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Executive Summary

This flood risk reduction strategy summarizes the framework for understanding risk and how we can connect on the promise to comprehensively reduce the risk of flooding throughout the community.

Over a ten-month period, a task force of staff and community members worked to come to a shared understanding of what flooding is, what is valuable, and what matters, where, and to whom.

Structural flood risk occurs through a variety of pathways; over the land surface, through groundwater seepage, and via sanitary backflow. Efforts to reduce risk depend on time. The best time to reduce flood vulnerability is before the flood. During a flood, the focus shifts to staying safe from harm, or sustaining or restoring services. After the flood, we focus on recovering and reviewing risk.

Over the land surface  
Groundwater seepage  
Sanitary backflow

Through the process, we come to a new understanding of the factors that define flood risk. Climate, exposure, and vulnerability vary with time, and across the landscape, assets, and people that characterize the community.

CLIMATE  
EXPOSURE  
VULNERABILITY

Short term (weather), mid-term (seasonal), and long term (climate) risks. Rainfall varies over time, and climate change increases the extremes.

The degree to which property, homes, buildings, infrastructure and other assets come into contact with flood water.

The degree to which exposed assets, both public and private, are unable to resist flooding and are damaged by floods.
Conventional flood risk management focuses primarily on reducing exposure to flooding or transferring risk, although sometimes in unknown or unexpected ways. This often means public capital infrastructure projects to modify the flood or regulatory standards applied when properties develop or redevelop. Through this framework we recognize that the public realm is a large opportunity space to reduce risk, but not the only one. Some of the simplest and most cost-effective ways to reduce risk are for people to reduce the vulnerability of their structures and property. This framework calls for public and private actions to reduce community flood risk. Additionally, the framework recognizes climate as a factor. Increasing climate extremes drive exposure and demand adaptation or resilience to mitigate the change.

We explored the factors that are driving increasing flood risk. The primary and secondary drivers are climate change and aging infrastructure. Well-drained landscapes and imperviousness also matter, but are more historical drivers of flood risk.

**Climate Change**

Climate change is making storms more intense and increasing the chance of extended wet periods or drought. Climate change has already, and will expose more assets to flooding in the future. This driver is predicted to overwhelm the other drivers in terms of scale.

**Aging Infrastructure**

Private and public assets and infrastructure are both exposed and vulnerable. Public infrastructure can define flood exposure for different points in the landscape, and serve as a pathway for private risk. Public infrastructure assets are old and not capable of meeting the current demand. This is a significant driver as infrastructure provides most stormwater service.

**Well-Drained Landscapes**

Development has connected the landscape to the water to make land well-drained. While this a major historic driver, it is a minor driver increasing future flood exposure. Most of the drainage and land development decisions have already been made, and cannot be unmade. There is additional demand for drainage that can reduce vulnerability, but marginally affects flood exposure downstream.

**Imperviousness**

Community demand for garages, parking areas, patios, decks, pools, and bigger homes has increased the hard cover of soils. Imperviousness drives runoff in small storms and marginally affects flood exposure in large storms.
These efforts to put flooding into focus have resulted in the creation of this framework to connect on the promise to **comprehensively reduce the risk of flooding throughout the community**.

Approaches for managing risk include reducing exposure, reducing vulnerability, transferring and sharing risks, increasing resilience to changing risks, and preparing, responding and recovering from floods.

Through the following areas of work, we will work with the community to comprehensively reduce flood risk.

**INFRASTRUCTURE**: We will renew our infrastructure and operate it to reduce risk. We will plan public streets and parks to accept and transmit flood waters to reduce the risk and disruption of related city services.

**REGULATION**: We acknowledge competing demands of land use and addressing drainage, groundwater, and surface water issues. We help people solve issues without harming another.

**OUTREACH AND ENGAGEMENT**: We make flood information available and give people tools for flood resilience.

**EMERGENCY SERVICES**: We help people prepare for floods, remove people from harm during floods, and recover after floods.

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**City of Edina budget goals**

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<th><strong>Strong Foundation</strong></th>
<th><strong>Livable City</strong></th>
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<td>Maintain physical assets and infrastructure.</td>
<td>Plan for connected and sustainable development.</td>
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<th><strong>Reliable Service</strong></th>
<th><strong>Better Together</strong></th>
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<td>Maintain service levels that best meet the needs of the community.</td>
<td>Foster an inclusive and engaged community.</td>
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Staff would like to thank the Task Force for their contributions. The experience, knowledge, and curiosity they brought to the process added value and influenced the Strategy.

Nora Davis (co-chair), Lake Cornelia Neighborhood

Kathy Amlaw (co-chair), Lake Edina Neighborhood

Greg Lincoln, Morningside Neighborhood

Michael Platteter, Morningside Neighborhood

Louise Segreto, Indian Hills Neighborhood

Roxane Lehnmann, Sunny Slope Neighborhood

Richard Strong, Concord Neighborhood

Richard Manser, Todd Park Neighborhood
Problem statement

Flooding can affect people, damage property, threaten health and safety, and disrupt transportation and business. Flooding is common in Edina and climate change is expected to make flooding worse.

Flooding has historically been considered a technical problem, requiring a technical solution. Land ownership, space, legislation, and hydrology are interwoven with values about problem ownership, water stewardship, service tradeoffs, and transferring risk.

When there is consensus on both values and knowledge, the problem is a technical one. A scientific problem is one in which there is consensus on values, but disagreement on knowledge. A political problem is one in which there is consensus on knowledge, but disagreement on values. When there is disagreement on both knowledge and values, the problem is a social one.

