair to get them through this winter and hopefully next winter where then they can plan a more permanent solution to the lake flooding. Temporary repairs using crushed stone with fabric membrane and stacked stone to keep membrane in place and allow water to flow into lake.		

Ownership	Private
Number of Units	50-60 Units
Vulnerability Index	9
01/11/20 Flooding	Yes
Construction Date	1928
Floors Above Grade	13
Floors Below Grade	1
Flood Insurance	Yes



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	4	Structure Type	Cast in place concrete
Building Evac. Plan	Yes	Cladding Type	Masonry
Flood Access Impact	Yes	# of Egress Impacted	2
Min. 50% Assistance	Yes	Elevator Termination	Unknown
Occupancy Notes	Multi-unit Co-op. Over 90% elderly		
Building Construction	None		
Flooding Impact History	1986 water went into window well on west side of building and into the basement. Emergency pump in basement for boiler, laundry, storage. Revetment added. Late 80's, parking lot flooded and froze and cars were stuck. 1-2" standing water in basement laundry storage. Multiple events in past year. On 1/11/20 waves broke windows, ground floor flooded.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	5
Building System Notes	All/most MEPFP equipment (electrical service/panels, boilers/water heaters, pumps, gas meter, fire pump/alarm panel) below grade at risk of flood damage. Recently experienced flood damage. Duplex sumps were present at lowest level in area but away from mechanical/electrical rooms.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	5	O&M Shore Protection	Unknown
Wave Overtopping	Unknown	Foundation Type	Unknown
Shore Protection	Unknown	Crest Over Shore Protection	Unknown
Shore Protection Notes	None		

Ownership	Private
Number of Units	239 Units
Vulnerability Index	6
01/11/20 Flooding	Yes
Construction Date	Unknown
Floors Above Grade	21
Floors Below Grade	1
Flood Insurance	Yes



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	4	Structure Type	Cast in place concrete
Building Evac. Plan	Yes	Cladding Type	Precast concrete
Flood Access Impact	No	# of Egress Impacted	Unknown
Min. 50% Assistance	Unknown	Elevator Termination	Below grade (basement)
Occupancy Notes	None		
Building Construction	None		
Flooding Impact History	No previous flooding. 1/11/20 fully flooded the lowest garage level 8", and partially flooded the upper garage level. Water entry was through the southeast most stairwell, this stairwell is right behind the seawall. The lowest basement level was below lake level and the upper basement was partially below lake level.		

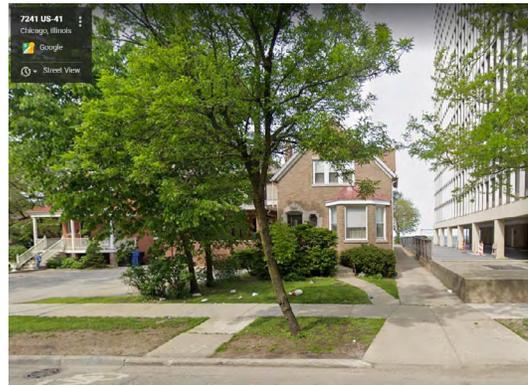
BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	3
Building System Notes	AHUs, boilers, water heaters, hydronic pumps are on the roof. Gas service outside on grade. Electrical service and/or electrical panels is below grade. Domestic Booster Pump is below grade. Flood protection limited to sump pump(s) at lowest level. Elevator Pit Pump is below grade. Fire Pump is below grade. Fire Alarm Panel is above grade.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	4	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Not discernable
Shore Protection	Other or combination	Crest Over Shore Protection	> 6 feet above grade
Shore Protection Notes	Crest as relative to top of parking deck. Covered in ice. Building contact said there is sheet pile wall at the perimeter. Assuming attachment of shore protection to structure based on proximity.		

Ownership	Private
Number of Units	Single Family Home
Vulnerability Index	3
01/11/20 Flooding	Unknown
Construction Date	Unknown
Floors Above Grade	2
Floors Below Grade	Unknown
Flood Insurance	Unknown



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	N/A	Structure Type	Unknown
Building Evac. Plan	Unknown	Cladding Type	Masonry
Flood Access Impact	Unknown	# of Egress Impacted	Unknown
Min. 50% Assistance	Unknown	Elevator Termination	Unknown
Occupancy Notes	Single Family Residence		
Building Construction	None		
Flooding Impact History	Unknown		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	3
Building System Notes	Access to property limited to exterior only. Property has a basement with electrical service from overhead and enters basement. Gas meter is substantially far away from the lake shore.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	4	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Unknown
Shore Protection	Unknown	Crest Over Shore Protection	> 6 feet above grade
Shore Protection Notes	Open beach in front Protection from south to north 40' damaged brick sea wall ' steel pile in front of concrete wall ' unprotected concrete wall. Brick seawall; damaged brick wall Erosion of earth around tree.		

Ownership	Private
Number of Units	Single Building
Vulnerability Index	4
01/11/20 Flooding	No
Construction Date	1892/1920
Floors Above Grade	2
Floors Below Grade	1
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	2	Structure Type	Bearing wall / Light framing
Building Evac. Plan	No	Cladding Type	Masonry
Flood Access Impact	Yes	# of Egress Impacted	2
Min. 50% Assistance	Unable to answer	Elevator Termination	Unknown
Occupancy Notes	Property consists of single-family house with rental cottage to the east.		
Building Construction	None		
Flooding Impact History	Experienced significant flooding in late 1980s. No flooding noted on 1/11/20.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	5
Building System Notes	Access to property limited to exterior only. Sever damage to patio very near electrical pole/service and near gas meter service (protected by dike/wall).

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	4	O&M Shore Protection	Unknown
Wave Overtopping	Unknown	Foundation Type	Unknown
Shore Protection	Unknown	Crest Over Shore Protection	Unknown
Shore Protection Notes	Rear back yard retaining wall and back yard concrete collapsed.		

Ownership	Private
Number of Units	Single Family Home
Vulnerability Index	10
01/11/20 Flooding	Yes
Construction Date	2010
Floors Above Grade	3
Floors Below Grade	0
Flood Insurance	Unknown



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	5	Structure Type	Structural steel
Building Evac. Plan	No	Cladding Type	Glass curtain wall/ Masonry
Flood Access Impact	Yes	# of Egress Impacted	Unknown
Min. 50% Assistance	Unknown	Elevator Termination	Unknown
Occupancy Notes	None		
Building Construction	Steel frame and concrete slabs.		
Flooding Impact History	The structure on the water experienced flooded 1st floor which receded after 30 hours. Sliding glass door was blown off hinges; 2 glass panels blown out and 2 broken. Since first floor glass panels boarded up. Waves coming over 2nd floor balcony, water damage to the 1st floor ceiling. Street was flooded, could only access in SUV.		

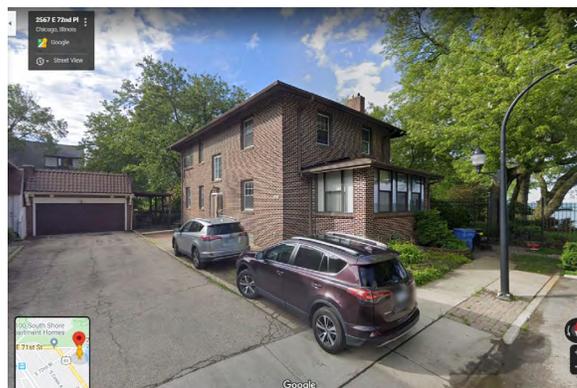
BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	5
Building System Notes	All MEP equipment is on the ground level. Recent flood damage to MEPPF equipment. Underfloor ducts were flooded. Electrical service and/or electrical panels are on ground level. Emergency Generator is on ground level, inside detached garage.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	5	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Not discernable
Shore Protection	Unknown	Crest Over Shore Protection	3-4 Ft / 4-6 ft
Shore Protection Notes	Crest varies. 3-4 feet to the north at yard area. 4-6 feet to the south adjacent to the home. Ice buildup on shore. Damaged exterior metal gates. Damaged pavers and pavements. Land erosion and sinkholes. Scattered debris; chunks of broken pavement larger than 1 foot found >50 ft from shoreline. Per homeowner, patio pavers were found inside the home kitchen area. Exposed plastic utility pipes. Dirt and sand on property and public street adjacent to home.		

Ownership	Private
Number of Units	5-10 Units
Vulnerability Index	2
01/11/20 Flooding	Yes
Construction Date	Unknown
Floors Above Grade	3
Floors Below Grade	0
Flood Insurance	Yes



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	N/A	Structure Type	Unknown
Building Evac. Plan	No	Cladding Type	Unknown
Flood Access Impact	Yes	# of Egress Impacted	Unknown
Min. 50% Assistance	No	Elevator Termination	Unknown
Occupancy Notes	Not full time resident.		
Building Construction	None		
Flooding Impact History	No previous flooding.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	3
Building System Notes	Limited access to exterior of property only. Gas meter within secured fenced area and facing lake.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	4	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Not discernable
Shore Protection	Unknown	Crest Over Shore Protection	3-4 Ft / 4-6 ft
Shore Protection Notes	Crest varies. 3-4 feet to the north at yard area. 4-6 feet to the south adjacent to the home. Along lake frontage of the home: there are concrete blocks with a concrete seawall behind the blocks. To the north of the home there is a concrete seawall with stone rubble in front of the seawall. Ice buildup on shore. Damaged exterior metal gates. Damaged pavers and pavements. Land erosion and sinkholes. Scattered debris; chunks of broken pavement larger than 1 foot found >50 ft from shoreline. Per homeowner, patio pavers were found inside the home kitchen area. Exposed plastic utility pipes. Dirt and sand on property and public street adjacent to home.		

Ownership	Private
Number of Units	Single Family Home
Vulnerability Index	3
01/11/20 Flooding	Unknown
Construction Date	Unknown
Floors Above Grade	2
Floors Below Grade	0
Flood Insurance	Unknown



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

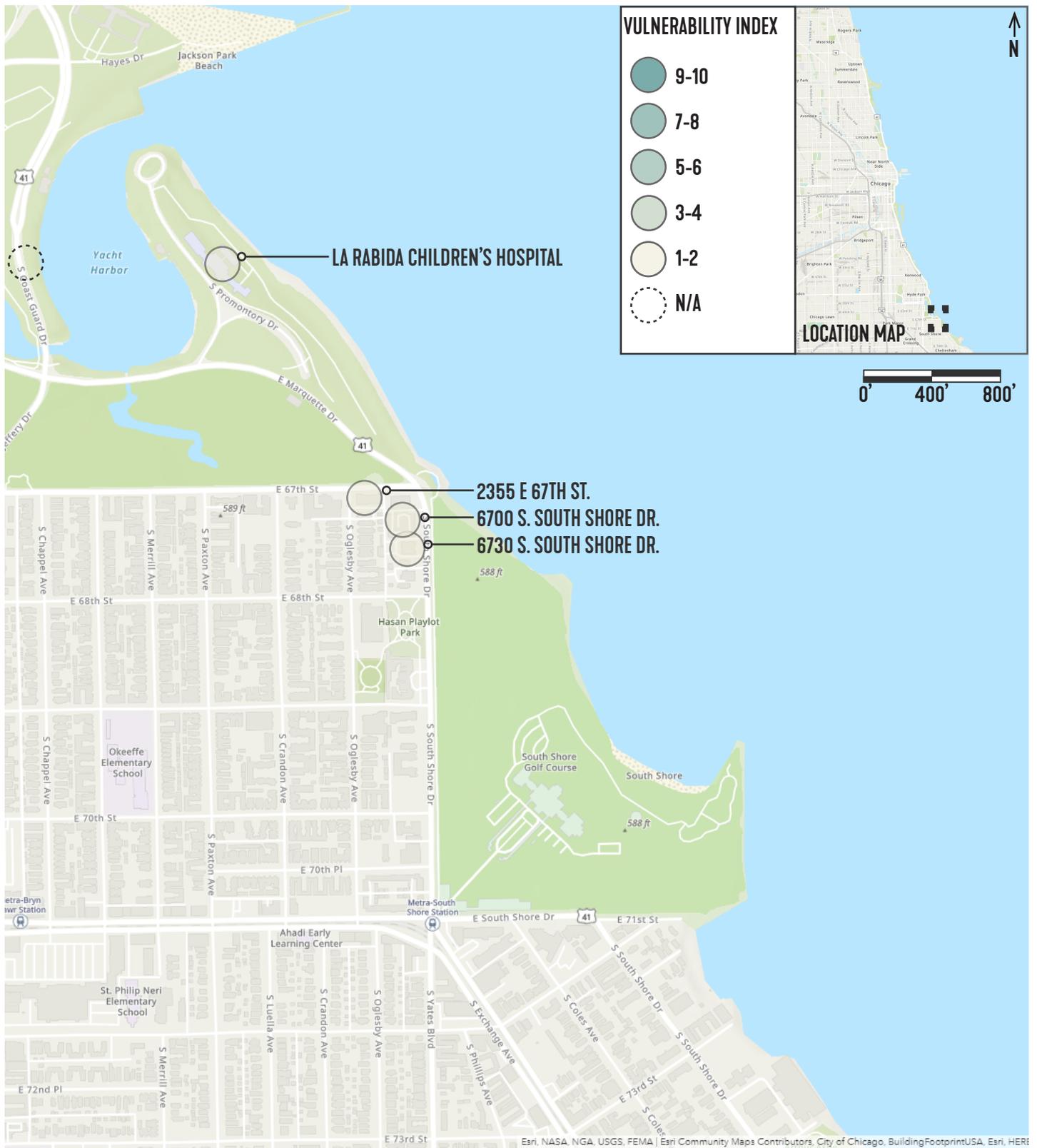
Structural Vulnerability	N/A	Structure Type	Unknown
Building Evac. Plan	Unknown	Cladding Type	Unknown
Flood Access Impact	Unknown	# of Egress Impacted	Unknown
Min. 50% Assistance	Unknown	Elevator Termination	Unknown
Occupancy Notes	None		
Building Construction	None		
Flooding Impact History	Unknown		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	3
Building System Notes	No access to property, however due to the property's location and presence of a basement along with a recent report of flooding, indicates MEPFP equipment is likely at risk of flood damage

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	5	O&M Shore Protection	Unknown
Wave Overtopping	Unknown	Foundation Type	Unknown
Shore Protection	Unknown	Crest Over Shore Protection	Unknown
Shore Protection Notes	None		



Ownership	Private
Number of Units	Unknown
Vulnerability Index	2
01/11/20 Flooding	Unknown
Construction Date	Unknown
Floors Above Grade	Unknown
Floors Below Grade	Unknown
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	2	Structure Type	Unknown
Building Evac. Plan	Unknown	Cladding Type	Unknown
Flood Access Impact	Unknown	# of Egress Impacted	Unknown
Min. 50% Assistance	Unable to answer	Elevator Termination	Below grade (basement)
Occupancy Notes	None		
Building Construction	None		
Flooding Impact History	Top of parking garage asphalt top coat deteriorating throughout. Concrete beams and slab show signs of water penetration. Buildings main basement area near storage lockers show no sign of water seepage. Rear concrete columns at back of building show cracking and spalling masonry at bottoms. No flooding information provided.		

