

# Executive Summary

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## Background

The Metropolitan Water Reclamation District of Greater Chicago (District) has authority for regional stormwater management within Cook County as granted by the Illinois General Assembly in Public Act 93-1049 (the Act). The Act requires the District to develop watershed plans for six Cook County watersheds, which include the North Branch of the Chicago River, Lower Des Plaines River, Calumet-Sag Channel, Little Calumet River, Poplar Creek, and Upper Salt Creek. The District published the *Cook County Stormwater Management Plan* (CCSMP) in February 2007 to identify stormwater management goals and to outline the District's approach to watershed planning. Chapter 6 of the CCSMP defines the District's approach to and standards for Detailed Watershed Plans (DWPs), which address regional stormwater problems in Cook County. The six major watersheds for which DWPs are being developed cover approximately 730 square miles in Cook County. The primary goals of the DWPs are as follows:

- Document stormwater problem areas.
- Evaluate existing watershed conditions using hydrologic and hydraulic (H&H) models.
- Produce flow, stage, frequency, and duration information about flood events along regional waterways.
- Estimate damages associated with regional stormwater problems.
- Evaluate potential solutions to regional stormwater problems.

The North Branch of the Chicago River (NBCR) and Lake Michigan (LM) DWP was developed to meet the goals for the NBCR and LM watersheds as described in the CCSMP. The Act required the formation of Watershed Planning Councils (WPCs) to advise the District during development of its countywide stormwater management program; therefore, the DWPs were developed in coordination with the WPCs. Membership of the WPCs consists of the chief elected official of each municipality and township in each watershed, or their designees. Many municipalities and townships are represented by engineers, elected officials, or public works directors. WPC meetings are also open to the public. Frequent coordination with WPCs was performed to ensure that local knowledge is integrated into the DWP and the DWP reflects the communities' understanding of watershed issues as well as the practicability of proposed solutions.

## Detailed Watershed Plan Scope

The scope of the NBCR and LM DWP includes the development of stormwater improvement projects to address regional problem areas along open waterways. Regional problems are defined as problems associated with waterways whose watersheds encompass multiple jurisdictions and drain an area greater than 0.5 square miles. Problems arising from capacity issues on local systems, such as storm sewer systems and minor open channel ditches, even if they drain more than one municipality, were considered local and beyond the scope of this study. Erosion problems addressed in this plan were limited to active erosion along regional waterways that

pose an imminent risk to structures or critical infrastructure. Interstate highways, U.S. highways, state routes, county roads with four or more lanes, and smaller roads providing critical access that are impacted by overbank flooding of regional waterways at depths exceeding 0.5 feet were also considered regional problems.

## Watershed Overview

The NBCR and LM watersheds are located in northeastern Cook County and drain an area of over 120 square miles that includes 20 communities. Figure ES.1 is an overview of the NBCR and LM watersheds.

The NBCR watershed area is a heavily urbanized area, characterized by low relief, with small portions of forest preserve and park areas. It is drained principally by the West and Middle Forks of the NBCR, the Skokie River, and the North Shore Channel, which all discharge into and/or combine to form the NBCR. The downstream limit of the NBCR is at the confluence with the Chicago River and South Branch of the Chicago River near West Lake Street in downtown Chicago.

The LM watershed within Cook County is located along the west coast of LM and generally extends west to the ridge along Green Bay Road. This watershed area is heavily developed and characterized by greater topographic relief. The LM watershed consists of seven ravines which drain east into Lake Michigan. The LM watershed ravines are included, along with the NBCR and the tributaries that flow into and/or combine to form it, within the scope of NBCR and LM DWP.

## Existing Conditions Evaluation

Locations with historic flooding and stream bank erosion problems on regional waterways exist throughout the watershed. Information on existing problem areas was solicited from WPC members as well as federal and state agencies and other stakeholders during the data collection and evaluation phase of the DWP development, which also included the collection of data regarding the watershed and evaluation of the data's acceptability for use. Responses from stakeholders were used to help identify locations of concern, and where field assessment or surveys were needed to support hydrologic and hydraulic modeling.