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Timothy M. Gieseke. Shared Governance for Sustainable Working Landscapes

What was once considered purely a technical problem may be more of a mix of a technical, scientific, political, and social one. This type of problem requires a different set of strategies, skill sets, and tools.

Project initiation

In September 2018 City Council adopted the 2018 Comprehensive Water Resources Management Plan. The implementation section of the plan included development of a Flood Risk Reduction Strategy.

A City Manager Task Force of Edina residents was formed to provide a community voice to the process. The City recognizes the contribution of these individuals and appreciates the value they’ve provided.

Resident Task Force members;

- Nora Davis (co-chair), Lake Cornelia Neighborhood
- Kathy Amlaw (co-chair), Lake Edina Neighborhood
- Greg Lincoln, Morningside Neighborhood
- Michael Platteter, Morningside Neighborhood
- Louise Segreto, Indian Hills Neighborhood
- Roxane Lehmann, Sunny Slope Neighborhood
- Richard Strong, Concord Neighborhood
- Richard Manser, Todd Park Neighborhood
The Task Force was charged with supporting and providing recommendations to inform the development of this strategy, specifically to:

- Incorporate local challenges, opportunities, knowledge, and community values.
- Incorporate voices from throughout the City of Edina. While the Morningside neighborhood has been identified as a focal area for case study, strategies and outcomes ought to be scalable city-wide.
- Identify action steps for building community capacity to address flood risk and resiliency in Edina.

In July 2019 staff began working with a resident Task Force to develop a Flood Risk Reduction Strategy. The group met over a dozen times, investing hundreds of hours collectively.

The strategy doesn’t solve flooding. We’ve learned that it’s too big of a problem to solve outright; however, we’ve charted a path to reduce the risk of flooding. Through this effort, we;

- Explored technical questions like, “How much does impervious cover matter?”, “What kind of flood risk does the future hold in the wake of a changing climate?”, “How much benefit can private storage provide?”, and “How much benefit can bigger infrastructure provide?”
- Interviewed the operators and maintainers of the system to better understand the level of service the system currently provides and its vulnerabilities.
- Gained a better understanding of the factors and drivers that influence flood risk.
- Described the various ways in which structural flooding occurs; over the land surface, through groundwater seepage, and sanitary sewer backflow.
- Defined the areas within which we already work and identified other actions the City could undertake, connecting these areas of work to Council work plan goals.
- Widened our approaches for reducing flood risk.
- Heard people share their experience and knowledge about flooding. The Task Force shared their community values around flood risk and informed the framework and strategy.

Based on Council and community feedback, the Morningside neighborhood was selected as the focal area for the Flood Risk Reduction Strategy. Further description about how the neighborhood was used to test ideas is provided in the Strategy Development section of this report.

Throughout this report, we briefly highlight relevant in-progress items and summaries of the technical analyses – more detailed memorandums describing the technical analyses are provided in the Appendix.
Pathways to structural flood risk

Too much water from rain or melting snow can overwhelm the system. Pipes run full, intersections flood, lakes and creeks overtop their banks, water flows over the land surface, sidewalks and paths become impassible, yards are inundated, groundwater builds up, water seeps through basement walls and floors, and water can back up into homes through sanitary sewers.

Surface water flooding

Severe storms or prolonged periods of wet weather can cause water levels in creeks, ponds, lakes, and rivers to rise and overflow their banks. If your home is near these water bodies or in a low-lying area, it can be at risk of flooding. Surface water can also cause what’s known as “flash flooding.” Because it occurs with little notice, flash flooding can catch people off guard. This normally occurs when existing drainage systems are overwhelmed by extremely heavy rain. Instead of soaking into the ground or draining through stormwater sewers, the water flows over the land surface, collecting in low-lying areas. Urban areas can be particularly vulnerable to flash flooding due to a greater amount of impervious surface.

Sanitary backflow

Sanitary backflow flooding can be caused by a blockage in the city’s sewer system. This normally occurs when the sewer pipes are flooded with stormwater. When this happens, wastewater can flow backwards—into your home.

Groundwater seepage

Groundwater can also be a source of flooding. This tends to occur after long periods of heavy rain or snowmelt, when more water infiltrates the ground and causes the groundwater to rise above the home’s foundation level.
Groundwater levels are increasing: summary of monitoring data

In the winter of 2020 Nine Mile Creek Watershed District and Minnehaha Creek Watershed District separately convened local water resources and emergency managers to share their groundwater level monitoring data.

After a string of exceptionally wet years and a record-breaking precipitation year in 2019, lakes and creeks are high, the ground is saturated and, in many places, groundwater level monitoring records show water table elevations are on the rise. Data from the Nine Mile Creek Watershed District showed one groundwater monitoring well in Edina near Bredesen Park had an increase of about 15 feet since 2010. In areas where the depth to the regional groundwater table is shallow, structures with basements are at an increased risk for flooding from groundwater seepage.

Groundwater is difficult to map. It’s dynamic, inconsistent, and the distribution can vary drastically from what we see on the land surface.

Flood risk factors

**Flood Risk:** Flood risk is determined by climate, exposure, and vulnerability.

**Flood Exposure:** The degree to which property, homes, buildings, infrastructure, and other assets come into contact with flood water.

**Flood Vulnerability:** The degree to which exposed assets are unable to resist flooding and are damaged by floods.

For example, two homes side-by-side might have the same flood exposure, but one home might be less vulnerable to the exposure. Vulnerability can be decreased with the installation of downspouts, proper grading, a basement sump pump, waterproof or reinforced foundations, mature trees with strong root systems, and excellent drainage through well-designed rain gardens, among other things.