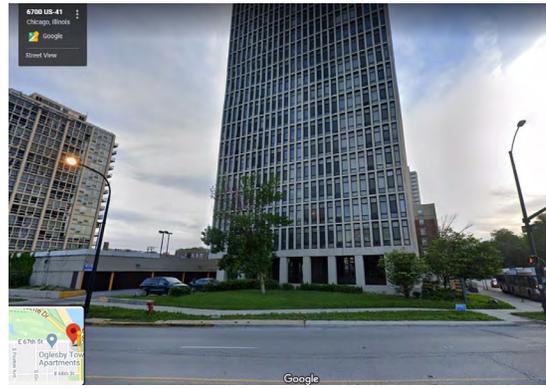
BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	3
Building System Notes	Majority of MEPFP equipment (electrical service, domestic booster pumps, fire pump, First floor air handler) slightly below grade. Boilers safe on 16th floor.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	3	O&M Shore Protection	Unknown
Wave Overtopping	Unknown	Foundation Type	Concrete Wall
Shore Protection	None - Building setback from lakefront	Crest Over Shore Protection	Unknown
Shore Protection Notes	Property not located directly on lakefront. The lake is across the 4 lane road (South Shore Drive) and the north edge of the South Shore Golf Course. Building management indicated South Shore Drive floods in front of their building during major storms.		

Ownership	Private
Number of Units	Unknown
Vulnerability Index	2
01/11/20 Flooding	No
Construction Date	1961/1968
Floors Above Grade	28/17
Floors Below Grade	1
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	1	Structure Type	Cast in place concrete
Building Evac. Plan	Yes	Cladding Type	Precast concrete
Flood Access Impact	No	# of Egress Impacted	0
Min. 50% Assistance	Yes	Elevator Termination	Below grade (basement)
Occupancy Notes	Condo building. First floor built above grade. Structure built in high podium. Less prone to flooding.		
Building Construction	First floor is above grade.		
Flooding Impact History	No flooding. Northwest basement area shows signs of water seepage at some point in time. South garage has deteriorated concrete slabs / beam below grade. Top membrane is deteriorates with water damage throughout. Water seepage at east and west exterior walls at lower levels. Tarps are hanging above vehicles to prevent water and debris from hit tenants cars. Channels have been drenched at lower slab to divert water penetrating to drains in the floor.		

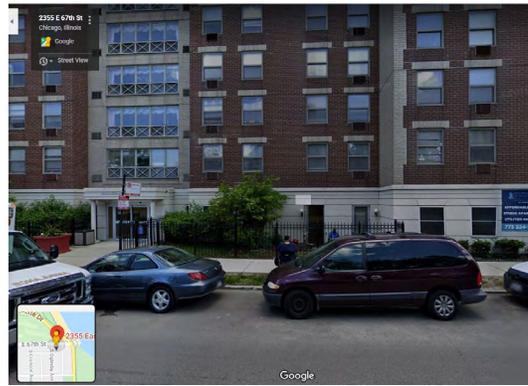
BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	3
Building System Notes	Majority of MEPFP equipment (electrical service, domestic booster pumps, fire pump, garage purge fan) below grade. Water heating and boilers safe on 28th floor.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	3	O&M Shore Protection	Unknown
Wave Overtopping	Unknown	Foundation Type	Concrete Wall
Shore Protection	None - Building setback from lakefront	Crest Over Shore Protection	Unknown
Shore Protection Notes	Property not located directly on lakefront. The lake is across the 4 lane road (South Shore Drive) and the north edge of the South Shore Golf Course. Building management indicated South Shore Drive floods in front of their building during major storms.		

Ownership	Private
Number of Units	Unknown
Vulnerability Index	2
01/11/20 Flooding	No
Construction Date	1998
Floors Above Grade	7
Floors Below Grade	0
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	2	Structure Type	Cast in place concrete
Building Evac. Plan	Yes	Cladding Type	Masonry
Flood Access Impact	No	# of Egress Impacted	0
Min. 50% Assistance	Yes	Elevator Termination	At grade
Occupancy Notes	Senior living.		
Building Construction	Minor break down of building materials due to age and exposure. Future storm events may cause further breakdown of materials.		
Flooding Impact History	Minor leaks in garage and basement during bad weather. Basement mechanical room experienced about 1" of standing water.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	2
Building System Notes	All MEP equipment (electrical service, boilers, water heating, domestic booster pumps, fire pump, utility transformer) on concrete pads on grade. Fire alarm panel above grade in lobby.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	3	O&M Shore Protection	Unknown
Wave Overtopping	Unknown	Foundation Type	Slab on Grade / Masonry Block
Shore Protection	None - Building setback	Crest Over Shore Protection	Unknown
Shore Protection Notes	South Shore Drive and E 67th street experience flooding.		

Ownership	Private (Hospital)
Number of Units	Not Applicable
Vulnerability Index	2
01/11/20 Flooding	No
Construction Date	1933, 2014 addition
Floors Above Grade	3
Floors Below Grade	0.5
Flood Insurance	Yes



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

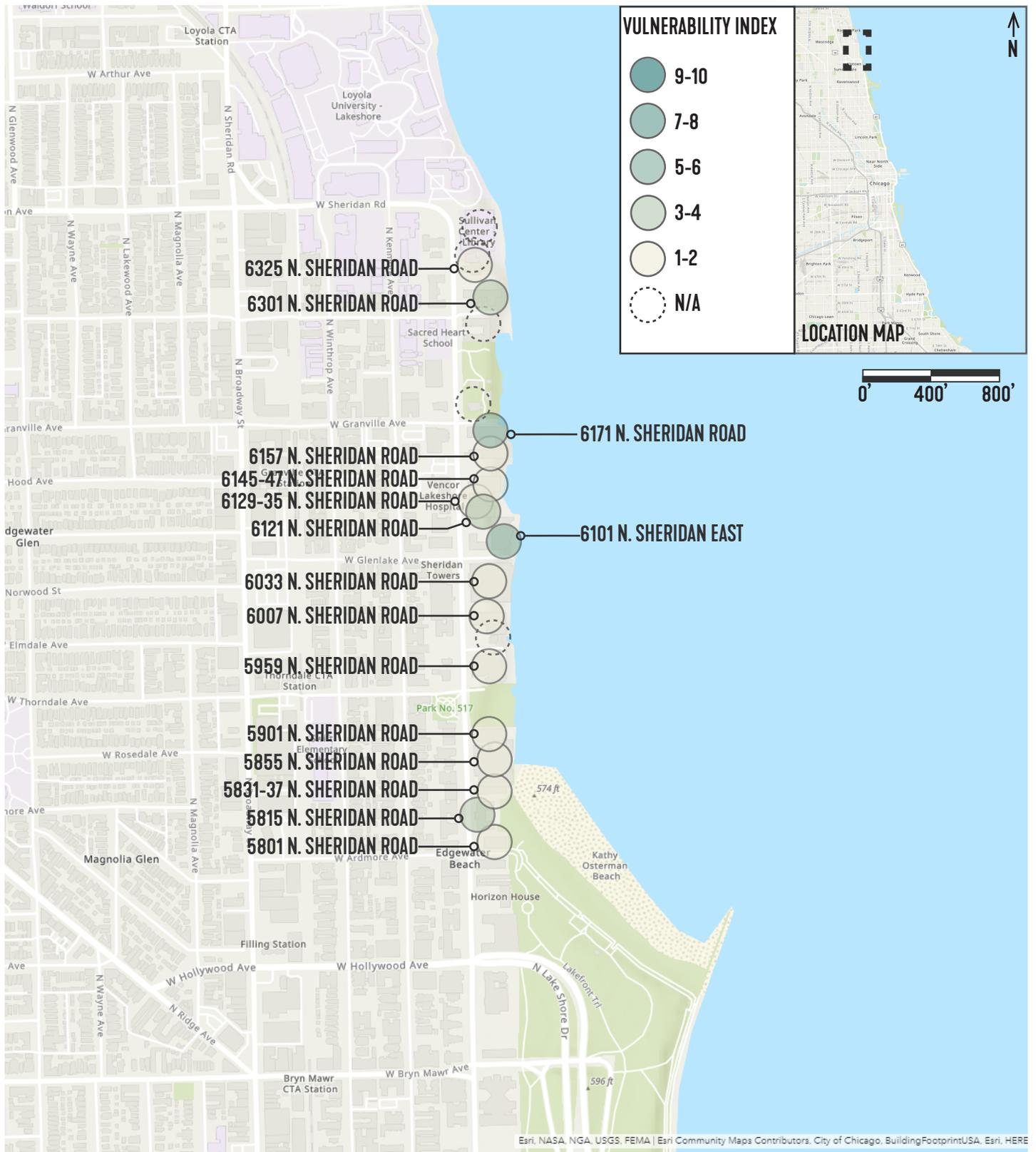
Structural Vulnerability	1	Structure Type	Additions precast concrete / New wing is steel
Building Evac. Plan	Unknown	Cladding Type	Historic masonry / Glass addition
Flood Access Impact	No	# of Egress Impacted	Unknown
Min. 50% Assistance	Yes	Elevator Termination	At grade
Occupancy Notes	La Rabida, very sick children		
Building Construction	None		
Flooding Impact History	No flooding. On 1/11/20 there was some flooding at the surface parking area north of the Yacht Club; this lot is used by the hospital. At inspection there is approx. 1.5 - 2 feet of freeboard at this lot area. This lot has previously experienced extended periods of standing water due to lake levels.		

BUILDING SYSTEMS VULNERABILITY PROFILE

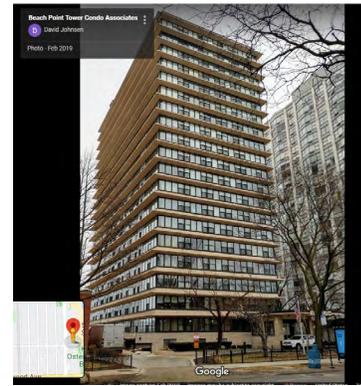
Systems Vulnerability	4
Building System Notes	Mechanical equipment (Boilers, Chillers, Med Gases) is 3 feet below grade. Mechanical room is exposed to the Lake. The Emergency generator Louvers, Mechanical Room Louvers are low on the wall facing the lake. All/most MEPFP equipment below grade potentially at risk of flood damage. Electrical services are inside at grade .DWHs are inside below grade. Flood protection limited to sump pump(s) at lowest level. Fire Pump is below grade. Fire Alarm Panel is above grade.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	3	O&M Shore Protection	Varies
Wave Overtopping	Yes	Foundation Type	Not discernable
Shore Protection	Unknown	Crest Over Shore Protection	Unknown
Shore Protection Notes	Crest elevation varies. Public path obstructed by debris from 1/11/20 overtopping. Debris areas on path and to north of large revetment. Debris north of large revetment includes sand, stone, woody debris, stones as large as around 10 inches. There is a catch basin behind the new revetment area adjacent to the hospital building; possible susceptibility to surcharge.		



Ownership	Private
Number of Units	Over 10 Units
Vulnerability Index	1
01/11/20 Flooding	No
Construction Date	1955
Floors Above Grade	20
Floors Below Grade	1
Flood Insurance	Yes/No



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	1	Structure Type	Cast in place concrete
Building Evac. Plan	No	Cladding Type	Precast concrete / Glass curtain wall
Flood Access Impact	No	# of Egress Impacted	0
Min. 50% Assistance	Unknown	Elevator Termination	Below grade (basement)
Occupancy Notes	None		
Building Construction	None		
Flooding Impact History	No lake flooding. Flooding due to excessive amount of rain. Stormsewer floor drain flooding during large rain events		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	3
Building System Notes	All major MEPFP equipment (electrical service/panels, boilers/water heaters, pumps, chiller, gas meter) below grade at risk of flood damage with flood protection limited to duplex sump pump(s). Flooding poses risk of electrocution from Cabinet Unit Heater mounted low at egress. Has below grade parking garage with electrical panels, exhaust fan and steam unit heaters. Louvers low above grade exposed to the lake.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	2	O&M Shore Protection	No
Wave Overtopping	No	Foundation Type	Concrete Wall
Shore Protection	Steel Sheet bulkhead	Crest Over Shore Protection	4 - 6 feet above grade
Shore Protection Notes	Water has reached the steel bulkhead. Water has not overtopped steel bulkhead		

Ownership	Private
Number of Units	212 Units
Vulnerability Index	3
01/11/20 Flooding	No
Construction Date	Unknown
Floors Above Grade	13
Floors Below Grade	1
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	1	Structure Type	Unknown
Building Evac. Plan	Unknown	Cladding Type	Unknown
Flood Access Impact	Unknown	# of Egress Impacted	Unknown
Min. 50% Assistance	No	Elevator Termination	At grade
Occupancy Notes	None		
Building Construction	Built as condos, recently bought and converted to apartments; undergoing renovations		
Flooding Impact History	No building impact from lake. Concern about standing water/flooding in adjacent bird sanctuary at Osterman Beach. Some seepage observed during 1/11/20 event.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	3
Building System Notes	Boilers, hydronic pumps, controls, gas services are below grade. Electrical service and/or electrical panels is below grade. Domestic Booster Pump is below grade. Domestic Water Heater is below grade. Flood protection limited to sump pump(s) at lowest level. Fire Pump is below grade.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	2	O&M Shore Protection	No
Wave Overtopping	No	Foundation Type	Unknown
Shore Protection	Sheetpile wall	Crest Over Shore Protection	4 - 6 feet above grade
Shore Protection Notes	Sheetpile wall at perimeter of deck area, with extended sandy land frontage beyond. Building manager indicated that during wave events, the water surges all the way up to the steps on their deck, but does not overtop onto the deck. The wave action and surging leaves behind a significant amount of standing water.		

Ownership	Private
Number of Units	Over 10 Units
Vulnerability Index	2
01/11/20 Flooding	No
Construction Date	1998
Floors Above Grade	3
Floors Below Grade	0
Flood Insurance	No



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	2	Structure Type	Light framing structure
Building Evac. Plan	No	Cladding Type	Masonry
Flood Access Impact	No	# of Egress Impacted	Unknown
Min. 50% Assistance	Unable to answer	Elevator Termination	Unknown
Occupancy Notes	None		
Building Construction	Complex is a series of individually-owned row houses.		
Flooding Impact History	Flooding due to excessive amount of rain. Stormsewer floor drain flooding during large rain events. No lake flooding.		