Hydrologic models were developed to represent runoff generated by rainfall throughout the NBCR watershed. The runoff was then routed through hydraulic models, which were created for the major open channel waterways within the watershed. Design rainfall events were simulated for the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year recurrence interval events based upon Bulletin 71 rainfall data (ISWS, 1992). The simulated water surface profiles were overlaid upon a ground elevation model of the study area to identify structures at risk of flooding.

Property damages due to flooding were estimated using a methodology consistent with the U.S. Army Corps of Engineers (USACE) Flood Damage Assessment program. Estimated flood damage resulting from a storm was considered in combination with the probability of the event occurring to estimate an expected annual damage. Erosion damages were assessed for structures or infrastructure at risk of loss due to actively eroding stream banks. Damages reported within this document refer to economic damages estimated over a 50-year period

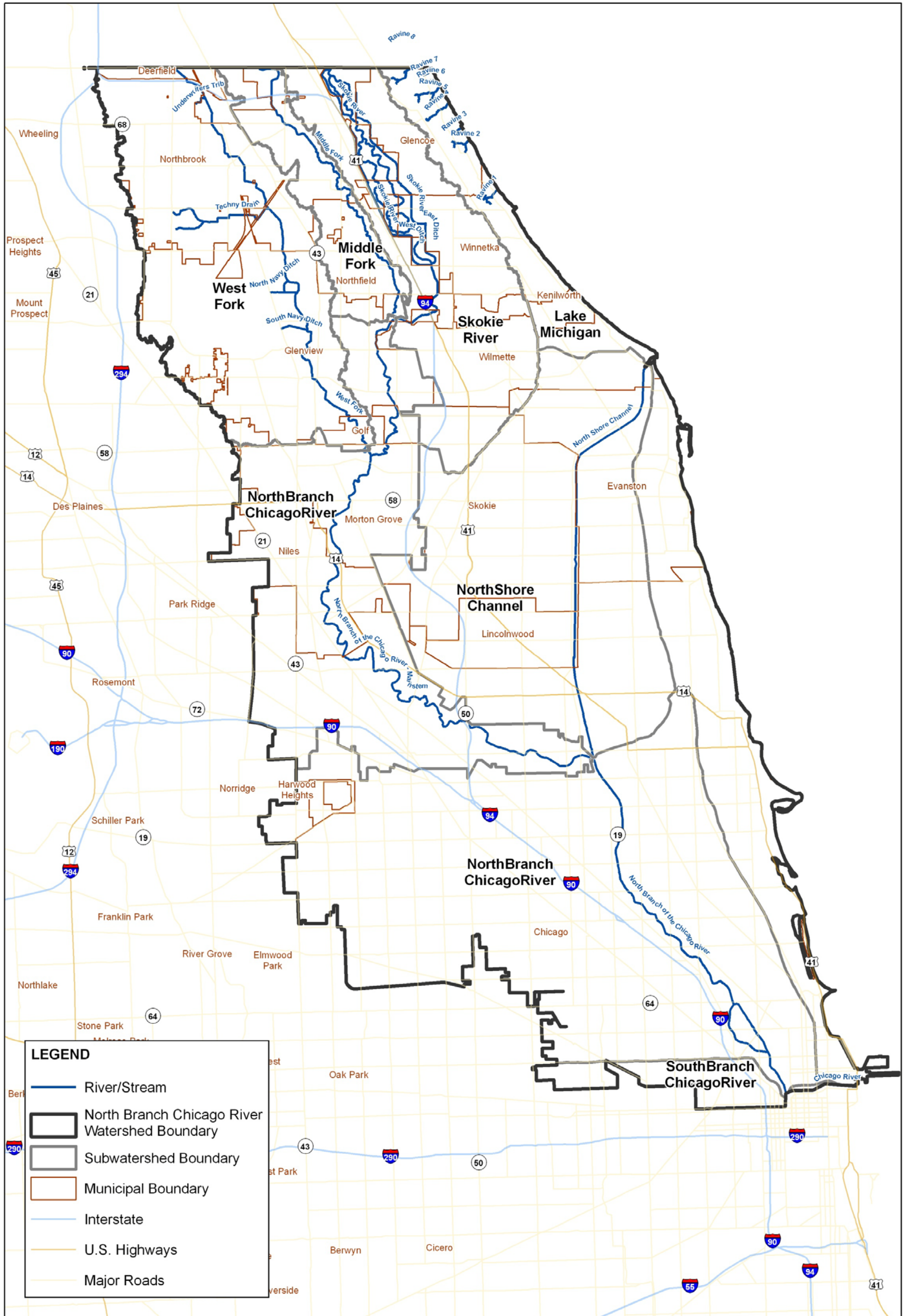


Figure ES.1  
North Branch Chicago River Watershed Overview

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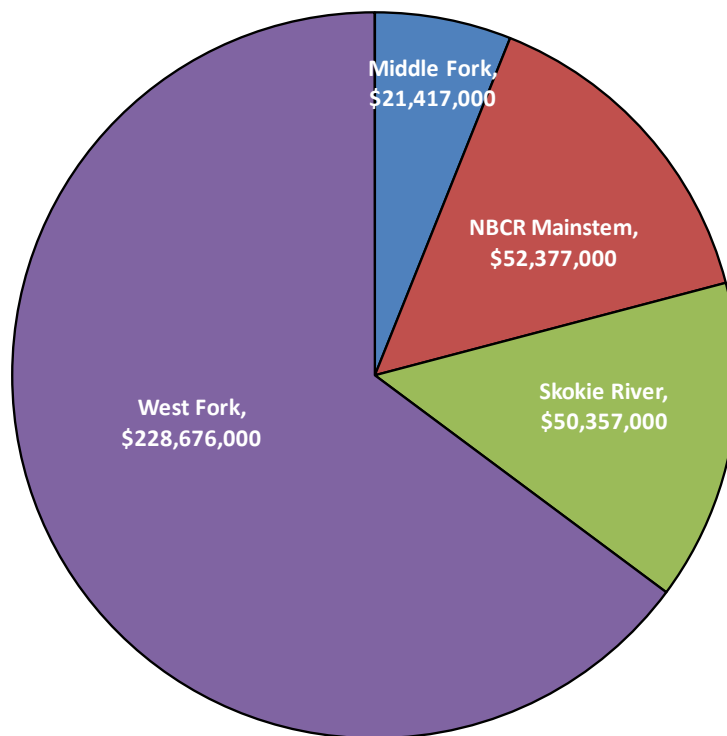
of analysis that result from regional overbank flooding or erosion of a regional waterway. Additional damages throughout the watershed exist, including damages due to flooding from local waterways and storm sewer systems, and also damages not easily quantified in financial terms such as water quality, wetland, riparian, and habitat impact, loss of emergency access, and loss of business or operations due to limited transportation access.