Flood risk factors and definitions adapted from IPCC, 2012: Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change.
Drivers of increasing flood risk

Flooding issues within the City of Edina continue to increase in frequency and severity. The following have been identified as primary drivers leading to increased flood risk.

Climate change and changing weather patterns:

- Climate change is the lead driver of increasing flood risk in Edina. Climatologists indicate that large, intense rainfall events are occurring more frequently, and models predict that large rainfall events will become more intense in the future. Minnesota is already experiencing prolonged wet periods; in fact, the years between 2015 and 2019 were the wettest in Minnesota history and we can expect more wet years in the future. This increase is also impacting neighboring communities, is occurring at the international, national, state, and watershed levels, and is expected to get much worse.
- With the update to the Comprehensive Water Resources Management Plan, the most recent precipitation frequency estimates were incorporated into the City’s flood model which showed increased flood risk throughout the City. It should be noted that this data only brings us to current climate conditions and does not provide protection for additional future risk caused by climate change.
- Modeling of storms and flood risk, and visualization of that risk has improved dramatically in recent decades, leading to better community perception of risk.
- See ‘Getting to scale: a challenging problem made even more challenging, climate change impact analysis’ and ‘Climate Action Plan: in progress item’ sections of this report.

Aging and obsolete infrastructure:

- Infrastructure is aging, and much is in poor repair, stretching maintenance and operations staff thin. Current resources dictate a reactive approach instead of a proactive approach.
- The current stormwater system was built for a different time and standard. Climate change has already increased the risk and made most of the system obsolete.
- Needs far exceed available resources. Flooding issues are extensive and improvements that address the 1%-annual-chance storm are often out of reach at current levels of funding.
Demand for well-drained landscapes:

- Development has connected the landscape to the water to make land well drained. Demand for well-drained landscapes has led to private and public drain line and gutter expansion. This expansion directly connects the landscape and the water generated there to downstream properties and waterbodies.
- While this a major historic driver, it is a minor driver increasing future flood exposure. Most of the drainage and land development decisions have been made, but there are some public and private system retrofits that continue to connect landscape and water bodies, marginally affecting flood exposure.

Imperviousness:

- Community demand for garages, parking areas, patios, decks, pools, and bigger homes has increased the hard cover of soils.
- There is an increasing trend of imperviousness in the City of Edina. Specifically, within the focal area of Morningside, nearly one million square feet of impervious surfaces (homes, structures, driveways, patios, swimming pools, etc.) have been added since 1950. This equates to about 14% of the total size of occupied parcels in the Morningside neighborhood (2019, City of Edina staff).
- This is a minor driver increasing future flood exposure. Most of the land development decisions have been made, but small additions to impervious cover marginally affect flood exposure. Soils can’t soak up the amounts of water floods provide.
**Getting to scale: a challenging problem made even more challenging, climate change impact analysis**

Through the Task Force process, staff heard the sentiment, “Stop studying the problem, you have the answer, it’s time to act.” While action is needed now, this report rebuts the sentiment that we have the answers. Our new understanding of risk in the 2018 Comprehensive Water Resources Management Plan show the system is overloaded. We now can more easily see how ‘solving’ a problem in one area can make a downstream problem worse. ‘Solutions’ need to review downstream risk and be packaged together comprehensively, acknowledging or mitigating the risk transfer. Packaging problems requires a scale of effort that has not been attempted in Edina, and the scales contemplated still do not totally ‘solve’ the problem, instead they may not even be keeping up with climate change.

Climate change is changing the target. Solutions of today have to accommodate more water than in the past, and solutions have to withstand the effects of climate change in the future. We need a new approach to planning. It is necessary to shift the approach from trying to reduce flood exposure for some, to reducing the vulnerability to flooding for all.

A memorandum describing the analysis in more detail is available in the appendix.

**Climate Action Plan: in progress item**

Development of a Climate Action Plan would further outline and prioritize actions for climate change mitigation and adaptation. City staff is working to scope a process for creating a Climate Action Plan for Edina. The Energy and Environment Commission recently completed a study and report on a timeline and parameters for such a plan, including the City’s leadership role.

Undoubtedly, carbon reduction in both the private and public sectors will be an area of opportunity. In order to meet community-wide emission reduction goals, it will take a process that includes the community to understand what actions are important and how to prioritize them. There is a clear overlap between addressing flood risk and mitigating climate change. To that end, it is prudent that the Flood Risk Reduction Strategy inform the larger Climate Action Plan work of the City’s Sustainability Manager and Energy and Environment Commission.
Formulating a Strategy

Comprehensively Reduce Flood Risk throughout the Community

Flooding in Edina is not only common, it’s increasing. The City of Edina’s strategy is to comprehensively reduce risk throughout the community. This means we address flooding through a broad range of actions and that decisions consider the assets and people that characterize the City. Approaches for managing risk include reducing exposure, reducing vulnerability, transferring and sharing risks, increasing resilience to changing risks, and preparing, responding and recovering from floods.

Adapted from IPCC, 2012: Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change

Strategy helps answer the question, “What are we trying to accomplish?” Every community has limited resources and deals with its own unique challenges – strategy acts as a guide to a set of actions and filters out those that do not fit.

Tactics help answer the question, “How are we going to accomplish our goal?” Tactics are the actions within the following City sectors of work; infrastructure, regulation, outreach and engagement, and emergency services. Each sector of work supports a City Council budget work plan goal.
These areas of work and the current state of practice are spelled out in greater detail in the water resources chapter of the Comprehensive Plan and the Comprehensive Water Resources Management Plan.