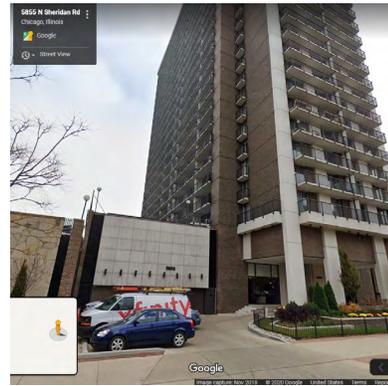
BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	3
Building System Notes	Access to property limited to (partial) exterior only. Property is a typical residential townhome with Furnace and Water Heater in closet at grade. Property has no basement. Outlets or extension cords pose risk of electrocution during a flood. Owner reported lake water wave action approached patio facing lake, in spite of significant distance from shoreline.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	2	O&M Shore Protection	No
Wave Overtopping	No	Foundation Type	Concrete Wall
Shore Protection	Concrete seawall	Crest Over Shore Protection	4 - 6 feet above grade
Shore Protection Notes	200' to coast from concrete seawall. Steel sheeting on adjacent property. Dual layered seawall of east side of building 2' high 12' gap to a 2' high seawall.		

Ownership	Private
Number of Units	226 Units
Vulnerability Index	2
01/11/20 Flooding	No
Construction Date	1966
Floors Above Grade	26
Floors Below Grade	0
Flood Insurance	No



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	1	Structure Type	Cast in place concrete
Building Evac. Plan	Yes	Cladding Type	Masonry
Flood Access Impact	No	# of Egress Impacted	Unknown
Min. 50% Assistance	Yes	Elevator Termination	At grade
Occupancy Notes	Mostly more mature residents who have lived here since it opened, starting to see more younger residents moving in but generally no families		
Building Construction	3 stories of parking above ground, amenities and units start on 4		
Flooding Impact History	In 80's water flooded garage. After installed ledges at exterior beach level doors to prevent water getting into garage. 1/11/20 water rising on property. No water from October/November storms. Installed sandbags and fabric barrier on back fencing to prevent wave action. Water ponding inside of sand bag line, not reaching the building. At site concrete has erosion below, had an engineer look at it, will evaluate more in spring. Concerned that erosion will reach building foundation.		

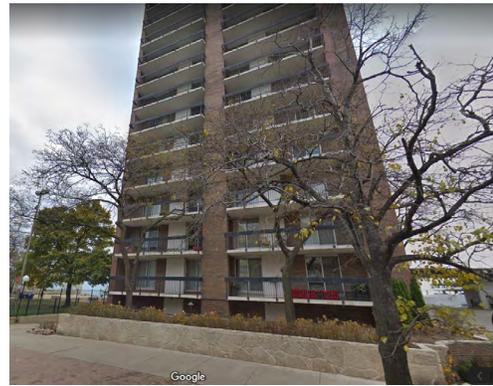
BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	3
Building System Notes	Individual condo FC/AC unit are present. Electrical services are at grade. All electric building (no gas). There are no sewage/sump pumps. Individual condo DWH (electric). Booster pump at grade. Fire Pump is at grade. Fire Alarm Panel above grade.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	3	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Not discernable
Shore Protection	Concrete wall on top of metal sheetpile wall.	Crest Over Shore Protection	4 - 6 feet above grade
Shore Protection Notes	The shore protection is a 1' x 4' tall concrete wall, on top of metal sheetpile wall. There is rubble mound majority of the length. The rubble mound was installed by the Corps in the 1980s. At the area where there is no rubble mound, building engineer indicated the water forms eddies and is causing erosion of lakebed causing some spalling of the concrete seawall. Ice buildup on pavement. Sand buildup on pavement. Sand beach no longer visible.		

Ownership	Private
Number of Units	Over 10 Units
Vulnerability Index	1
01/11/20 Flooding	No
Construction Date	1966
Floors Above Grade	16
Floors Below Grade	0
Flood Insurance	Yes



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	1	Structure Type	Cast in place concrete
Building Evac. Plan	Yes	Cladding Type	Glass curtain wall
Flood Access Impact	No	# of Egress Impacted	Unknown
Min. 50% Assistance	Yes	Elevator Termination	At grade
Occupancy Notes	None		
Building Construction	None		
Flooding Impact History	No flooding.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	2
Building System Notes	All electric building (no gas service). Large building condo has no mechanical rooms below grade. Only plumbing, Fire Protection and electrical related equipment in mech rooms at grade. Flooding poses risk of electrocution from electric baseboard in office and laundry area.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	1	O&M Shore Protection	Yes
Wave Overtopping	No	Foundation Type	Concrete Wall
Shore Protection	Concrete seawall	Crest Over Shore Protection	> 6 feet above grade
Shore Protection Notes	20' wide rubblemound stone in front of 5' - 6' high concrete seawall. No damage visible to shore protection		

Ownership	Private
Number of Units	Not Applicable
Vulnerability Index	2
01/11/20 Flooding	No
Construction Date	1954
Floors Above Grade	2
Floors Below Grade	1
Flood Insurance	Yes



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	1	Structure Type	Cast in place concrete
Building Evac. Plan	Yes	Cladding Type	Masonry
Flood Access Impact	Yes	# of Egress Impacted	Unknown
Min. 50% Assistance	No	Elevator Termination	Unknown
Occupancy Notes	Place of worship.		
Building Construction	None		
Flooding Impact History	Experienced significant flooding in late 1980s. USACE did remediation after 1987 flood of adjacent beach. Current flooding is from floor drain sewer backup.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	2
Building System Notes	All major MEPFP equipment (electrical service/panels, boilers, pumps, gas meter, fire alarm panel) below grade potentially at risk of flood damage.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	4	O&M Shore Protection	Unknown
Wave Overtopping	Unknown	Foundation Type	Not discernable
Shore Protection	Concrete seawall	Crest Over Shore Protection	Unknown
Shore Protection Notes	Concrete seawall has several cracks that go through the wall. Sections of significant damage. Parking lot between building and seawall at 5% min slope. No flooding issues in building.		

Ownership	Private
Number of Units	347 Units
Vulnerability Index	2
01/11/20 Flooding	No
Construction Date	1969
Floors Above Grade	39
Floors Below Grade	1
Flood Insurance	Yes



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	1	Structure Type	Cast in place concrete
Building Evac. Plan	Yes	Cladding Type	Masonry
Flood Access Impact	No	# of Egress Impacted	Unknown
Min. 50% Assistance	No	Elevator Termination	At grade
Occupancy Notes	None		
Building Construction	347 condo units		
Flooding Impact History	Unknown		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	2
Building System Notes	Individual condo FC/AC unit are present. Electrical services are at grade. All electric building (no gas service). Individual condo DWH (electrical). Booster pump at grade. Flood protection limited to sump pump(s) at lowest level. Fire Pump is at grade and Fire Alarm Panel above grade.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	4	O&M Shore Protection	Unknown
Wave Overtopping	Unknown	Foundation Type	Pile Foundation
Shore Protection	Steel Sheet bulkhead	Crest Over Shore Protection	Unknown
Shore Protection Notes	Will share report from scuba team inspection of sea wall.		

Ownership	Private
Number of Units	498 Units
Vulnerability Index	2
01/11/20 Flooding	No
Construction Date	Unknown
Floors Above Grade	46
Floors Below Grade	0
Flood Insurance	Yes



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	1	Structure Type	Unknown
Building Evac. Plan	Yes	Cladding Type	Unknown
Flood Access Impact	No	# of Egress Impacted	Unknown
Min. 50% Assistance	No	Elevator Termination	At grade
Occupancy Notes	30-40 people in need of assistance in an emergency		
Building Construction	45 residential floors, garden level first floor of retail concourse and building amenities. Lowest level is MEP rooms, 4' below grade. Had scuba investigation of sea wall 2 years ago, then hired consultant to do engineering to attach sea wall to building; waiting for permit.		
Flooding Impact History	Experienced significant flooding in late 1980s. Concrete wall at end of Glenlake was constructed since late 80s. At that time lake water came over the street and into areaway to building corridor. Water flooded down stairs in building. Abated with sandbags from the city. No flooding noted on 1/11/20.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	2
Building System Notes	Electrical services are at grade. All electric building (no gas service). Emergency Generator is outside, exposed but on dock. Individual condo DWH (electrical). Domestic Booster Pump is below grade. Flood protection limited to sump pump(s) at lowest level. Elevator Pit Pump is below grade.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	4	O&M Shore Protection	Unknown
Wave Overtopping	No	Foundation Type	Pile Foundation
Shore Protection	Steel Sheet bulkhead	Crest Over Shore Protection	> 6 feet above grade
Shore Protection Notes	No visible signs of overtopping. Building manager indicated only spray occurs above top of wall. Concerned wall is tilting and no longer 90 degrees, that the wave action is putting pressure on the bottom of wall. Building manager indicated the building plans to hire consultant to renovate and attach seawall to building.		

Ownership	Private
Number of Units	160 Units
Vulnerability Index	6
01/11/20 Flooding	Yes
Construction Date	1969
Floors Above Grade	Unknown
Floors Below Grade	Unknown
Flood Insurance	Yes



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	3	Structure Type	Cast in place concrete
Building Evac. Plan	Yes	Cladding Type	Masonry
Flood Access Impact	Yes	# of Egress Impacted	Unknown
Min. 50% Assistance	No	Elevator Termination	Below grade (basement)
Occupancy Notes	Population skews older but is a mix. Has diversified in age more in recent years.		
Building Construction	Units all condos. Slab is a mix of waffle, smooth/tensioned, and cast beams (more linear than a waffle). Direction of linear beams changes.		
Flooding Impact History	No previous flooding. On 1/11/20 noted flooding.		

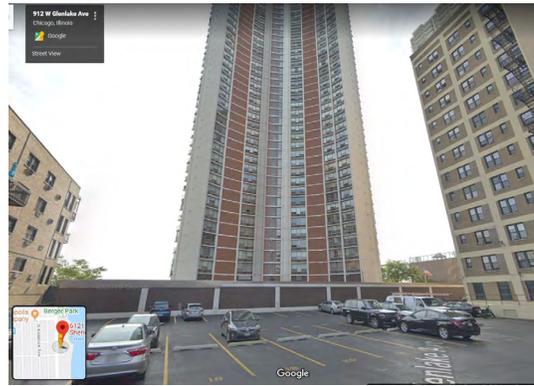
BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	3
Building System Notes	Individual condo FC and AC units. All electric building (no gas service). Electrical services are at grade. DWH is below grade. Domestic Booster Pump is below grade. Flood protection limited to sump pump(s) at lowest level. Fire Pump is below grade.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	5	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Pile Foundation
Shore Protection	Steel sheetpile / Concrete wall	Crest Over Shore Protection	> 6 feet above grade
Shore Protection Notes	Concrete wall 6 feet above grade appears to be connected to building structure. Approximately 8 feet wide of rubblemound in front of concrete wall visible. Shore protection bounds both east side and north side corner of building. No gaps in shore protection observed.		

Ownership	Private
Number of Units	31 Units
Vulnerability Index	3
01/11/20 Flooding	Yes
Construction Date	1960s
Floors Above Grade	5
Floors Below Grade	Unknown
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	1	Structure Type	Cast in place concrete
Building Evac. Plan	No	Cladding Type	Masonry
Flood Access Impact	No	# of Egress Impacted	Unknown
Min. 50% Assistance	No	Elevator Termination	Unknown
Occupancy Notes	Mix of middle aged, some elderly, some young families		
Building Construction	Ground floor parking is approx. 2' below grade with 5 floors of units above.		
Flooding Impact History	No previous flooding. On 1/11/20 noted flooding.		

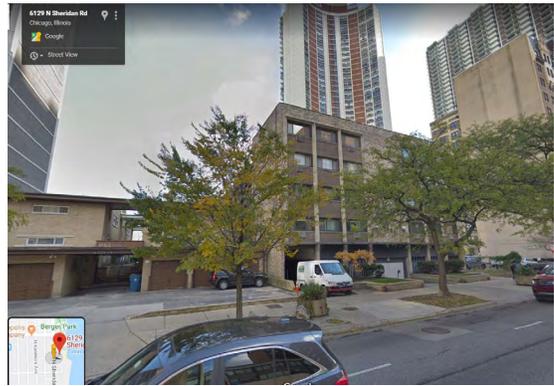
BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	3
Building System Notes	Individual condo electric heating and AC units. Electrical services are at grade. All electric building (no gas service). Booster Pump is at grade. DWH is at grade for Laundry.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	3	O&M Shore Protection	Unknown
Wave Overtopping	Yes	Foundation Type	Slab on Grade
Shore Protection	Rubble mound / Concrete wall	Crest Over Shore Protection	Unknown
Shore Protection Notes	Lakeside of property has rubble mound with concrete wall with 3 foot cinder block wall. Northeast corner of property has concrete block and concrete wall only. Broken and displaced revetment stone. 10" ice on pavement along east building face. Ice on east fence. Staining and ice on east building wall. Northeast corner of property has damage to stairs and concrete wall.		

Ownership	Private
Number of Units	Over 10 Units
Vulnerability Index	2
01/11/20 Flooding	No
Construction Date	1957
Floors Above Grade	2
Floors Below Grade	0
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	1	Structure Type	Bearing wall
Building Evac. Plan	Unknown	Cladding Type	Masonry
Flood Access Impact	No	# of Egress Impacted	Unknown
Min. 50% Assistance	Unable to answer	Elevator Termination	Unknown
Occupancy Notes	Mix of ages		
Building Construction	Garden style duplexes		
Flooding Impact History	No flooding.		

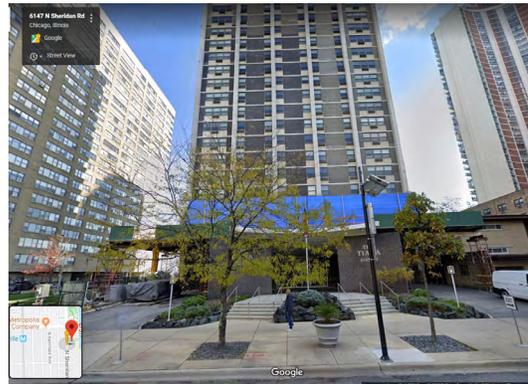
BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	4
Building System Notes	Boiler is in Basement - hydronic heating. Electrical service and/or electrical panels are below grade. Domestic Water Heater is below grade.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	3	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Not discernable
Shore Protection	Concrete	Crest Over Shore Protection	4 - 6 feet above grade
Shore Protection Notes	Building manager described the shoreline as a concrete slab, with accumulated sand and stone over the top of the slab. Slab is not visible due to the accumulations. The accumulations have occurred over time. Behind the slab/ accumulated sand and stone, and set back around feet from the waters edge is a concrete knee wall. Crest from water to top of kneewall. Some ice buildup on land side of kneewall. Sand behind kneewall per building manager. Building manager said there was no flooding of buildings during the 1/11/20 event.		