Figure ES.2 summarizes the distribution of existing conditions damages within the NBCR and LM watersheds over a fifty-year planning period. The LM watershed does not have regional damages related to overbank flooding and erosion problems on regional waterways. The West Fork of the NBCR and its tributary waterways comprise of roughly 60 percent of the existing conditions damage within the watershed. The West Fork reach has the second largest tributary area within the watershed, and the relatively dense development within the area subject to flooding combined with the very flat topography of the area resulted in significant damages.

The estimated damages summarized in Figure ES.2 include calculated regional damages related to overbank flooding and erosion problems on regional waterways that threaten structures only and transportation damages. Localized problems, such as storm-sewer capacity issues, are not included in this estimate. Reported problems classified as local are presented in Table 2.2.1 in Section 2.2.1. Also provided in Table 2.2.1 is the reasoning behind classifying the problems as local or regional.

**FIGURE ES.2**

Summary of Existing Conditions Damages within the North Branch of the Chicago River and Lake Michigan Watersheds over 50-Year Period of Analysis



## Evaluation of Alternatives

Stormwater improvements, or alternatives, were developed to address regional stormwater problems along intercommunity waterways. WPC members participated in the alternative development process by providing input on possible solutions and candidate sites for new stormwater infrastructure. It should be noted that the alternatives presented in the DWP are developed at a conceptual level of feasibility.