The gap between the current Comprehensive Water Resources Management Plan and the Strategy

Past iterations and the current Comprehensive Water Resources Management Plan have focused primarily on reducing exposure to flooding or transferring risk, although sometimes in unknown or unexpected ways. This often means capital infrastructure projects to modify the flood or regulatory standards applied when properties develop or redevelop. The current Comprehensive Water Resources Management Plan outlines projects that add or upsize pipes or surface flood storage. This narrow approach has some pitfalls.

- First, it limits the approaches, and thereby the actions that could be implemented to reduce flood risk. The actions focus on reducing exposure only. Many opportunities exist using
approaches to reduce vulnerability, transfer and share risks, increase resiliency to changing risks, and preparing, or responding, and recovering from flooding.

- Second, it ignores the risk transferred to downstream people and assets. Many of the capital infrastructure projects don’t consider impacts outside the immediate project area. In a fully developed landscape, many of the downstream storage areas in Edina and in our neighboring communities are already full.

- Third, it implies that the public realm is the only opportunity space to reduce risk – some of the simplest and most cost-effective ways to reduce risk are for people to reduce the vulnerability of their structures and property. Some resources to this end have been developed as part of this process (see Outreach Products in the Outreach and Education section of this report).

- Fourth, it doesn’t recognize the lead driver; climate change, and sets us on a path in which we cannot catch up to the increasing risk. The strategy and associated actions must be able to scale to the problem.

City Sectors of Work

The City of Edina works in the following four sectors to reduce community flood risk. Detailed in each sector overview is; a statement of the intended outcome of the work, a list of the City departments and partners who lead the work, a list of City departments and partners who help, are involved, or are part of the process, a description of when and how flood risk is considered, and a summary of gaps identified during detailed discussions with the Task Force.

Infrastructure

What is the outcome: Building stormwater infrastructure that manages areas of flood flow and storage that, with the landscape, define areas of vulnerability. Reducing the vulnerability of infrastructure so they are durable to extreme events or fail-safe. Reducing exposure and vulnerability of related sanitary sewer infrastructure that can serve as a conduit for flood waters between structures. The service provided by water resource and other infrastructure is defined in the 2018 City of Edina Comprehensive Plan and Comprehensive Water Resources Management Plan.

Who does the work: Public Works Department, Engineering Department, property owners, private redevelopment, and contractors.

Who is involved: Planning Department, Building Department, and future property owners.

When flooding risk is considered: At decision points, in projects, during design, failure analysis, and during infrastructure planning.

Gaps: Actual service level falls short of expected service, aging infrastructure, reactive maintenance, reactive emergency response, capital improvements do not have scale to ‘fix it’ or even keep up with climate change trend.

Pace of redevelopment: Currently driven by owners of at-risk properties.
Enhancing public infrastructure by building new, retrofitting old, and keeping what we have in working condition is a key action to reducing flood exposure.

Stormwater systems route water to low areas where it is temporarily stored, and then they work to convey water downstream. The stormwater system is made up of 127 miles of gravity main ranging from 12-84” in diameter, 6800 manholes, 900 outlets, 38 miles of small diameter sump drain, 11 stormwater lift stations, one half mile of stormwater force main, and more than 150 ponds and wetlands (2018 Draft Comprehensive Plan Chapter 7).

The City’s stormwater system was designed to convey a certain amount of water and protect against impacts at a certain level. This “level of protection” is based on the capacity of public infrastructure to handle stormwater and on the probability that a storm will occur. When storms are bigger or more intense than the infrastructure is designed to handle, or when it clogs, there are consequences such as disruptions to services, facilities, or damage to property. The city stormwater system is exposed to flooding and also determines the flood exposure of people and assets.

Risk is changing primarily because climate is changing and the level of protection for design is a moving target. Designs from the past are undersized for today and there is a growing realization in technical circles that even if designs were revised to reflect today’s climate they would quickly be obsolete due to the changing risk brought by climate change.

**Go Big, Go Bigger: infrastructure analysis**

To test the possible scale of implementation in the face of projected climate change impacts, a preliminary evaluation and conceptual design of potential flood risk reduction options for the Morningside neighborhood was completed.

A cursory evaluation was conducted to assess which option reduced flood exposure for the most homes. This was completed for a range of storm events from the 20%-annual-chance storm event (5-year storm which is 3.6 inches in 24 hours) to the 1%-annual-chance storm event (100-year storm which is 7.5 inches in 24 hours). Infrastructure options that were evaluated included increasing storm sewer pipe sizes, constructing flood walls, creating additional flood storage by excavating (lowering) the ballfield area of Weber Park and then reconstructing the fields, creating additional flood storage by excavating the wooded area north of Weber Pond and excavating and re-grading existing low areas (e.g. low area at Lynn Avenue and Kipling Avenue north of West 42nd Street), excavating backyards in key locations, installing predictive pumping systems for a few key areas (including Weber Pond), and installing underground flood storage.

Seven infrastructure options were developed using combinations of some of the mitigation options identified above with planning-level costs estimated between $3.4M and $31.6M. The option with the largest benefit in terms of homes that would no longer be exposed to flooding up to the 1%-annual-chance storm event (Option 7b, the ‘Go Bigger’ option) has an estimated cost of $8.5M and completely removes approximately 24% of the homes potentially impacted under existing conditions.
The next best infrastructure option (Option 2b, the ‘Go Big’ option) removes approximately 16% of the homes currently impacted and would cost approximately $4.5M.