Ownership	Private
Number of Units	100 Units
Vulnerability Index	2
01/11/20 Flooding	Yes
Construction Date	1965
Floors Above Grade	30
Floors Below Grade	0
Flood Insurance	Yes



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	2	Structure Type	Structural steel
Building Evac. Plan	Yes	Cladding Type	Masonry
Flood Access Impact	No	# of Egress Impacted	1
Min. 50% Assistance	No	Elevator Termination	At grade
Occupancy Notes	25% - 33% of tenants would need assistance in an emergency		
Building Construction	3 floors of parking above ground. Amenity spaces on 4th floor. Units start on 5th floor.		
Flooding Impact History	Waves run up and enter the garage through louvers on east face on the second level. There is also a doorway on the east face on the first level where water from waves enters. The building engineer removed approx. 160 gallons of water from behind the doorway as a result of the 1/11/20 event.		

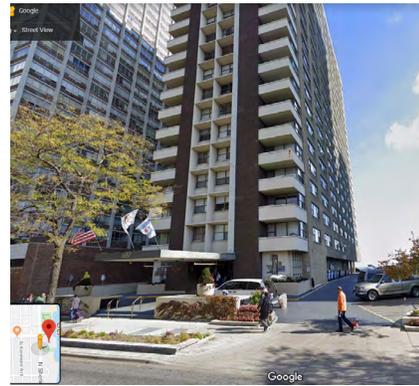
BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	4
Building System Notes	Individual condo FC/AC unit are present. Louvers low above grade exposed to the lake. Previously minor leakage through garage vent louver. Electrical service and/or electrical panels is below grade. There is no sump pump. DWH is inside below grade. Domestic Booster Pump is below grade. Fire Pump is below grade. Fire Alarm Panel is above grade.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	3	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Not discernable
Shore Protection	Rubblemound with likely sheetpile wall	Crest Over Shore Protection	2 - 4 feet above grade
Shore Protection Notes	Could not see the sheetpiling due to ice and snow cover. Per building engineer, during the 1/11/20 event, a few of the revetment stones broke into multiple pieces from the wave action. Significant ice cover limited visibility. There is around 10 inches of ice on the concrete pavement along the east face of the building. There is ice on the fence along the east face of the building. There is ice and staining on the east building wall.		

Ownership	Private
Number of Units	286 Units
Vulnerability Index	2
01/11/20 Flooding	No
Construction Date	1960
Floors Above Grade	25
Floors Below Grade	1
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	1	Structure Type	Structural steel
Building Evac. Plan	Yes	Cladding Type	Masonry
Flood Access Impact	No	# of Egress Impacted	Unknown
Min. 50% Assistance	No	Elevator Termination	Unknown
Occupancy Notes	3-4 mobility impaired. Condos mix of owner occupied and rented.		
Building Construction	1 level of garage below grade, plus boiler room sub level. 268 units, condos are a mix of owner occupied and rented. Scissor stairs.		
Flooding Impact History	No flooding. 1/11/20 event there was some minor intrusion of water at the east wall of the parking garage, through wall joints.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	4
Building System Notes	Heating boiler, hydronic pumps, and gas service are below grade. Chiller is at grade. Electrical service and/or electrical panels is below grade. DWH is inside below grade. Domestic Booster Pump is below grade. Flood protection limited to sump pump(s) at lowest level. Fire Pump is below grade. Fire Alarm Panel is above grade.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	3	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Not discernable
Shore Protection	rubble mound with concrete wall	Crest Over Shore Protection	> 6 feet above grade
Shore Protection Notes	>6 ft crest relative to top of deck Sand accumulations on parking deck suggest wave overtopping.		

Ownership	Private
Number of Units	312 Units
Vulnerability Index	5
01/11/20 Flooding	Yes
Construction Date	1962
Floors Above Grade	30
Floors Below Grade	1
Flood Insurance	Yes



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	3	Structure Type	Cast in place concrete
Building Evac. Plan	Yes	Cladding Type	Masonry
Flood Access Impact	No	# of Egress Impacted	Unknown
Min. 50% Assistance	No	Elevator Termination	At grade
Occupancy Notes	4% of population might need assistance, mostly middle-aged		
Building Construction	312 condo units.		
Flooding Impact History	No previous flooding. Water intrusion into the building occurred at a vertical crack located at the SE corner basement wall of the parking garage. Water intrusion also occurred at a door along the east face of the building. The door has been sandbagged. Afterward, had to jet the sand from floor drains to clear them.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	3
Building System Notes	Boilers and hydronic pumps are at grade. Hydronic heating, individual condo AC units. Electrical services at grade. DWH is inside at grade. Domestic Booster Pump is below grade. Flood protection limited to sump pump(s) at lowest level. Fire Pump is below grade. Fire Alarm Panel is above grade.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	4	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Not discernable
Shore Protection	See shore protection type notes	Crest Over Shore Protection	> 6 feet above grade
Shore Protection Notes	Crest is >6 ft from top of deck. 4-6 feet at rubble mound. 10/19, an approx. 3ft x 4ft x 8ft concrete block (shore protection) was lifted by wave action and pushed into a metal fence. The metal fence (approx. 30 LF) was running east-west along the south property line, from the east face of the building to the lake. The fence was destroyed by the waves and then afterward dismantled by owner. It is now stockpiled adjacent to its previous installed location. Ice buildup on shoreline. Staining on north and east sides of building.		

Ownership	Private
Number of Units	136 Units
Vulnerability Index	3
01/11/20 Flooding	Yes
Construction Date	1963
Floors Above Grade	26
Floors Below Grade	1
Flood Insurance	Yes



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	2	Structure Type	Cast in place concrete
Building Evac. Plan	Yes	Cladding Type	Glass curtain wall
Flood Access Impact	Yes	# of Egress Impacted	0
Min. 50% Assistance	No	Elevator Termination	Below grade (basement)
Occupancy Notes	None		
Building Construction	None		
Flooding Impact History	Typically multiple flooding events per year. 1/11/20 noted flooding, severe roadway flooding.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	4
Building System Notes	Some MEPFP equipment (electrical service/panels, fan coil units, DCW booster pumps, gas meter, gas pressure booster, fire pump) below grade in parking garage. Recent flood has displaced jersey barriers putting parking garage at risk. Flooding poses risk of electrocution from cabinet unit heater mounted low at egress. Louvers low above grade pose a risk to flooding into parking garage.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	4	O&M Shore Protection	Yes
Wave Overtopping	Yes	Foundation Type	Concrete Wall
Shore Protection	See below	Crest Over Shore Protection	4 - 6 feet above grade
Shore Protection Notes	From North of property to south 0' - 4.5' wide concrete seawall. 40' steel piling with jersey wall 30' behind landscaped section. Jersey wall initially behind fence. 2' wide stone barrier in front of sea wall. Top of parking garage wall at lake level. Seawall extends from basement to 4' above grade. South and East garage walls were leaking. Above grade shore protection has repaired cracks that extend up and over the sea wall.		

Ownership	Private
Number of Units	Over 10 Units
Vulnerability Index	2
01/11/20 Flooding	No
Construction Date	Unknown
Floors Above Grade	Unknown
Floors Below Grade	Unknown
Flood Insurance	Yes



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	1	Structure Type	Unknown
Building Evac. Plan	Yes	Cladding Type	Unknown
Flood Access Impact	No	# of Egress Impacted	Unknown
Min. 50% Assistance	No	Elevator Termination	At grade
Occupancy Notes	Mostly able-bodied residents. About 25% Loyola students		
Building Construction	None		
Flooding Impact History	No flooding. During 1/11/20 event there was some minor intrusion of water at the east wall of the parking garage, through wall joints. The wind was carrying water toward the building as high as the fifth floor, no damage.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	4
Building System Notes	AHUs and Boilers are on roof. Chiller is on grade and cooling tower outside on grade, exposed to lake. Electrical service and/or electrical panels is below grade. Domestic Booster Pump is below grade. DWH is on roof. Flood protection limited to sump pump(s) at lowest level. Fire Pump is below grade. Fire Alarm Panel is above grade.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	3	O&M Shore Protection	Unknown
Wave Overtopping	Unknown	Foundation Type	Unknown
Shore Protection	Rubble mount with sheet pile wall	Crest Over Shore Protection	Unknown
Shore Protection Notes	Signs of overtopping: Ice buildup on deck behind seawall. Ice buildup on fence along top of seawall. Sand accumulations on pool deck at seawall and past the pool.		

Ownership	Private
Number of Units	46 Units
Vulnerability Index	1
01/11/20 Flooding	No
Construction Date	1920
Floors Above Grade	4
Floors Below Grade	0
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

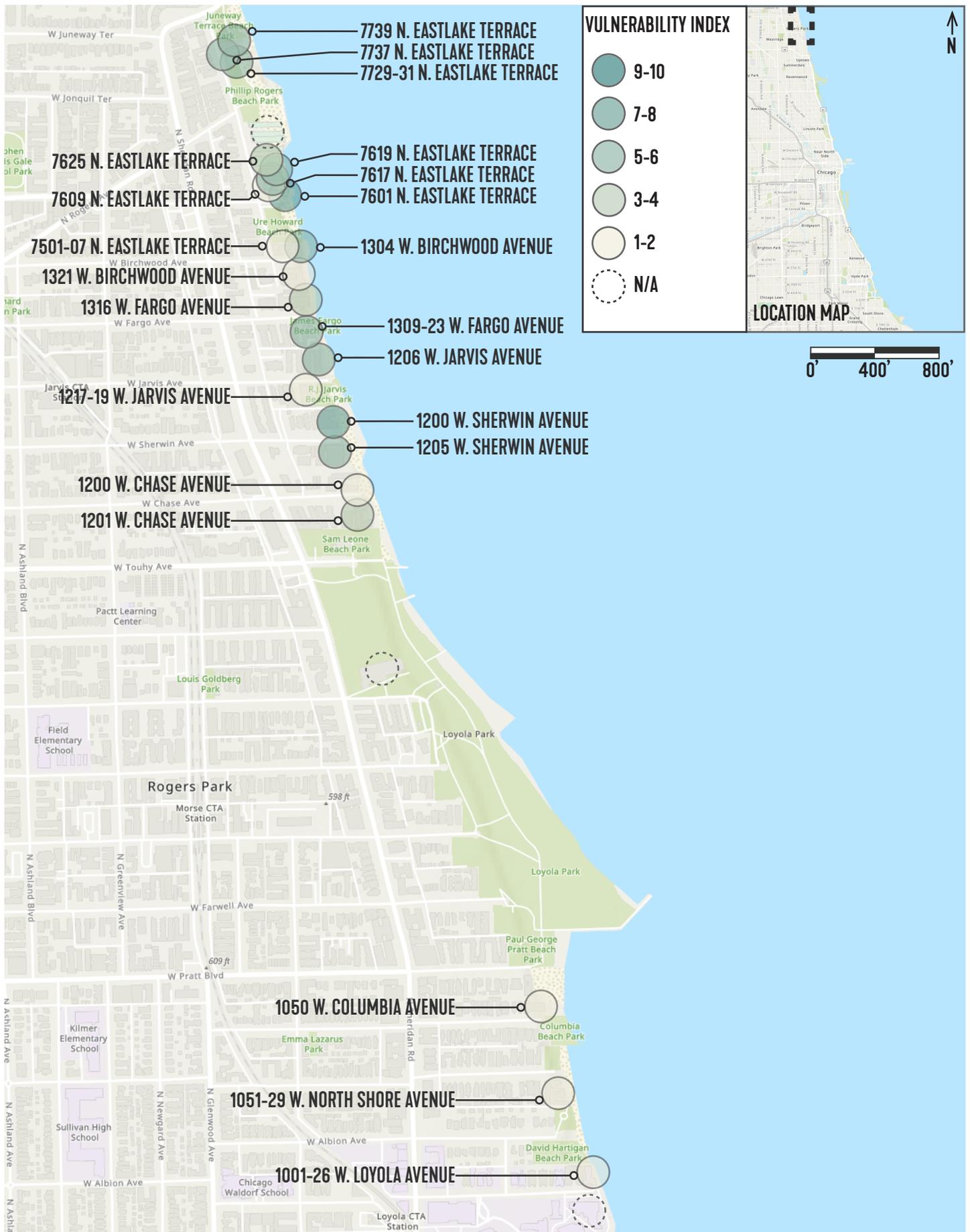
Structural Vulnerability	1	Structure Type	Cast in place concrete
Building Evac. Plan	Yes	Cladding Type	Masonry
Flood Access Impact	No	# of Egress Impacted	Unknown
Min. 50% Assistance	No	Elevator Termination	Unknown
Occupancy Notes	Residential for students, professors and other professionals		
Building Construction	Courtyard building, point load entrances, 49 rental units		
Flooding Impact History	No previous flooding. On 1/11/20 waves were coming over alley and up to building, however no water inside. Entrances off Loyola Ave are raised from the street therefore, no flooding into the entrance. Noted about 12" of water on the street. Alley was inaccessible during flooding		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	3
Building System Notes	Boiler is in the basement. Mechanical room has windows on aisle which is damaged by water erosion. Electrical service and/or electrical panels are below grade. Domestic Water Heater is below grade.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	2	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Unknown
Shore Protection	Other or combination	Crest Over Shore Protection	Unknown
Shore Protection Notes	Building is not on the immediate shore line; there is another building east of it. Building manager indicated during 1/11/20 event, waves overtopped the public alley to the north and washed against the north face of the building wall. During this same event, the public street (Loyola Avenue) to the south of the building flooded with up to a foot of water.		



Ownership	Private
Number of Units	Over 10 Units
Vulnerability Index	2
01/11/20 Flooding	No
Construction Date	1920s
Floors Above Grade	4
Floors Below Grade	1
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	1	Structure Type	Bearing wall
Building Evac. Plan	No	Cladding Type	Masonry
Flood Access Impact	No	# of Egress Impacted	0
Min. 50% Assistance	Unable to answer	Elevator Termination	Unknown
Occupancy Notes	None		
Building Construction	None		
Flooding Impact History	No flooding.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	3
Building System Notes	Significant MEP equipment (boilers, water heating) below grade. Bottom of electrical service inside exactly at grade.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	3	O&M Shore Protection	Unknown
Wave Overtopping	Unknown	Foundation Type	Concrete Wall
Shore Protection	rubble mound with concrete wall	Crest Over Shore Protection	Unknown
Shore Protection Notes	No flooding issues. Visible portion from outside property in good condition. 4' rubble mound with 2' wide 4' high concrete wall.		

Ownership	Private (Loyola)
Number of Units	Unknown
Vulnerability Index	N/A
01/11/20 Flooding	No
Construction Date	1963
Floors Above Grade	4
Floors Below Grade	1
Flood Insurance	No



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	1	Structure Type	Masonry
Building Evac. Plan	No	Cladding Type	Masonry
Flood Access Impact	No	# of Egress Impacted	0
Min. 50% Assistance	No	Elevator Termination	At grade
Occupancy Notes	Humanities Building Loyola		
Building Construction	4-story masonry building with basement		
Flooding Impact History	Experienced significant flooding in late 1980s; added pumps.. Multiple events in the past year. Had clogged drain tile that has been repaired recently.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	3
Building System Notes	All major MEPFP equipment (electrical service/panels, boilers/water heaters, pumps, fire alarm panel) below grade potentially at risk of flood damage. Flood protection limited to sump pump(s) at lowest level at multiple locations.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	2	O&M Shore Protection	Unknown
Wave Overtopping	Unknown	Foundation Type	Masonry Wall
Shore Protection	None	Crest Over Shore Protection	Unknown
Shore Protection Notes	No visible shore protection, may be covered by snow. Building 70' from shoreline 150' property width 2' high berm at shoreline.		