Hydrologic and hydraulic models were used to determine the benefit of alternative stormwater improvement projects. Models were run and damages were calculated for the existing conditions evaluation. Benefits were calculated for each project as the difference between existing and alternative conditions damages. Only regional financial benefits (e.g., relief of flooding due to a regional problem as defined above) were considered. Local benefits (e.g., improved sewer drainage due to reduced outlet elevation) and non-economic benefits (e.g. improved emergency access, improved wetland, riparian, and habitat, and improved access to businesses) are not included in the benefits. The alternative stormwater improvement projects may have significant local and non-economic benefits. Local benefits are not reported in the DWP, which focuses on regional benefits.

Conceptual level cost estimates were produced to represent the estimated costs for design, construction, and maintenance of a specific alternative over a 50-year period of analysis. The cost estimates were developed using standard unit cost items located within a District database and used for all six watershed plans. In addition, standard markups on the estimated capital costs, such as utility relocation, design and engineering costs, profit and contingency were included.

A benefit-to-cost (B/C) ratio was developed for each alternative, which represents the ratio of estimated benefits to costs. The B/C ratios calculated may be used to rank the alternatives in a relative manner as the District's Board of Commissioners prioritizes the implementation of recommended stormwater improvement projects. Only regional financial benefits were considered in determination of the B/C ratios. The B/C ratios do not include local and non-economic benefits and should not be interpreted to be the sole measure of justification of an alternative. In addition to the B/C ratio, noneconomic criteria such as water-quality impact, number of structures protected, and impact on wetland and riparian areas were noted for each alternative. These criteria may also be considered along with the calculated B/C ratios as the District's Board of Commissioners prioritizes the implementation of recommended stormwater improvement projects.

## Recommendations

Alternatives were recommended based upon consideration of their ability to reduce stormwater damages and to address problems reported by communities. Table ES.1 lists the recommended alternatives, their costs, and regional financial benefits. Note that additional benefits to the local systems and non-economic benefits will result from the recommended alternative projects.

Figure ES.3 summarizes the extent to which recommended alternatives address existing regional financial damages within each stream reach, ordered by increasing existing conditions damages. The two line series illustrated on the graph represent existing condition

TABLE ES.1  
Recommended Alternatives Summary for the North Branch of the Chicago River and Lake Michigan Watersheds

Project	Category	Description	B/C Ratio	Total Benefits	Total Project Cost	Probable Construction Cost	Cumulative Structures Protected	Communities Involved
WF-03	Erosion Stabilization	Hard armoring of WF east bank along Metra Milwaukee North District RR and Fair Lane between Dundee Road and Cherry Lane.	0.77	\$1,550,000	\$2,022,000	\$1,097,000	3	Metra and Northbrook
WF-06	Detention/Conveyance	Techny Reservoir 32A Expansion into Anetsberger Golf Course and steepening existing side slopes to 3H:1V. Includes inlet weir and restrictor barrel revisions. Adds approximately 1,100 ac-ft of detention storage.	1.26	\$146,484,000	\$116,088,000	\$87,422,000	216	Northbrook Park District, Northbrook, Glenview, Golf, Unincorp. Cook Co.
MF-04	Levee	Flood wall on the east bank of the MF through the Fair Acres/Waters Edge subdivision. Compensatory storage proposed for adjacent Forest Preserve District property (approximately 5 ac-ft).	0.12	\$178,000	\$1,495,000	\$736,000	4	Forest Preserve District of Cook County (FPDCC), Northbrook, Unincorp. Cook Co.
MF-06	Erosion Stabilization	Hard armoring of both banks of MF along Robin Hood Lane, New Willow Road, and Northfield Road.	4.59	\$7,391,000	\$1,610,000	\$873,000	7	Northfield
MF-07	Erosion Stabilization	Hard armoring of MF at Meadowbrook Drive.	1.65	\$1,600,000	\$971,000	\$526,000	3	Northfield
SR-08 <sup>1</sup>	Levee	I-94 at Winnetka Road Levees. Construct approximately 1,700 ft of levee along both sides of I-94 near Winnetka Road. <sup>1</sup>	1.35	\$7,760,000	\$5,761,000	\$3,512,000	0	Northfield, IDOT, FPDCC, Cook County Highway Department
MS-10 <sup>2</sup>	Levee	Albany Park Floodwall Project. Construct approximately 6,300 ft of floodwall along NBCR between Foster Avenue and Kimball Avenue.	1.51	\$24,746,000	\$16,402,000	\$4,176,000	329	Chicago, Chicago Park District, FPDCC, Private Property Owners
MS-14 <sup>3</sup>	Detention/Conveyance	Combination of Alternative Projects MS-12 + MS-13 (Wilmette Golf Course Reservoir + Channel Modification on Main Stem). Addition of a new reservoir on the Wilmette Golf Course (approximately 2,800 ac-ft of storage). Channel modification widens the Main Stem channel by approximately 100 feet (50 ft per side) from the Middle Fork to the West Fork, approximately 18,500 ft.	0.25	\$64,431,000	\$260,121,000	\$185,117,000	1,153	Wilmette Park District, Wilmette, FPDCC, Glenview