**Baseline:** the current replacement value of stormwater infrastructure in the City is about $70M. Over 16 square miles this is approximately;
- $6,800/acre
- Baseline replacement value of stormwater infrastructure

The ‘Go Big’ option contemplated a $4.5M project serving about 630 properties and 185 acres.
- $24,300/acre
- Cost 3.6 times larger than the baseline

The ‘Go Bigger’ option contemplated an $8.5M project serving about 630 properties and 185 acres.
- $45,900/acre
- Cost 6.7 times larger than the baseline

In addition to costs, the projects come with tradeoffs, contemplating major changes in parks, open spaces, existing water bodies, and piping and utility operations changes. The projects also present opportunity for co-planning around park and sustainability improvements as sections of aging infrastructure are renewed.

A memorandum describing the analysis in more detail is available in the appendix.

---

**Morningside Roadway Reconstruction Engineering Study: in progress item**

Infrastructure options remain the foundation of reducing flood exposure, but the scale of climate change will make transformation change a challenge. In April 2020 staff will ask Council to consider a scope of service for preliminary engineering for the street reconstruction project in the Morningside D/E and Morningside C neighborhoods in 2022 and 2023, respectively. Staff will also ask Council to consider the engagement plan to go along with the project concept-level design. This would be the first major street reconstruction project to be designed under the proposed flood risk reduction strategy.

The operations and maintenance of public infrastructure is a key component of reducing flood risk. Operations includes inspection and condition assessment, street cleaning, catch basin clog clearing, pipe and outlet clog clearing, sediment control, pump and power system monitoring, and emergency
operations. Maintenance includes catch basin repair, pipe repair, outlet repair, sediment removal, weed and woody debris removal, and other actions.

Stormwater models that predict flood problems assume that all pipes, catch basins, inlets, and outlets are in good working order and free from obstructions. The reality is that material and debris often enter the system before or during storms and can cause service disruptions. Aging infrastructure also lends to more failures.

Staff prioritizes their stormwater operation and maintenance work based on opportunity and requests for service within the constraints of their resources. Opportunities include repairing and renewing stormwater infrastructure in areas where other work is already planned. For example, crews inspect and repair stormwater catch basins in neighborhoods where street improvements are planned, thereby extending the life of the street improvement and providing real value to the public. Requests for service also get prioritized. As storm events occur, staff evaluate the risk and respond as resources allow.

Operations and maintenance staff were invited to talk about their work with the Task Force. Some themes related to the challenges and opportunities emerged.

**Challenges related to operation and maintenance:**

- Much of the system aside from pump and power systems are managed with reactive, run-to-failure approach and there is significant deferred maintenance in the system leading to small items remaining unaddressed, leading to larger issues.
- The program for evaluating maintenance needs meets the minimum regulatory standard. It is not comprehensive.
- The system is aging, much of it originating in the 1950s and 1960s.
- During events, stormwater systems and sanitary sewer systems are stressed at the same time. When flood events coincide with snow and ice events, staff are further stretched to provide services and must make decisions about priorities, constrained by their resources.
- Some stormwater features in the city have been installed to intentionally capture pollutants and debris in order to protect clean water. When not properly maintained, they can interfere with overlapping drainage and flood protection services.
- Service levels are not clearly defined. During the peak of events, staff are receiving, prioritizing, responding to, and communicating on requests for service. Residents often don't know where their issue ranks or what service level they can expect.

**Opportunities for operation and maintenance:**

- Proactive maintenance, the benefits of which go beyond flood protection. Proactively cleaning and maintaining stormwater infrastructure can support clean water goals by properly managing accumulated pollutants.
- Increased street sweeping to keep stormwater conveyances clear. This also has a clean water benefit.
• Promotion of the new metro-wide adopt-a-drain program to augment city street sweeping. Residents are asked to adopt a storm drain in their neighborhood and keep it clear of leaves, trash, and other debris to reduce water pollution. The program also works to provide flood protection. Often, once a system is flooded, the primary objective for maintenance staff is to clear the obstruction. At this point, the opportunity to clear and dispose of clogging debris before its transported to downstream waterbodies is largely lost.
• High value infrastructure retrofits. In some cases, maintaining and optimizing existing can be more cost effective than new infrastructure.
• Better definition of service levels to inform residents on what they can expect for given issues.
• More general communication about the City’s flood response during and after events.
• Continued investment in the sanitary sewer system and its resiliency during floods.

An increase in resources dedicated to public works staff would be required in order to address issues and capitalize on opportunities in operations and maintenance.

Regulation

What is the outcome: Homes and buildings have reduced exposure to floods. Those that are exposed to floods take actions to reduce vulnerability. Private improvements such as structures, landscaping, grading, and other private systems manage their own risk, and take actions that do not increase exposure of neighboring properties, reducing it if possible.

Who does the work: Engineering Department, Building Department, private permit applicants.

Who is involved: Public Works Department, Planning Department, future property owners.

When flooding risk is considered: At application and permit, during construction, at final inspection and permit close.

Gaps: Added impervious marginally increases community risk, long term maintenance of private drainage systems is uncertain, “retail” nature of permitting a variety of single family improvements is time intensive, regulation in limited areas due to limited resources, the first point of contact that interfaces with builders, homeowners, and describes issues in homes with existing exposure is time intensive.

Redevelopment provides a once-in-a-generation opportunity to build-in resilience. City staff are actively engaged with the development community through regulatory programs and provide technical support to permitted and affected private parties. In response, new structures or additions can be required to meet minimum elevations for low floors (such as basements) or low openings (such as the top of windows wells). Another response to redevelopment includes requiring durable flow paths to route water away from structures. The City could consider enhancing standards for resilience in redevelopment plans or encourage a deeper risk conversation with the development community to promote resilient decision-making within the permit process. Increased regulation of redevelopment in
Edina would reduce risk. A tradeoff would be that a change in regulation could impose additional costs to developers and impact overall market conditions.