Ownership	Private
Number of Units	Over 10 Units
Vulnerability Index	3
01/11/20 Flooding	Unknown
Construction Date	Unknown
Floors Above Grade	4
Floors Below Grade	0
Flood Insurance	Unknown



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	1	Structure Type	Masonry
Building Evac. Plan	Unknown	Cladding Type	Masonry
Flood Access Impact	Unknown	# of Egress Impacted	Unknown
Min. 50% Assistance	Unknown	Elevator Termination	Unknown
Occupancy Notes	None. Only limited surveying was performed at the exterior.		
Building Construction	None		
Flooding Impact History	3 story masonry building has seepage but no structural damage. It set back 50ft from retaining wall, 100 ft setback from sea wall. Basement has groundwater infiltration from all sides.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	4
Building System Notes	Significant MEP equipment (boilers, condensate pumps, water heating) below grade. Louvers below grade. Constant groundwater flow through hallway and boiler room.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	5	O&M Shore Protection	No
Wave Overtopping	No	Foundation Type	Concrete Wall. Pile Foundation
Shore Protection	Rubble mound with concrete wall, stone revetment, concrete seawall	Crest Over Shore Protection	2 - 4 feet above grade
Shore Protection Notes	50ft setback from retaining wall and 100 ft setback from sea wall. 100' rubble mound armor stone with 4' high concrete. Stone revetment held by steel piling and concrete seawall. Additional seawall behind first wall (damaged) 40' landscaped section 4' high concrete wall. Southern portion of property protected by 50' rubbermound armor stone and sheet piles 40' sand section 4' high concrete wall. East concrete seawall damaged in several places. Does not appear to be connected with rebar at damaged locations. Steel piling visible under stone.		

Ownership	Private
Number of Units	Over 10 Units
Vulnerability Index	N/A
01/11/20 Flooding	No
Construction Date	1927
Floors Above Grade	3
Floors Below Grade	1
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	N/A	Structure Type	Bearing wall
Building Evac. Plan	No	Cladding Type	Masonry
Flood Access Impact	Yes	# of Egress Impacted	1
Min. 50% Assistance	No	Elevator Termination	Unknown
Occupancy Notes	None		
Building Construction	None		
Flooding Impact History	No previous flooding.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	
Building System Notes	No access to property.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	5	O&M Shore Protection	Unknown
Wave Overtopping	Unknown	Foundation Type	Unknown
Shore Protection	Unknown	Crest Over Shore Protection	Unknown
Shore Protection Notes	None		

Ownership	Private
Number of Units	Over 10 Units
Vulnerability Index	6
01/11/20 Flooding	Yes
Construction Date	1924
Floors Above Grade	8
Floors Below Grade	1
Flood Insurance	No



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	3	Structure Type	Masonry bearing wall
Building Evac. Plan	No	Cladding Type	Masonry
Flood Access Impact	Yes	# of Egress Impacted	2
Min. 50% Assistance	No	Elevator Termination	Below grade (basement)
Occupancy Notes	None		
Building Construction	None		
Flooding Impact History	Experienced significant flooding in late 1980s. On 1/11/20 boat room under east terrace flooded. 1/11/20 storm flooded the beach storage and caused large amounts of sand to be forced inside. Storage area has pits to collect water and portable pumps. Flooding was as high as 18 " but was completely dry at time of inspection. No structural damage. Flooding enters on south end of property into basement, which is 3' below grade. Steel piling is submerged during large rain events.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	4
Building System Notes	All/most MEPFP equipment (electrical service/panels, boilers/water heaters, pumps, gas meter, fire pump) below grade at risk of flood damage. Flood protection limited to duplex sump pump(s) at lowest level in the mechanical room. Recently experienced flood damage with much sand forced into the building.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	3	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Concrete Wall
Shore Protection	Concrete seawall	Crest Over Shore Protection	4 - 6 feet above grade
Shore Protection Notes	Approx. 50ft set back from shore line. 150' length of concrete seawall. 60' from seawall to the water. No damage to shore protection. South of property is unprotected.		

Ownership	Private
Number of Units	Over 10 Units
Vulnerability Index	8
01/11/20 Flooding	Unknown
Construction Date	1923
Floors Above Grade	4
Floors Below Grade	1
Flood Insurance	Yes



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	5	Structure Type	Bearing wall / Cast in place concrete
Building Evac. Plan	No	Cladding Type	Precast concrete / Masonry
Flood Access Impact	No	# of Egress Impacted	0
Min. 50% Assistance	No	Elevator Termination	Unknown
Occupancy Notes	None		
Building Construction	Underground parking garage with terrace roof was constructed in 2006.		
Flooding Impact History	Multiple events in the past year. Street drains into underground parking. 1/11/20 storm caused major flooding, 8ft of water; damage (\$75,000 and damage to 3 cars) to enclosed parking due its location being below grade and the lake water level. The sump pumps were overwhelmed and flood level reached several feet above parking floor slab. Various locations of 2" standing water. No structural damage. Minor erosion of lake front. Trench drain currently full and not draining. Parking lot currently has water. Trench drain in front of garage full and not draining.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	5
Building System Notes	All major MEPFP equipment (electrical service/panels, boilers/water heaters, pumps, gas meter, fire alarm panel) in main building or parking garage below grade at risk of flood damage. Flood protection limited to triplex sump pump(s) at garage level. Recent \$75,000 flood damage to parking garage including mech/electrical equipment (sump pumps could not keep up).

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	3	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Concrete Wall
Shore Protection	Concrete seawall	Crest Over Shore Protection	4 - 6 feet above grade
Shore Protection Notes	Significant shoreline erosion. Unprotected sand shore eroded away. 150' concrete seawall 5' high. Water within 5' of concrete wall.		

Ownership	Private
Number of Units	Over 10 Units
Vulnerability Index	2
01/11/20 Flooding	No
Construction Date	Unknown
Floors Above Grade	3
Floors Below Grade	1
Flood Insurance	Unknown



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	1	Structure Type	Masonry bearing wall
Building Evac. Plan	No	Cladding Type	Masonry
Flood Access Impact	No	# of Egress Impacted	Unknown
Min. 50% Assistance	Unknown	Elevator Termination	Unknown
Occupancy Notes	None		
Building Construction	None		
Flooding Impact History	No flooding.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	3
Building System Notes	All MEP equipment (electrical service/panels, AHUs, boilers/water heaters, pumps) below grade potentially at risk of flood damage.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	3	O&M Shore Protection	Unknown
Wave Overtopping	Unknown	Foundation Type	Concrete Wall
Shore Protection	None	Crest Over Shore Protection	Unknown
Shore Protection Notes	Right of way protected by steel piles east-west 5' high. North-South concrete seawall.		

Ownership	Private
Number of Units	Over 10 Units
Vulnerability Index	5
01/11/20 Flooding	Yes
Construction Date	Unknown
Floors Above Grade	3
Floors Below Grade	1
Flood Insurance	No



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	4	Structure Type	Bearing wall
Building Evac. Plan	No	Cladding Type	Masonry
Flood Access Impact	No	# of Egress Impacted	Unknown
Min. 50% Assistance	No	Elevator Termination	Unknown
Occupancy Notes	None		
Building Construction	North exterior wall was completely rebuilt following storm damage in 1987.		
Flooding Impact History	Experienced significant flooding in late 1980s; structures to mitigate waves and jersey barriers near building. On 1/11/2020 Residents took temporary measures to prevent flooding in garden units and soil washout. Some seepage occurred through service door going into water tank room.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	3
Building System Notes	Most MEP equipment (electrical service, boilers, condensate pumps, water heating) below grade. Bottom of electrical service inside exactly at grade with door facing lake.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	2	O&M Shore Protection	Unknown
Wave Overtopping	Unknown	Foundation Type	Concrete Wall
Shore Protection	Rubble mound w/ sheet pile wall	Crest Over Shore Protection	Unknown
Shore Protection Notes	70 ft setback from lake. Rubble mound 2' wide. 2-layer concrete seawall west of seawall. Sheet pile wall with fence attached to top. 60' between seawalls. 2' high concrete walls installed in late 80's to address flooding. Water got to building during Jan 11 storm.		

Ownership	Private
Number of Units	2-4 Units
Vulnerability Index	6
01/11/20 Flooding	Yes
Construction Date	1920
Floors Above Grade	3
Floors Below Grade	1
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	4	Structure Type	Masonry bearing wall
Building Evac. Plan	No	Cladding Type	Masonry
Flood Access Impact	Yes	# of Egress Impacted	4
Min. 50% Assistance	Unable to answer	Elevator Termination	Unknown
Occupancy Notes	None		
Building Construction	None		
Flooding Impact History	No previous flooding. On 1/11/20 flooding noted. Some seepage in mechanical room but no structural damage. Water came up to units during Jan 11th storm.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	2
Building System Notes	Minor MEP equipment (gas water heating) below grade. Bottom of electrical service inside nearly at grade. Individual unit gas furnaces are at risk only on lowest level.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	4	O&M Shore Protection	Unknown
Wave Overtopping	Yes	Foundation Type	Concrete Wall
Shore Protection	Steel Sheet bulkhead	Crest Over Shore Protection	Unknown
Shore Protection Notes	Building set back 70 ft from lake. 2' sand beach. Steel sheet pile. Concrete seawall in poor condition. No weephole or outlet for storm water.		

Ownership	Private
Number of Units	Over 10 Units
Vulnerability Index	4
01/11/20 Flooding	Yes
Construction Date	1963
Floors Above Grade	5
Floors Below Grade	Unknown
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	2	Structure Type	Cast in place concrete
Building Evac. Plan	Yes	Cladding Type	Masonry
Flood Access Impact	No	# of Egress Impacted	2
Min. 50% Assistance	Unable to answer	Elevator Termination	At grade
Occupancy Notes	1st floor lobby, mechanical and laundry room - 2nd thru 5th floor residential.		
Building Construction	None		
Flooding Impact History	Beach waterfront has eroded. Past storm events: water has washed up to front of building, but not entered. Site and adjoining walls are settling due to continuous erosion. A concrete retaining wall protects property, but being breached frequently.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	2
Building System Notes	Most MEP equipment (electrical service, electric water heaters with no concrete pad, domestic booster pump) on grade. All-electric building with only lobby on grade, so resident units are protected.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	4	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Pile Foundation
Shore Protection	Concrete seawall	Crest Over Shore Protection	Crest is below grade
Shore Protection Notes	Stepped concrete seawall. Three levels visible. Lowest level of concrete seawall is below water by approximately 6 inches. Building manager indicated waves from the north wash over neighboring property and into their property.		

Ownership	Private
Number of Units	Over 10 Units
Vulnerability Index	1
01/11/20 Flooding	No
Construction Date	1963
Floors Above Grade	3
Floors Below Grade	0
Flood Insurance	No



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	1	Structure Type	Bearing wall
Building Evac. Plan	Yes	Cladding Type	Masonry
Flood Access Impact	No	# of Egress Impacted	0
Min. 50% Assistance	No	Elevator Termination	At grade
Occupancy Notes	Condo building.		
Building Construction	None		
Flooding Impact History	Water washes up to doorways but has not entered the building. Two concrete retaining walls help protect property.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	2
Building System Notes	Minor MEP equipment (domestic booster pump) on grade; electrical service 24" above grade. All-electric building with limited common spaces on grade and some resident units on grade.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	4	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Slab on Grade
Shore Protection	Concrete seawall	Crest Over Shore Protection	2 - 4 feet above grade
Shore Protection Notes	Rubblemound in front of concrete seawall has been washed away in some locations. Seawall installed approximately 40 years ago.		

Ownership	Private
Number of Units	Over 10 Units
Vulnerability Index	2
01/11/20 Flooding	No
Construction Date	1900s
Floors Above Grade	4
Floors Below Grade	1
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	2	Structure Type	Bearing wall
Building Evac. Plan	Yes	Cladding Type	Masonry
Flood Access Impact	No	# of Egress Impacted	0
Min. 50% Assistance	No	Elevator Termination	Unknown
Occupancy Notes	None		
Building Construction	None		
Flooding Impact History	No flooding. East side of complex protected by adjacent building.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	3
Building System Notes	Significant MEP equipment (boilers, water heating) below grade. Bottom of electrical service inside nearly at grade.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	2	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Concrete Wall
Shore Protection	Rubblemound armor stone revetment	Crest Over Shore Protection	Crest is below grade
Shore Protection Notes	Rubblemound is directly adjacent to concrete walkway approximately 7' wide with north building face on other side of walk. Concrete blocks directly adjacent to property that may be owned by the park neighboring the property show clear signs of shifting with erosion occurring behind blocks. Concrete pathway/patio show signs of overtopping. Visible manhole in pathway directly adjacent to shoreline protection could indicate a potential storm outfall not visible.		

Ownership	Private
Number of Units	Over 10 Units
Vulnerability Index	4
01/11/20 Flooding	Yes
Construction Date	1910s
Floors Above Grade	3 to 4
Floors Below Grade	1
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	2	Structure Type	Bearing wall / Light framing
Building Evac. Plan	Yes	Cladding Type	Masonry
Flood Access Impact	No	# of Egress Impacted	1
Min. 50% Assistance	No	Elevator Termination	Unknown
Occupancy Notes	None		
Building Construction	Building construction appears quite robust. Masonry, mortar, doors, and windows withstood the elements quite well. North exterior wall at garage has masonry fractures and is bulging outward.		
Flooding Impact History	Property faces lake with high level of exposure. Lakefront flooding is eroding site and beachfront areas. On 1/11/20 damage to barrier fence and gates occurred. Minor water seepage into the basement utility room from an east-facing door.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	3
Building System Notes	Significant MEP equipment (boilers, water heating) below grade. Bottom of electrical service inside nearly at grade. Small emergency generator lakeside on grade.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	2	O&M Shore Protection	Unknown
Wave Overtopping	Unknown	Foundation Type	Concrete Wall
Shore Protection	Rubble mound w/ concrete wall	Crest Over Shore Protection	Unknown
Shore Protection Notes	Lakefront along building on two sides. Concrete wall on east side of building only. Rubblemound on both sides. Management indicated north side rubblemound was installed a month ago. East side of property has a 4 foot high wall with outdoor lawn/patio that has wave overtopping up to entry doors leaving behind sand and ice. Patio area drains through wall scupper back to lake.		