1 - SR-08 project addresses overbank flooding of the Skokie River near I-94 (Edens Expressway) and Winnetka Road. For purposes of benefit calculation for SR-08, no other temporary closure of I-94 due to overbank flooding is assumed.

2 - The City of Chicago has expressed a preference for Alternative MS-07, which is described in Section 3.4.3.5. Alternative MS-10 yields a higher B/C ratio and was therefore selected as the recommended alternative for the DWP.

3 - MS-14 project's total benefits includes benefits to the Middle Fork, Skokie River, and Main Stem NBCR subwatersheds. FPDCC and Wilmette Park District have indicated their unwillingness to provide land for this alternative.

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damages and benefits, respectively, for each stream reach. The columns indicate the extent to which recommended alternatives address estimated damages, while the red B/C symbols indicate the combined B/C ratio for alternatives associated with each stream reach. As an example, the recommended West Fork alternatives, WF-03 and WF-06, address roughly 65 percent of estimated damages along the West Fork (indicated by the column), which corresponds to a benefit of approximately \$148,034,000. In contrast, the recommended alternative that benefits the Skokie River, MS-14, addresses over 90 percent of the estimated damages along the Skokie River, but this project results in only about \$46,996,000 of benefit for the Skokie River reach. Stated simply, areas with lower existing regional financial damages typically show lower benefits from flood control projects.