Future flooding is projected to get worse. The models that predict flood risk use data from the past to estimate precipitation. The City could consider a flood risk standard that incorporates future risk due to climate change to match the lifecycle of the private improvements that rely on them. By planning street flood storage, lowering roads, managing overflow paths, and taking other actions based on a future flood risk level due to climate change, capacity could be built into the system to make them future ready for their expected design lives.

Land use is often cited as a key sector for managing flood risk, though fully developed communities such as Edina may not be able to realize the same returns in this sector as a less developed community. Many of the decisions about land use in Edina have already been made – that is to say that neighborhoods emerged in places and at times that might not have otherwise happened if those land use decisions were made today.

The regulatory program remains an effective way to reduce the consequences of flooding for the developing property. The City could consider further enhancing the outreach to property owners, builders and developers to promote resilient design.

**Where they work:** As private improvements are made, or properties redevelop, the City provides flood risk information and holds standards that control or mitigate the exposure to flooding through its regulatory program. Existing controls through the regulatory program are working to raise the low elevations or low openings of structures. This raising of structures reduces the exposure to flooding.

**Where they don’t work:** While the regulatory program is good to reduce exposure and vulnerability to the property or improvement that is changing and its immediately adjacent neighbors, it is a poor tool to reduce the flood exposure downstream.
Keep your water to yourself: private infrastructure analysis

The impact of comprehensive stormwater storage including underground storage within private property, the right of way, or under streets in the Morningside neighborhood was evaluated. This analysis was conducted as a result of Task Force discussions about the potential impacts of requiring private homeowners to store stormwater running off from their impervious areas on-site similar to requirements for commercial development.

The benefits achieved by storing the first 1-inch, 2-inches, and 3-inches of precipitation from storm events of varying size, from the 20%-annual-chance storm event (5-year storm) to the 1%-annual-chance storm event (100-year storm) are summarized in the table below. For the private storage evaluation underground storage vaults were assumed under a portion of each of the 570 residential parcels within the Morningside neighborhood. The analysis showed that storing the first 1-inch of storms of this magnitude had a negligible impact on flood levels. Storing the first 2-inches and 3-inches showed a more significant benefit with regards to reduction in peak flood levels. Depending on the storm event, and depending on the location within the neighborhood, the results varied anywhere from flood level decreases of a few inches to decreasing nearly a foot and a half. However, this apparent benefit comes at an initial cost of approximately $15,000 per inch of stormwater stored per residential parcel. To store 2-inches of runoff in the entire neighborhood would cost approximately $17 million. In addition, while the flood levels may be lowered, the number of homes that are removed from potential impacts from flood inundation is small. For example, one home may potentially be removed from flood inundation at Weber Pond depending on the storm event. Finally, the management and maintenance of these underground stormwater storage vaults distributed throughout an entire neighborhood is expected to be complicated and unprecedented.

This solution would provide a moderate benefit for a very high cost. Additionally, a preliminary look at the compounding effect of climate change suggests that any improvement realized by implementing additional storage would be taken back by climate change (i.e., increased precipitation amounts).

<table>
<thead>
<tr>
<th>Inches of Runoff Stored on Private Property</th>
<th>Approximate Cost for All Parcels in Morningside to Store Runoff</th>
<th>Flood Level Reduction Benefit (in feet) for Weber Pond Subwatershed (MS_40)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>5-yr Storm (3.6&quot; of precipitation)</td>
</tr>
<tr>
<td>1 inch</td>
<td>$8,550,000</td>
<td>0.1</td>
</tr>
<tr>
<td>2 inches</td>
<td>$17,100,000</td>
<td>0.6</td>
</tr>
<tr>
<td>3 inches</td>
<td>$25,650,000</td>
<td>0.7</td>
</tr>
</tbody>
</table>

A memorandum describing the analysis in more detail is available in the appendix.
From ‘ill-drained’ to impervious: impervious surface analysis

The Task Force wanted to explore the impact of limiting impervious cover through regulating development and redevelopment. The impact of decreased imperviousness across the Morningside neighborhood was evaluated.

The analysis showed an impervious limit would have little impact on flood risk. Although an impervious limit or reduction supports other values such as open space, room for trees, neighborhood character, and limiting heat island effect, the case for flood risk reduction was weak. Additionally, setting impervious limits would require a large financial investment.

The impervious area that is directly connected to the storm sewer system in the Morningside neighborhood is estimated to be about 25% of the total land area, in aggregate. The analysis tested the sensitivity to changes in impervious by modifying the stormwater model so that the imperviousness of the entire contributing drainage area was increased, decreased, and even lowered all the way to 0%, which reflects a pre-development condition. This sensitivity test was also completed for a range of storm events, from the 20%-annual-chance storm event (5-year storm) to the 1%-annual-chance storm event (100-year storm). As expected, the imperviousness sensitivity test showed that less impervious area generates less stormwater runoff and more impervious area generates more stormwater runoff. However, the magnitude of the runoff changes generated by adjusting imperviousness were not as impactful as may have been expected. Additionally, the little flood reduction benefit shown in the analysis does not consider future climate change.

A memorandum describing the analysis in more detail is available in the appendix.
Outreach and Engagement

**What is the outcome:** People understand their vulnerability and exposure to flooding, know what action to take to reduce each in the immediate, short and long term. People have the knowledge and resources to take action. People are motivated to take action to protect themselves.

**Who does the work:** Engineering Department, Communications Department, partner agencies, community groups.

**Who is involved:** The public, and public and private organizations.

**When flooding risk is considered:** In anticipation of spring melt, during flood events, post-hazard recovery, at property transfer, upon FEMA flood hazard map update.