Ownership	Private
Number of Units	5-10 Units
Vulnerability Index	6
01/11/20 Flooding	Yes
Construction Date	1920s
Floors Above Grade	3
Floors Below Grade	1
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	4	Structure Type	Bearing wall / Cast in place concrete / Light framing
Building Evac. Plan	No	Cladding Type	Masonry
Flood Access Impact	Unknown	# of Egress Impacted	1 to 3
Min. 50% Assistance	No	Elevator Termination	Unknown
Occupancy Notes	All rental units.		
Building Construction	Back entries to apartment units are unusable when areaway access get flooded at ground level. East foundation wall at window is fractured below glass block window. North porch egress would be obstructed by flooding		
Flooding Impact History	Previous flooding, typically one per year. Multiple events in the past year. 1/11/20 East basement door blown out by lake water. East foundation wall features ice built up. Large crack in east concrete foundation wall. Section of concrete foundation wall under glass block window washed away. East access door to Lakefront terrace blown out. Flood water levels reach west exterior porch.		

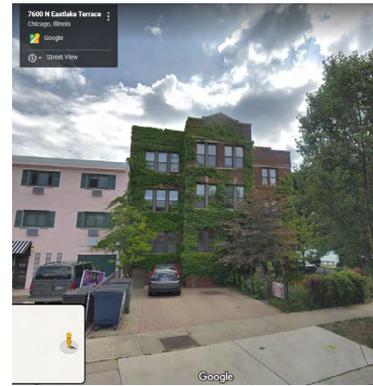
BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	4
Building System Notes	Significant MEP equipment (boilers, water heating) below grade with boiler room door to the north. Bottom of electrical service inside nearly at grade. North walkway floods with spray from waves. Condensing unit on grade protected by concrete-block dam.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	3	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Masonry Wall
Shore Protection	Steel Sheet bulkhead	Crest Over Shore Protection	0 - 2 feet above grade
Shore Protection Notes	Large steel sheet pile 30x30 with assumed concrete behind sheetpile covered in ice. Due to location and ice cover, unclear damage extent. No shore protection on north edge of building visible.		

Ownership	Private
Number of Units	5-10 Units
Vulnerability Index	2
01/11/20 Flooding	No
Construction Date	1958
Floors Above Grade	4
Floors Below Grade	0
Flood Insurance	No



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	1	Structure Type	Masonry bearing wall
Building Evac. Plan	No	Cladding Type	Masonry
Flood Access Impact	No	# of Egress Impacted	0
Min. 50% Assistance	No	Elevator Termination	Unknown
Occupancy Notes	None		
Building Construction	None		
Flooding Impact History	Original seawall failed during 1/11/20 storm. Owner trying to make repairs.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	3
Building System Notes	Minor MEP equipment (electric water heaters with no concrete pad, electric baseboard) on grade. Electric baseboard at entrance poses egress electrocution hazard. Utility transformer is padpoint on lake side; electrical service 24" above grade. All-electric building with limited common spaces on grade and some resident units on grade.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	3	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Concrete Wall
Shore Protection	Steel Sheet bulkhead	Crest Over Shore Protection	Crest is below grade
Shore Protection Notes	Steel sheet piles No visible stone. 2' high concrete seawall 10' from steel sheet pile. Seawall failure noted. Bathometric survey conducted 6 months ago Building plans to build an addition. Put on hold until seawall is built.		

Ownership	Private
Number of Units	8 Units
Vulnerability Index	6
01/11/20 Flooding	Yes
Construction Date	1940s
Floors Above Grade	2
Floors Below Grade	1
Flood Insurance	Yes



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	3	Structure Type	Masonry bearing wall
Building Evac. Plan	Yes	Cladding Type	Masonry
Flood Access Impact	Yes	# of Egress Impacted	1
Min. 50% Assistance	No	Elevator Termination	Unknown
Occupancy Notes	Condo units		
Building Construction	Exterior wall is covered with plywood. Unable to gain entry to verify interior conditions		
Flooding Impact History	Previous flooding, one event in the last year.		

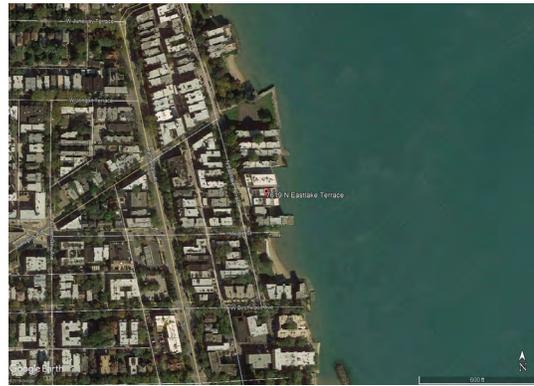
BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	4
Building System Notes	No common space; one floor of resident units extends 24" below grade with stairwells that face south. Resident basements contain boiler and water heater below grade and electrical service 24" above grade. Some condensing units at grade.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	3	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Concrete Wall
Shore Protection	Steel Sheet bulkhead	Crest Over Shore Protection	Crest is below grade
Shore Protection Notes	Minor damage to shore protection visible in snow. Clearly sheetpile with approximately 12' concrete backing up to it. Most likely attached to structure foundation. Chainlink fence along perimeter of sheetpile, severely damaged. Clear signs of overtopping reaching individual condo unit doors and windows. Overtopping waves leaving behind debris, sand, and ice.		

Ownership	Private
Number of Units	Over 10 Units
Vulnerability Index	6
01/11/20 Flooding	Yes
Construction Date	1940s
Floors Above Grade	2
Floors Below Grade	1
Flood Insurance	Yes



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	3	Structure Type	Bearing wall
Building Evac. Plan	No	Cladding Type	Masonry
Flood Access Impact	No	# of Egress Impacted	1
Min. 50% Assistance	No	Elevator Termination	Unknown
Occupancy Notes	None		
Building Construction	Building's exterior walls show no structural damage at time of inspection. Unit F north deck has been removed, exterior door has 2x4 installed obstructing egress. Unable to gain entry to verify seepage in basement. See adjacent property notes for 7617 N Eastlake Terrace.		
Flooding Impact History	Previous flooding, one event in the last year.		

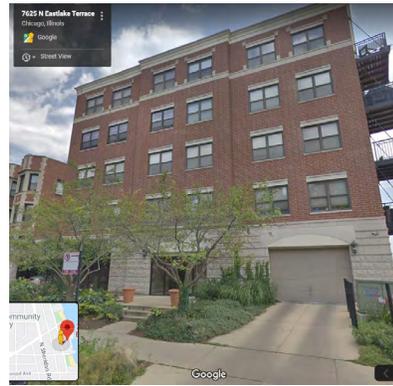
BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	4
Building System Notes	No common space; one floor of resident units extends 24" below grade with stairwells that face north. Resident basements contain boiler and water heater below grade and electrical service 24" above grade. Some condensing units at grade. Twin to 7617

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	3	O&M Shore Protection	Unknown
Wave Overtopping	Unknown	Foundation Type	Unknown
Shore Protection	Unknown	Crest Over Shore Protection	Unknown
Shore Protection Notes	None		

Ownership	Private
Number of Units	40 Units
Vulnerability Index	4
01/11/20 Flooding	Yes
Construction Date	1997
Floors Above Grade	5
Floors Below Grade	2
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	2	Structure Type	Cast in place concrete
Building Evac. Plan	Yes	Cladding Type	Masonry
Flood Access Impact	No	# of Egress Impacted	Unknown
Min. 50% Assistance	No	Elevator Termination	At grade
Occupancy Notes	Condo units. Mixed demographic.		
Building Construction	Garage areas are below grade.		
Flooding Impact History	Previous flooding, typically one per year. Multiple events in the past year. Cracks in east water front concrete terrace. Water seepage at west side of garage from floor slab (about 12 feet below grade) and south foundation wall. Exterior wall at east has repairs made at bottom.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	3
Building System Notes	Minor MEP equipment (water heating) below grade. Lakeside louvers for lower garage 24" above grade 6' from lake; lower garage well below grade. RTU above garage leaks into upper garage ductwork when wave spray hits it. Pad-mount transformer on street side; electrical service at grade.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	3	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Concrete Wall
Shore Protection	Concrete seawall	Crest Over Shore Protection	Crest is below grade
Shore Protection Notes	Multi-level concrete wall second level not visible at time of visit. Concrete seawall is only shoreline protection. Building management indicated there is cracking on the front of wall which is only visible from the lake side. Concrete seawall frozen ice. Spray reaches up to second level balconies.		

Ownership	Private
Number of Units	10 Units
Vulnerability Index	5
01/11/20 Flooding	Yes
Construction Date	1920s
Floors Above Grade	4
Floors Below Grade	0
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	2	Structure Type	Bearing wall
Building Evac. Plan	Yes	Cladding Type	Masonry
Flood Access Impact	No	# of Egress Impacted	1
Min. 50% Assistance	No	Elevator Termination	Unknown
Occupancy Notes	6 unit building. Gutted for remodel. Currently vacant building. Property currently undergoing renovations. No occupants.		
Building Construction	None		
Flooding Impact History	Previous and 1/11/20 flooding noted.		

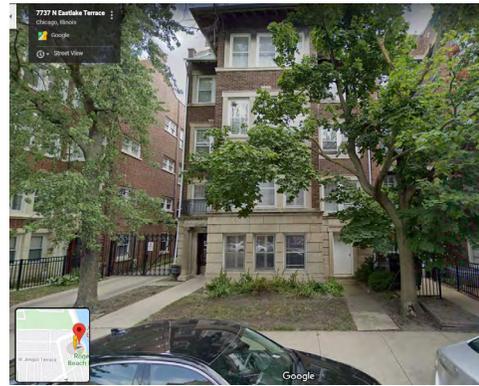
BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	4
Building System Notes	Currently gutted for remodeling, the new electrical service and gas services are 12" above grade. Lower level resident units extend 24" below grade and are at risk, along with MEP systems installed at that level.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	3	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Masonry / Concrete wall
Shore Protection	Rubblemound armor stone revetment	Crest Over Shore Protection	Crest is below grade
Shore Protection Notes	Rubblemound surrounding two sides of property. Rubblemound directly adjacent to garage wall/foundation and concrete driveway.		

Ownership	Private
Number of Units	10 Units
Vulnerability Index	5
01/11/20 Flooding	Yes
Construction Date	1920s
Floors Above Grade	4
Floors Below Grade	0
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	2	Structure Type	Heavy timber / Bearing wall
Building Evac. Plan	Yes	Cladding Type	Masonry
Flood Access Impact	No	# of Egress Impacted	1
Min. 50% Assistance	No	Elevator Termination	Unknown
Occupancy Notes	Rental unit.		
Building Construction	Exterior damage to concrete drive and patio area. Unable to determine structure under drive/patio at shoreline. Rock break wall installed in front of drive/patio area. Damage to east metal fence at shoreline.		
Flooding Impact History	Previous flooding, one event in the last year.		

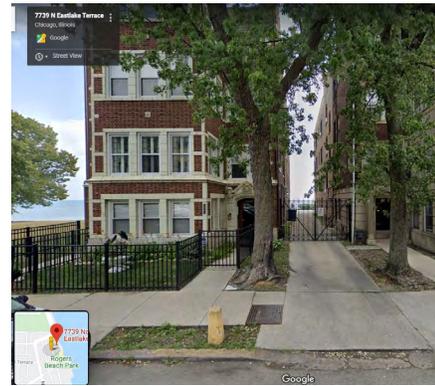
BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	4
Building System Notes	Significant MEP equipment (boilers, condensate pumps, water heating) 24" below grade. Bottom of electrical service inside, 12" above grade, with door facing lake.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	3	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Masonry Wall
Shore Protection	Rubblemound armor stone revetment	Crest Over Shore Protection	Crest is below grade
Shore Protection Notes	Rubblemound stone is directly adjacent to concrete parking area. Unclear if shore protection, concrete patio, and foundation are connected. Assumed shore protection is rubblemound only that is directly adjacent to concrete patio. Building connected to building next door. Visible cracking in wall from wave damage.		

Ownership	Private
Number of Units	Unknown
Vulnerability Index	5
01/11/20 Flooding	Yes
Construction Date	Unknown
Floors Above Grade	4
Floors Below Grade	0
Flood Insurance	Unknown



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	2	Structure Type	Light framing structure
Building Evac. Plan	Unknown	Cladding Type	Masonry
Flood Access Impact	No	# of Egress Impacted	1
Min. 50% Assistance	Unknown	Elevator Termination	Unknown
Occupancy Notes	None		
Building Construction	Lower level unoccupied boathouse below parking garage flooded with severe damage to north foundation wall and footing. Footing no longer bearing on soil and has separated from the foundation wall. Active Building Department Court Case from November 19 Inspection.		
Flooding Impact History	Previous flooding, multiple events in past year.		

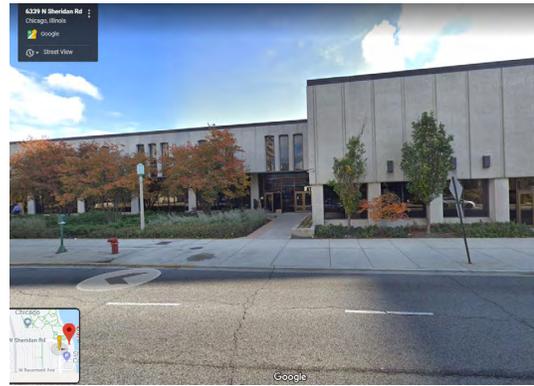
BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	4
Building System Notes	Significant MEP equipment (boilers, condensate pumps, water heating) 12" below grade. Bottom of electrical service inside, 12" above grade, with door facing lake.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	3	O&M Shore Protection	Unknown
Wave Overtopping	Unknown	Foundation Type	Masonry Wall
Shore Protection	rubble mound with concrete wall	Crest Over Shore Protection	Unknown
Shore Protection Notes	Wave overtopping icing over stone, fence, and patio/parking area. Waves have broken patio fence. Boathouse beneath building now inaccessible.		

Ownership	Private (Loyola)
Number of Units	Not Applicable
Vulnerability Index	Not Applicable
01/11/20 Flooding	No
Construction Date	Approx. 1960's
Floors Above Grade	2
Floors Below Grade	1
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	1	Structure Type	Unknown
Building Evac. Plan	Yes	Cladding Type	Precast concrete
Flood Access Impact	No	# of Egress Impacted	Unknown
Min. 50% Assistance	No	Elevator Termination	Unknown
Occupancy Notes	Sullivan Center for Student Services. Occupancy is administration offices and storage in lower level; one auditorium and classrooms.		
Building Construction	None		
Flooding Impact History	No flooding. Some past groundwater seepage lower level. Has basement, no past history of flooding, some past groundwater seepage lower level.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	4
Building System Notes	AHUs, Chiller, Hydronic Pumps, Condensing Water Pumps are in the Basement. Cooling Tower is on the roof. Outdoor air intake and exhaust air louvers are exposed to the Lake although protected by area wells and grates. Electrical service and/or electrical panels is below grade. DWH (electric) is below grade. Flood protection limited to sump pump(s) at lowest level.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	4	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Not discernable
Shore Protection	Unknown	Crest Over Shore Protection	Unknown
Shore Protection Notes	The vegetation along the east edge of the Sullivan Center is also bent backward away from the lake.		

Ownership	Private (Loyola)
Number of Units	Not Applicable
Vulnerability Index	Not Applicable
01/11/20 Flooding	No
Construction Date	1930
Floors Above Grade	14
Floors Below Grade	1
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	1	Structure Type	Cast in place concrete
Building Evac. Plan	Yes	Cladding Type	Masonry
Flood Access Impact	No	# of Egress Impacted	Unknown
Min. 50% Assistance	Unable to answer	Elevator Termination	At grade
Occupancy Notes	Performing arts center and educational facility		
Building Construction	Historic Building. Foundation drain system feeds into former boiler room and was installed sometime during renovations in mid 2000's. Connected to pumps on power- loss of power could create secondary hazard of flooding in mechanical room. Even with system in place water seeping into mech room at anchors in concrete.		
Flooding Impact History	Past flooding from groundwater and sewage backups. Lower mechanical level was raised up around 3 feet around year 07.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	3
Building System Notes	Chilled water and heating water are coming from the Central Plant Hydronic Pumps are in the Basement. Electrical service and/or electrical panels is below grade. Flood protection limited to sump pump(s) at lowest level.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability		O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Not discernable
Shore Protection	Unknown	Crest Over Shore Protection	Unknown
Shore Protection Notes	None		

Ownership	Private (Loyola)
Number of Units	Not Applicable
Vulnerability Index	Not Applicable
01/11/20 Flooding	Unknown
Construction Date	1930
Floors Above Grade	3
Floors Below Grade	1
Flood Insurance	Unknown



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	1	Structure Type	Cast in place concrete
Building Evac. Plan	Yes	Cladding Type	Masonry
Flood Access Impact	No	# of Egress Impacted	Unknown
Min. 50% Assistance	Unknown	Elevator Termination	Unknown
Occupancy Notes	None		
Building Construction	Site consists of 2 buildings. Piper is an historic home, on the register of historic places. Coffey is newer, built for dormitories and later converted to office/classroom space. Large glass windows at first floor face toward lake, raised about 3' from ground level.		
Flooding Impact History	Past flooding from sewer backup at lower level. Some past groundwater intrusion in lower level mechanical area.		

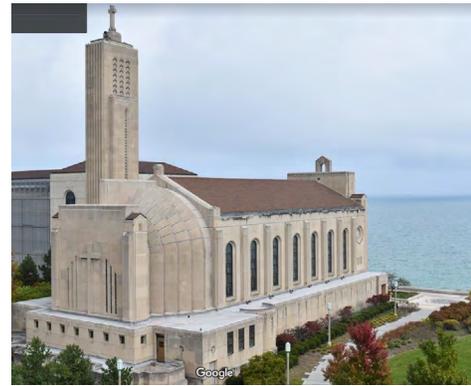
BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	4
Building System Notes	AHUs, Boilers, Hydronic Pumps are in the Basement. Condensing unit is outside on grade. Electrical service and/or electrical panels is below grade. DWH (electric) is below grade. Booster pumps are below grade. Flood protection limited to sump pump(s) at lowest level.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability		O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Not discernable
Shore Protection	Unknown	Crest Over Shore Protection	Unknown
Shore Protection Notes	East of Coffey Hall: At northeast corner of Coffey Hall, the sheetpile terminates and switches to concrete seawall going south. The concrete seawall is spalling and rebar is showing. There is sand on the bottom rail along the seawall. At the rain gardens along the lake, there is sand, some minor erosion and the vegetation is bent backward away from the lake.		

Ownership	Private (Loyola)
Number of Units	Not Applicable
Vulnerability Index	Not Applicable
01/11/20 Flooding	No
Construction Date	1938
Floors Above Grade	2
Floors Below Grade	1
Flood Insurance	Unknown



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	1	Structure Type	Cast in place concrete
Building Evac. Plan	Unknown	Cladding Type	Masonry
Flood Access Impact	Yes	# of Egress Impacted	1
Min. 50% Assistance	No	Elevator Termination	Unknown
Occupancy Notes	Loyola Chapel		
Building Construction	Historic Building. No history of flooding, but front door faces lake, potential in a more dramatic storm event for waves to prohibit access to the front door. Basement floor is unfinished sand.		
Flooding Impact History	No flooding.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	3
Building System Notes	Chilled water is coming from the Central plant. Heating water is from adjacent building plant. AHUs and Hydronic Pumps are in Basement. Electrical service and/or electrical panels is below grade. Domestic Water Heater is below grade. Flood protection limited to sump pump(s) at lowest level.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability		O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Not discernable
Shore Protection	Unknown	Crest Over Shore Protection	Unknown
Shore Protection Notes	None		

Ownership	Private (Loyola)
Number of Units	Not Applicable
Vulnerability Index	Not Applicable
01/11/20 Flooding	No
Construction Date	2009
Floors Above Grade	4
Floors Below Grade	0
Flood Insurance	Unknown



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	1	Structure Type	Cast in place concrete / Structural steel
Building Evac. Plan	Unknown	Cladding Type	Glass curtain wall
Flood Access Impact	No	# of Egress Impacted	1
Min. 50% Assistance	No	Elevator Termination	At grade
Occupancy Notes	Several offices, electronic study/library, cafe		
Building Construction	Operable panels are fritted with motors at mullions line beneath. They are similar to doors- and are made to open, so they leak. Ground floor is raised access floor-leaks would not be visible. Entire east side is curtain wall. Connected to natural air automated systems (LEED), contributes to water infiltration and wear on gaskets/seals.		
Flooding Impact History	No flooding. Potential for water intrusion at east glass face during driving rain events.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	3
Building System Notes	Operable windows used in the natural ventilation mode are exposed to Lake. Electrical services are at ground. DWH are above ground. Fire Pump in basement of Cudahy Library serves the adjacent Information Commons.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability		O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Not discernable
Shore Protection	Unknown	Crest Over Shore Protection	Unknown
Shore Protection Notes	East of Loyola Commons: Washed up dock on top of rocks.		

Ownership	Private (Loyola)
Number of Units	N/A
Vulnerability Index	Not Applicable
01/11/20 Flooding	No
Construction Date	1960s
Floors Above Grade	5
Floors Below Grade	0
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	1	Structure Type	Cast in place concrete
Building Evac. Plan	Unknown	Cladding Type	Masonry
Flood Access Impact	No	# of Egress Impacted	1
Min. 50% Assistance	No	Elevator Termination	At grade
Occupancy Notes	Crown Hall Loyola. Occupancy is office and lecture halls.		
Building Construction	None		
Flooding Impact History	No previous flooding. Endures a lot of weather-dependent damage from driving wind and rain. No flooding from lake.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	3
Building System Notes	Chilled water is coming from the Central plant. AHUs are located in the Penthouse. Electrical service and/or electrical panels are below grade. Transformer is located outside on grade. Elevator pitpump is below grade. DWHs are in the Penthouse and Booster Pump is at grade. There is no Fire Pump. Fire Alarm panel is above grade.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	5	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Not discernable
Shore Protection	Unknown	Crest Over Shore Protection	Unknown
Shore Protection Notes	East of Crown Center: Sand on paved walkway behind sheetpile and on top of revetment stone.		

Ownership	Private (Loyola)
Number of Units	Unknown
Vulnerability Index	Not Applicable
01/11/20 Flooding	Yes
Construction Date	Approx. 1940s
Floors Above Grade	9
Floors Below Grade	0
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	4	Structure Type	Cast in place concrete
Building Evac. Plan	Yes	Cladding Type	Masonry
Flood Access Impact	Yes	# of Egress Impacted	2
Min. 50% Assistance	No	Elevator Termination	At grade
Occupancy Notes	Santa Clara Hall (Dormitory) Loyola. Occupied by students, mix of professors and other professionals		
Building Construction	Courtyard building with point-loaded entrances.		
Flooding Impact History	No previous flooding. Street floods from sewer clogs, water flows towards front door. Evidence of sand in windows at ground floor common spaces. Sand in sills and screens indicating waves crashing up to windows. Lower pit level in Mech room was filling with water, no drain. Alley was inaccessible during 1/11/20 flooding. Water enters the mechanical louvers on the building, east face, northeast corner, from wave action. Water enters south doors via overland flow path at curb cut off of the public street. Loyola uses sandbags to limit water entry.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	5
Building System Notes	All/most MEPFP equipment below grade potentially at risk of flood damage. Electrical service and/or electrical panels is below grade. Heating boilers and hydronic pumps are in the basement. Chiller and MAU are on the roof. Louvers are low above grade exposed to the lake. Electrical service and/or electrical panels is below grade. Emergency Generator is below grade, and louvers are low, exposed to the Lake. DWHs and Booster pumps are in the Basement. Flood protection limited to sump pump(s) at lowest level. Fire Pump is at grade. Fire Alarm Panel is above grade.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	5	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Not discernable
Shore Protection	Unknown	Crest Over Shore Protection	Unknown
Shore Protection Notes	Major damage at alley north of Santa Clara Hall. At Santa Clara Hall - facilities indicated ice was built up on the metal fence to the east of the building, sand buildup on pavement at east side of building and at first floor windows, sandbagging of south door. Alley to north of Santa Clara Hall - collapsed public alley north of the building. At east end of Loyola Avenue right of way, there were two concrete benches that were displaced by waves and have since been reinstalled.		

Ownership	Chicago Park District
Number of Units	Not Applicable
Vulnerability Index	Not Applicable
01/11/20 Flooding	Yes
Construction Date	Unknown
Floors Above Grade	2
Floors Below Grade	1
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	5	Structure Type	Light framing structure
Building Evac. Plan	No	Cladding Type	Siding
Flood Access Impact	No	# of Egress Impacted	Unknown
Min. 50% Assistance	No	Elevator Termination	Unknown
Occupancy Notes	Jackson Harbor Station. 9 employees on regular basis park district office		
Building Construction	Originally built as emergency/fire response before Coast Guard, then WestRec, then CPD within past 4 years. Built with rooms for overnight stays with kitchens, etc.		
Flooding Impact History	Flooding noted on 1/11/20.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	5
Building System Notes	AHU is below grade. Electrical service and/or electrical panels is below grade. Domestic Water Heater is below grade.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	4	O&M Shore Protection	Unknown
Wave Overtopping	Unknown	Foundation Type	Unknown
Shore Protection	Unknown	Crest Over Shore Protection	Unknown
Shore Protection Notes	None		

Ownership	Chicago Park District
Number of Units	Not Applicable
Vulnerability Index	Not Applicable
01/11/20 Flooding	Unknown
Construction Date	Unknown
Floors Above Grade	1
Floors Below Grade	0
Flood Insurance	Unknown



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	3	Structure Type	Unknown
Building Evac. Plan	Unknown	Cladding Type	Unknown
Flood Access Impact	Unknown	# of Egress Impacted	Unknown
Min. 50% Assistance	Unknown	Elevator Termination	Unknown
Occupancy Notes	None		
Building Construction	None		
Flooding Impact History	Unknown		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	
Building System Notes	

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	3	O&M Shore Protection	Unknown
Wave Overtopping	Unknown	Foundation Type	Slab on Grade
Shore Protection	None	Crest Over Shore Protection	Unknown
Shore Protection Notes	Sand Beach.		

Ownership	Chicago Park District
Number of Units	Not Applicable
Vulnerability Index	Not Applicable
01/11/20 Flooding	Yes
Construction Date	2013
Floors Above Grade	1
Floors Below Grade	0
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	3	Structure Type	Light framing structure
Building Evac. Plan	Yes	Cladding Type	Siding
Flood Access Impact	No	# of Egress Impacted	Unknown
Min. 50% Assistance	No	Elevator Termination	Unknown
Occupancy Notes	Unoccupied structure. Seasonal summer use. Gazebo concession structure and patio.		
Building Construction	Light framed wood structure. Rotting at framing base due to water damage. Stair railings and protective barriers that were destroyed from storm has made area unsafe and will require repairs.		
Flooding Impact History	Previous flooding. Multiple events in past year.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	4
Building System Notes	All plumbing and kitchen equipment is in portable trailers removed for winter. Grade connections to domestic and sanitary for temporary restaurant building and portable kitchen and restroom trailers have been damaged, including freestanding electrical panel knocked down.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	2	O&M Shore Protection	Unknown
Wave Overtopping	Unknown	Foundation Type	Unknown
Shore Protection	Unknown	Crest Over Shore Protection	Unknown
Shore Protection Notes	None		

Ownership	Chicago Park District
Number of Units	Not Applicable
Vulnerability Index	Not Applicable
01/11/20 Flooding	Yes
Construction Date	Approx. 2015
Floors Above Grade	1
Floors Below Grade	0
Flood Insurance	No



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	3	Structure Type	Light framing structure
Building Evac. Plan	Yes	Cladding Type	Siding
Flood Access Impact	No	# of Egress Impacted	0
Min. 50% Assistance	No	Elevator Termination	Unknown
Occupancy Notes	Unoccupied structure. Seasonal summer use. Complex of multiple light framed seasonal concession and restrooms facilities.		
Building Construction	None		
Flooding Impact History	Previous flooding. One event in past year.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	3
Building System Notes	Electrical and gas services in building at grade, outside showers leaning.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	4	O&M Shore Protection	Unknown
Wave Overtopping	Unknown	Foundation Type	Slab on Grade
Shore Protection	None	Crest Over Shore Protection	Unknown
Shore Protection Notes	Sand beach only.		

Ownership	Chicago Park District
Number of Units	Not Applicable
Vulnerability Index	Not Applicable
01/11/20 Flooding	Yes
Construction Date	1920s
Floors Above Grade	1
Floors Below Grade	0
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	2	Structure Type	Bearing wall
Building Evac. Plan	Yes	Cladding Type	Masonry
Flood Access Impact	Yes	# of Egress Impacted	0
Min. 50% Assistance	Unable to answer	Elevator Termination	Unknown
Occupancy Notes	Unoccupied structure. Public Restroom facility used during summer.		
Building Construction	Historic building owned by Park District.		
Flooding Impact History	Previous flooding noted.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	4
Building System Notes	Historical building with underground conduit exposed lakeside from erosion. Restroom fixtures at grade, adjacent concession electrical and plumbing connections at risk.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	4	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Slab on Grade
Shore Protection	Concrete seawall	Crest Over Shore Protection	0 - 2 feet above grade
Shore Protection Notes	Building directly adjacent to lakeshore walking path with concrete seawall.		