**Gaps:** No coordinated plan and message, limited public and private resources. Knowledge alone doesn’t equal action. Although not at the same scale as a capital item, engaging the public still costs money. Equity should be considered in tactics.

When people understand the risks of flooding, they can take actions to reduce the consequences of flooding. Actions could range from simple things, like moving valuables to higher floors, to more complex retrofit improvements like flood proofing and sanitary sewer backflow prevention.

Risk awareness could be encouraged by improved distribution of information products like the existing flood risk map available on the City’s website. This local map is industry leading, with few small cities producing and publicly sharing detailed local flooding information. Although the information had been public for a long time, it had been in a format that required some technical knowledge to interpret. With new mapping tools, increasingly detailed digital stormwater system data, and more precise data about topography of the landscape, we’re better able to visually display the risk.
Outreach products: in progress item

Through the process, we uncovered some ‘quick-win’ actions to be implemented immediately.

- Actions for Flood Resilient Homes Fact Sheets. These fact sheets describe common actions that people can take to reduce their own exposure and vulnerability to flooding. A copy of the fact sheets are provided in the appendix.
- “What is my flood risk?” interactive map. This application allows users to visualize the flooding on the land surface for any property in the City of Edina. This information is already available on the interactive water resources map; however, this application is more focused on communicating flood risk specifically. The map is available on the Maps page of the City website.
- Sandbagging how-to videos. The City provides sandbags, free of charge. This series of videos will be used to promote the service, inform people on how to request sandbags, demonstrate how to build a sandbag dike, and describe how to dispose of sandbags after a flood.

Emergency Services

What is the outcome: Parties respond to remove people from harm. Parties respond to prevent damage to property if possible, or provide aid after damage occurs. Limited disturbance and damage. Rapid return to normalcy.

Who does the work: Police Department, Fire Department, Public Works Department, Engineering Department, County/State/Federal Emergency Responders, other infrastructure owners, and private contractors.

Who is involved: Emergency operations command, emergency responders, the public, property owners, visitors, other infrastructure owners.

When flooding risk is considered: In emergency operations plans, disaster planning, training and drills, post-hazard recovery.

Gaps: Current response is triggered in major/severe events. The utility group’s first priority is to maintain or reestablish function of infrastructure systems. Call centers can be overwhelmed and need clear triage procedure. There is nearly no service available for property owners during a flood. The process of after-action inquiry, questions and blame that realize long-known service gaps is adversarial and leads to rushed planning. Requests or complaint-based reactions may not provide an equitable distribution of services.
The City's role in emergency situations include responding to life, health and safety calls and supporting or restoring the operation of the utilities. When floods occur the ability to respond effectively quickly degrades as phone lines and other communications channels fill with requests and reports. The ability to sort and serve these requests goes into triage with critical system function and support measures competing with urgent requests from the public.

Empowering people to adapt to flood risk, prepare for flood events, and mitigate the impacts of climate change all contribute to a more resilient community. Adaptation and preparedness actions work to mitigate the consequences of flooding.

Strategy Development

Task Force role and process

In order to incorporate community values into the process, a volunteer Task Force of eight Edina residents was formed. Members represent homeowners with a variety of knowledge and experience. Most have experienced flooding on their properties or have engaged with flood issues in the larger community. Members came from all across the City of Edina. Task Force members met 12 times and attended two City Council work sessions between July 2019 and March 2020.

The Morningside neighborhood was selected as the focus area of study due to the presence of significant modeling and research in the area. The Morningside neighborhood faces a range of flooding challenges that past efforts have struggled to address. As part of this effort, a 2-dimensional model was developed and field calibrated to better refine the flood model and relate the models of St Louis Park and Minneapolis. The Morningside neighborhood was also used as the case study neighborhood for evaluating impervious limits, private storage, big infrastructure, and future climate change as noted in the various analysis sections of this report.

The Task Force’s charge was to “Provide recommendations to inform a Flood Risk Reduction Strategy to be considered for adoption by the City Council and incorporation as a major amendment to the City's Comprehensive Water Resources Management Plan.” The products of this process including meeting agendas, minutes, and analyses are available for review in the Water Resources Library on the City of Edina website.

To better understand the nature of the issue, Task Force members requested and were presented with the following:

- Overview of the focal area of Morningside neighborhood, its historical and current flood challenges, and previous efforts to evaluate flood risk reduction options.
- A technical exploration of City-owned stormwater infrastructure, maintenance operations, levels of service, and the stormwater utility.
- Regulatory options that have been implemented in other comparable communities and associated challenges and trade-offs.
• Modeled sensitivity analyses to explore the potential impact of comprehensive impervious limits, private stormwater storage, and enhanced infrastructure including larger pipes and stormwater storage.

• Communications strategies that promote preparedness and connect residents with resources during flood events.

• Overview of the City’s floodplain management ordinance and participation in the National Flood Insurance Program.

• The City’s policy and standards for stormwater management through the permit process, related to development and redevelopment.

• A conversation with maintenance staff to understand routine operation and maintenance as well as storm response.

Interacting directly with the Task Force has provided staff members with insight into public perception of their role in flood risk reduction. During these conversations, staff began to see certain discrepancies between the following City assumptions; perception of risk, interpretation of the term ‘flooding’, and the role of City services.

• How does the City define flood risk? Flood risk has been seen as a combination of the statistical probability of a flood event happening and the potential community-wide losses that occur as a consequence of that event. In the City of Edina, the increasing value of homes located within the floodplain is occurring in tandem with changing weather patterns that increase intensity of storm events, both of which increase the overall risk. The City’s idea of current flood risk is also being shaped by changing community expectations for service.

• Defining “flooding” is similarly complicated by social perception. FEMA defines flooding as “A general and temporary condition of partial or complete inundation of 2 or more acres of normally dry land area or of 2 or more properties…” When intense or prolonged rain events occur, the system can become overwhelmed. A wet basement, flooded garage, or standing water may not fit FEMA’s definition, but each impacts the community and was considered “flooding” by Task Force members.

• City services play a critical role in the following common flooding issues; creeks outside their banks, curb lines flowing full, storm drains clogging, pipes running full, low points in streets or yards filling up and threatening structures, flow paths eroding, sump pumps flowing, basement foundations leaking, and sanitary sewers backing up. Community service expectations are mismatched with available resources for preventative maintenance and timely emergency response to these issues.

Staff heard the following sentiments from the Task Force;

• Flooding affects quality of life by disrupting daily activities, risking safety, and damaging structures.

• A priority should be to reduce risk to residential structures.

• Help property owners protect themselves and prevent damage to structures.

• Be ready to help the community recover after floods.
• Maintain the function of the existing system to maintain service.
• Be a good neighbor.

Brainstorming, prioritizing, and categorizing possible actions

A series of actions were proposed for a possible menu or toolbox of actions as a result of discussions with the Task Force. Each action was accompanied by a detailed description, justification/motivating factors, tradeoffs and other considerations, cost score, staff-ranked effectiveness score, community enthusiasm ranking, and action category. The brainstorming exercise resulted in more than 40 potential actions. Reviewing and ranking these actions was no small task.

Task Force members were asked to rank possible flood risk reduction actions based on community enthusiasm, informed by community held positions and interests related to flooding. Positions are surface statements of where a person or community stands. Interests are the underlying reasons, values or motivations that explain a certain position. Based on perceived community position and interests, the Task Force was asked to rank the action items in terms of community enthusiasm. Enthusiasm is the community’s interest or approval of the action. Considerations for community enthusiasm include tradeoffs, community impacts, land, sustainability, environmental outcomes, and social outcomes.

Task Force members shared their hesitation in representing the community with their rankings because they felt that each flood experience was unique and they hadn’t had sufficient information or opportunity to gauge community enthusiasm at this detailed level. A summary of the aggregated Task Force rankings is included in the appendix with this caveat - in the end, the conversations around actions provided the most value for staff in forming the framework and strategy. The process helped to identify quick-win actions that could be implemented immediately, clarified areas of agreement and disagreement between the Task Force and staff, and will be used as a starting point for future Comprehensive Water Resources Management Plan program development work. We would expect rankings to be continually refined as more people participate and more information becomes available. The exercise itself outweighs the absolute ranking of the actions.

The full set of possible actions as well the Task Force ranking summary is included in the appendix of this report.

Conclusion

The process has reiterated the need to address flooding with a range of strategies that span technical, scientific, political, and social approaches. Many communities are struggling with managing increasing flood risk.

Key takeaways:

• The current stormwater model helps to better visualize where the issues are; they are extensive, interwoven, and difficult to solve. The existing stormwater system is overloaded and the strategy to put water somewhere else is limited.
• Climate change impacts are significant.
• Groundwater levels are increasing. The years between 2015 and 2019 were the wettest in Minnesota history.
• The Flood Risk Reduction Strategy widens our approaches, and thereby actions, to reduce flood risk. The current Comprehensive Water Resources Management Plan is narrow and can’t keep up with the lead driver; climate change.
• There are opportunities to empower people and institutions to adapt, prepare, and mitigate. The Strategy opens the approach of reducing vulnerability. Often, some of the simplest and most cost-effective ways to reduce risk are for people to reduce the vulnerability of their structures and property.
• Impervious surfaces matter; however, the opportunity to reduce flood risk by limiting or reducing impervious cover in the City of Edina is limited.
• Additional resources are needed to implement actions.
• Residents have high expectations for service.
• Other promising opportunities exist for operation and maintenance, public infrastructure (though climate change will make transformational change a challenge), and redevelopment standards anchored in resiliency.

Lastly, there is an opportunity to knit together the Flood Risk Reduction Strategy with the existing Living Streets Plan and forthcoming Climate Adaptation Plan. Bringing these efforts into focus and examining strategies through an equity lens are necessary to deliver high-value benefits to the community.
Acknowledgement

Staff would like to thank the Task Force for their contributions. The experience, knowledge, and curiosity they brought to the process added value and influenced the Strategy.

Nora Davis (co-chair), Lake Cornelia Neighborhood
Kathy Amlaw (co-chair), Lake Edina Neighborhood
Greg Lincoln, Morningside Neighborhood
Michael Platteter, Morningside Neighborhood
Louise Segreto, Indian Hills Neighborhood
Roxane Lehmann, Sunny Slope Neighborhood
Richard Strong, Concord Neighborhood
Richard Manser, Todd Park Neighborhood
Appendix

Appendix A: Resident Task Force Report

Appendix B: ‘Getting to scale: a challenging problem made even more challenging, climate change impact analysis’, technical memo

Appendix C: ‘Go Big, Go Bigger: infrastructure analysis’, technical memo

Appendix D: ‘Keep your water to yourself: private infrastructure analysis’, technical memo

Appendix E: ‘From ‘ill-drained’ to impervious: impervious surface analysis’, technical memo

Appendix F: Actions for Flood Resilient Homes, fact sheets

Appendix G: Task Force charge

Appendix H: Potential action matrix key, ranked response, and potential action matrix
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