Ownership	Chicago Park District
Number of Units	Not Applicable
Vulnerability Index	Not Applicable
01/11/20 Flooding	Yes
Construction Date	1910
Floors Above Grade	1
Floors Below Grade	0
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	4	Structure Type	Cast in place concrete
Building Evac. Plan	Yes	Cladding Type	Cast in place concrete
Flood Access Impact	Yes	# of Egress Impacted	2
Min. 50% Assistance	Unable to answer	Elevator Termination	Unknown
Occupancy Notes	Low occupancy / usage		
Building Construction	Historic Building. A new elevated sidewalk was built to permit easier (and drier access into building) in response to last flooding events.		
Flooding Impact History	Previous flooding, multiple events in past year.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	5
Building System Notes	Floor drains (connected directly to lake/lagoon) back up with rising lake levels to flood the building. Electric water heater and gas furnaces on concrete pads in mechanical room surrounded by currently 2" of standing water.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	4	O&M Shore Protection	Unknown
Wave Overtopping	Unknown	Foundation Type	Slab on Grade
Shore Protection	None	Crest Over Shore Protection	Unknown
Shore Protection Notes	No permanent shore protection. Currently using jersey barriers, sand bags and a pump to attempt to keep lagoon water off of concrete apron and building floor. It was indicated that water is coming up through plumbing and sewer connections. The concrete apron in the center of the building is potentially undermined with observed bubbles coming up within 2-4 feet of the building.		

Ownership	Chicago Park District
Number of Units	Not Applicable
Vulnerability Index	Not Applicable
01/11/20 Flooding	No
Construction Date	1970s
Floors Above Grade	1
Floors Below Grade	0
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	N/A	Structure Type	Structural steel
Building Evac. Plan	Yes	Cladding Type	Metal panel
Flood Access Impact	No	# of Egress Impacted	0
Min. 50% Assistance	No	Elevator Termination	Unknown
Occupancy Notes	Complex of seasonal concession, storage and patio areas. Unoccupied. Open summer months only.		
Building Construction	Light framing, wood		
Flooding Impact History	No flooding.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	4
Building System Notes	Utility transformer at grade, electrical service barely above grade, restrooms at grade, abandoned fuel oil tank at risk. Only RTU is safe.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	1	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Slab on Grade
Shore Protection	Unknown	Crest Over Shore Protection	0 - 2 feet above grade
Shore Protection Notes	Partially vegetated dune, partially sand beach.		

Ownership	Chicago Park District
Number of Units	Not Applicable
Vulnerability Index	1
01/11/20 Flooding	No
Construction Date	1906
Floors Above Grade	3
Floors Below Grade	1
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	1	Structure Type	Non-combustible exterior/ Combustible framing
Building Evac. Plan	Yes	Cladding Type	Masonry
Flood Access Impact	No	# of Egress Impacted	Unknown
Min. 50% Assistance	No	Elevator Termination	Unknown
Occupancy Notes	None		
Building Construction	Site consists of 4 different historic structures which have been adapted to community spaces.		
Flooding Impact History	No flooding.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	2
Building System Notes	Boilers and hydronic pumps are below grade. Electrical service and/or electrical panels is below grade. Domestic Water Heater is below grade.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	3	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Not discernable
Shore Protection	Rubblemound armor stone revetment	Crest Over Shore Protection	4 - 6 feet above grade
Shore Protection Notes	Public path right-of-way along lake obstructed by waves, sand rock from 1/11/20 event. Thick ice on ground behind revetment. Sand behind revetment. Per interview, revetment stones shifted during the 1/11/20 event, forward toward the lake. Sand and small rocks were washed up onto the path by waves during the 1/11/20 event and this has since been cleaned up.		

Ownership	Chicago Park District
Number of Units	Not Applicable
Vulnerability Index	1
01/11/20 Flooding	No
Construction Date	1950s
Floors Above Grade	2
Floors Below Grade	0
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	1	Structure Type	Cast in place concrete
Building Evac. Plan	Yes	Cladding Type	Masonry
Flood Access Impact	No	# of Egress Impacted	0
Min. 50% Assistance	No	Elevator Termination	Unknown
Occupancy Notes	Loyola Park Recreation Center. Fieldhouse and concession and toilet bldg. Large indoor and outdoor recreation and classroom complex.		
Building Construction	None		
Flooding Impact History	No previous flooding. Minor flooding in parking lot. Little to no damage observed. Concession stand has up to 10 inches of sand against walls.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	
Building System Notes	

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	3	O&M Shore Protection	Unknown
Wave Overtopping	Unknown	Foundation Type	Slab on Grade
Shore Protection	None - Building setback	Crest Over Shore Protection	Unknown
Shore Protection Notes	Building set back from beach approximately 100 feet. Set back from sand beach that is partially vegetated.		

Ownership	Chicago Park District
Number of Units	Not Applicable
Vulnerability Index	Not Applicable
01/11/20 Flooding	Yes
Construction Date	Unknown
Floors Above Grade	1
Floors Below Grade	0
Flood Insurance	No



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	N/A	Structure Type	Light framing structure
Building Evac. Plan	No	Cladding Type	Siding
Flood Access Impact	Yes	# of Egress Impacted	1
Min. 50% Assistance	No	Elevator Termination	Unknown
Occupancy Notes	Small seasonal concession stand located on beach front.		
Building Construction	Light framed wood structure.		
Flooding Impact History	Previous flooding. One event in past year.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	
Building System Notes	

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability		O&M Shore Protection	Unknown
Wave Overtopping	Yes	Foundation Type	Slab on Grade
Shore Protection	None	Crest Over Shore Protection	Unknown
Shore Protection Notes	Building directly on sand beach. No vegetation.		

Ownership	City of Chicago
Number of Units	Not Applicable
Vulnerability Index	Not Applicable
01/11/20 Flooding	Yes
Construction Date	1945
Floors Above Grade	0
Floors Below Grade	0
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	1	Structure Type	Cast in place concrete
Building Evac. Plan	Yes	Cladding Type	Masonry
Flood Access Impact	Yes	# of Egress Impacted	0
Min. 50% Assistance	No	Elevator Termination	Below grade (basement)
Occupancy Notes	None		
Building Construction	WPP facility is very large w/ many buildings and many floor levels%2C including sub-sub basements and not all equipment types could be confirmed. Only portions of buildings closest to lake were visited.		
Flooding Impact History	Flooding noted on 1/11/20.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	5
Building System Notes	Large/critical facility w/ MEPFP (electrical panels, boilers/water heaters, pumps, gas pressure booster) and process equipment (water treatment & chemical injection) throughout, some approx. -30' below lake level, potentially at risk of flood damage, however facility has flood protection measures (rip-rap, walls, sump pumps). Backup generators w/ redundancy and diesel fuel belly tanks are outside in elevated enclosures. Boilers are dual fuel. Low pressure gas service is being upgraded to medium pressure. Existence and height of equipment housekeeping pads and dikes vary. Limited fire protection (carpenter area, chemical agent for control room)

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	2	O&M Shore Protection	Yes
Wave Overtopping	Yes	Foundation Type	Concrete Wall
Shore Protection	Concrete seawall	Crest Over Shore Protection	2 - 4 feet above grade
Shore Protection Notes	20' of concrete seawall missing, south end of property. Significant erosion 40' from current edge of water. 400' of shore protection is stone or slope wall. 100' of concrete sea wall significantly damaged. Intake wall becomes seawall during intake. Interior wall is in good condition. Lake elevation +3 North side of building has 6' concrete wall and 300' beach. Majority of wall protected by off shore stone break wall. Most damage at southern portion not covered by breakwall. Broken / damaged trees on backslope toward property. Broken, damaged, fencing and shore protection. Rusted steel sheet pile.		

Ownership	City of Chicago
Number of Units	Not Applicable
Vulnerability Index	Not Applicable
01/11/20 Flooding	Yes
Construction Date	1958
Floors Above Grade	2
Floors Below Grade	2
Flood Insurance	Unable to answer



OCCUPANT AND BUILDING STRUCTURE VULNERABILITY PROFILE

Structural Vulnerability	3	Structure Type	Cast in place concrete
Building Evac. Plan	Yes	Cladding Type	Cast in place concrete w/ misc.
Flood Access Impact	Yes	# of Egress Impacted	Unknown
Min. 50% Assistance	No	Elevator Termination	Below grade (basement)
Occupancy Notes	None		
Building Construction	None		
Flooding Impact History	Previous and 1/11/20 flooding noted.		

BUILDING SYSTEMS VULNERABILITY PROFILE

Systems Vulnerability	5
Building System Notes	Many pumps and panels at various levels, down to -15' from lake level. History of cofferdam failure allowing lake to flood void space below most of the man-made island, filling the -15' space up to the building final walls. Medium-voltage feed concrete-encased from Park east to ComEd vault above grade. New back-up generator plant on grade.

COASTAL VULNERABILITY PROFILE

Coastal Vulnerability	3	O&M Shore Protection	No
Wave Overtopping	Yes	Foundation Type	Pile Foundation
Shore Protection	Varied based on location	Crest Over Shore Protection	Crest is below grade
Shore Protection Notes	Earthen cofferdam appears to be approximately 8 feet above current lake level. Concrete seawall approximately 3 feet above lake level. Clear signs of overtopping of earthen cofferdam causing small to large sinkholes behind concrete wall. Eroded earth and lawn along perimeter of earthen cofferdam. Displaced stone from rubblemound in some locations. Observed locations of cracks and breaking concrete wall specifically along transitions between earthen cofferdam and sheetpile bulkhead.		



APPENDIX 4 RESILIENCE TYPOLOGIES

APPENDIX 4 – RESILIENCE TYPOLOGIES

SITE FEATURES

ARCHITECTURAL WALL



Source: Visit Vancouver USA

\$ \$

Wall setback from the shoreline edge that provides protection from wave overtopping and creates secondary benefit of an amenity: planter, seating, rain garden, etc.

- Protection heights: up to 3 feet.
- Typically construction: concrete or steel with structural foundation.
- Advantageous in areas with limited space for improvement.
- Minimal maintenance and long service life, requires inspection after storm events.
- Permanent solution that provides passive protection once constructed.

BEACH FILL



Source: SAGE, Living Shorelines

\$ \$\$ \$\$\$ \$\$\$\$\$ \$\$\$\$\$\$

Coarse grained sediments added to the shoreline to combat erosion, provides protection from high water levels and wave overtopping, and creates secondary benefits for recreation and habitat.

- Protection heights: designed to address flood conditions.
- Typical construction: sand or gravel/cobble.
- Maintains or expands shoreline, recreational and habitat value.
- Avoids construction of hard and permanent shoreline structures and can protect existing habitat.
- Usually used in combination with other structural solutions to hold sediment in place, requires periodic replenishment and maintenance.

REVETMENT



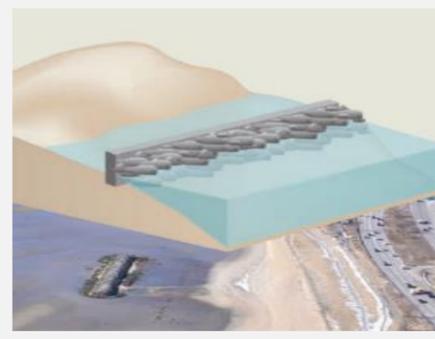
Source: SAGE, Living Shorelines

\$ \$\$ \$\$\$

Sloping structure placed on shoreline to combat erosion and provides protection from high water levels and wave overtopping.

- Protection heights: designed to address flood conditions.
- Typical construction: stone, concrete blocks or slabs, sand or concrete filled bags.
- Protects shore from wave action but not high-water levels.
- Minimal maintenance required and long service life.
- Permanent solution that provides passive protection once constructed.

BREAKWATER



Source: SAGE, Living Shorelines

\$ \$\$ \$\$\$ \$\$\$\$\$

Permanent or temporary offshore structure that can be shoreline connected or detached. Protects the shoreline from wave overtopping.

- Protection heights: designed to address flood conditions.
- Typical construction: stone and/or concrete or steel sheet pile (permanent), stone or water ballasted barge (temporary).
- Protects shore from wave action but not high-water levels. Not applicable for high water level flooding.
- Minimal maintenance required and long service life.
- Permanent solution that provides passive protection once constructed.

APPENDIX 4 – RESILIENCE TYPOLOGIES

BUILDING FEATURES

TEMPORARY WALL (Seasonal Deployment)



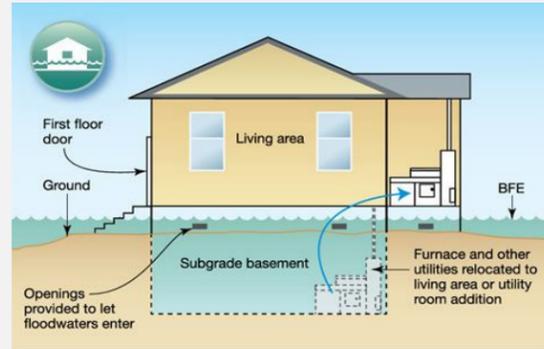
Source: ABC, Enhancing Resilience in Boston

\$ \$

Wall temporarily installed to protect buildings from flooding and wave overtopping.

- Protection heights: up to 12 feet (varies by system type).
- Typical construction: geotextile compartment filled with water/aggregate/sand; steel panels with framing/anchorage system.
- Does not require structural or retrofitting measure for building.
- Deployable requiring human intervention and planning to allow for installation time.
- Medium service life, requiring minimal maintenance and inspection after storm events.

WET FLOODPROOFING



Source: FEMA, Floodproofing Non-Residential Buildings

\$ \$\$\$ \$\$\$\$ \$\$\$\$\$

Structure is retrofit to allow water to enter building during flooding so that hydrostatic pressure is equalized and damage to the structure is minimized.

- Protection heights: first floor of building.
- Typical construction: flood openings for equalization, flood damage-resistant materials, protection of vulnerable equipment.
- Applicable to buildings with basements, garages, and enclosed areas below the flood elevation.
- Long service life, requiring periodic inspection and maintenance of materials and structure to ensure resistance to flood-related forces and impacts.
- Restricts use of first floor and basement space

OPENING CLOSURES (Doors, windows, garages)



Source: FEMA, Floodproofing Non-Residential Buildings

\$

Exterior building openings are permanently or temporarily sealed to protect interior of buildings from flooding and wave overtopping.

- Protection heights: up to full height of opening.
- Typical construction: aluminum or steel with sealants/gaskets(temporary); brick, concrete, etc. to be consistent with building materials (permanent).
- Recommended for scenarios where flooding does not last more than 12 hours.
- Medium service life, requiring periodic inspection and maintenance of seals and structural components, leaks are expected and measures to remove infiltrated water are usually necessary.
- Permanent or temporary solution, can involve passive and/or active protection.

DEPLOYABLE WALL (Passive)



Source: FloodBreak

\$ \$

Wall permanently installed which rises from the existing subgrade during a flood event. Protects buildings from flooding and wave overtopping.

- Protection heights: up to 6 feet.
- Typical construction: steel and/or concrete anchored in existing subgrade.
- Cost effective in areas with frequent flooding and does not require human intervention.
- Long service life with regular maintenance and inspection.
- Permanent solution that provides passive protection once constructed.