FIGURE ES.3  
North Branch of the Chicago River Watershed Alternative Summary

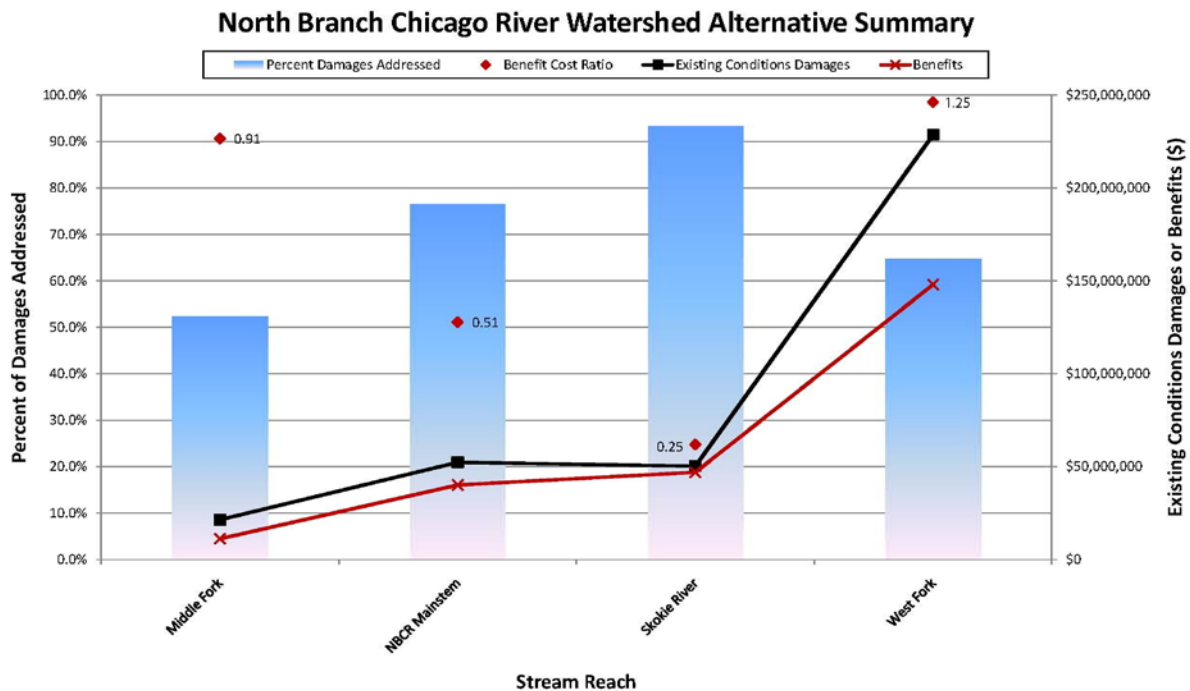


Figure ES.3 Notes:

1. Skokie River stream reach only includes benefits and damages addressed for the MS-14 project due to overlapping benefit with the SR-08 benefit.
2. Benefits, project costs, and damages addressed for the Middle Fork, NBCR Mainstem, and Skokie River stream reaches include results from the MS-14 project. Project costs have been prorated among the three reaches based on benefit percentage to each respective stream reach.

In Figure ES.3, the Skokie River stream reach only reports the MS-14 project's benefits, costs, and percent damages addressed on the Skokie River. MS-14 is the only project reported for the Skokie River stream reach since the Skokie River subwatershed benefits provided by this project are more comprehensive than the SR-08 project, which has been included as a recommended project to serve as an alternative feasible solution to the I-94 at Winnetka Road overbank flooding problem should the MS-14 project not be implemented.

Because the MS-14 project provides benefits to the Middle Fork, Skokie, and NBCR Mainstem stream reaches, the benefits provided by MS-14 for each stream reach were incorporated into the percent damages addressed and B/C ratio for each stream reach. Distribution

of project costs for MS-14 between the associated stream reaches was estimated by prorating the MS-14 project costs among the three reaches based on benefit percentage provided by

MS-14 to each respective stream reach. It should be noted that approximately 2,800 acre-feet of stormwater storage is required to realize the benefits of MS-14. The property owners, namely FPDCC and Wilmette Park District, of the potential storage locations have expressed an unwillingness to allow the storage to be provided on their respective properties.

The NBCR DWP integrated stormwater data from a large number of sources in order to identify and prioritize solutions to existing stormwater problems. An extensive data collection effort undertaken for the DWP development included surveying of streams, bridges, and culverts throughout the entire watershed. Field reconnaissance was performed throughout the watershed to understand conditions unique to the watershed. This compilation of current, accurate data was used by the District to document and identify existing stormwater problems throughout the study area.

A large number of alternatives were developed and evaluated for their effectiveness in reducing regional damages within the NBCR watershed. The alternatives listed in Table ES.1 were identified as the most effective improvements for reducing expected damages due to flooding within the watershed. In some tributaries, greater opportunities to reduce regional flooding were identified than in others. Factors such as the lack of availability of land and location of structures relative to stream channels limited the practicality of alternative projects to eliminate all flooding damages for all design storms evaluated.

While some recommended alternatives involve the use of FPDCC property, it is noted that the enabling legislation (70 ILCS 2605/7h (g)) for the District's stormwater management program states "the District shall not use Cook County Forest Preserve District land for stormwater or flood control projects without the consent of the Forest Preserve District of Cook County (FPDCC)"; therefore proposed projects involving FPDCC property cannot be implemented without FPDCC's permission. The District will work collaboratively with FPDCC to develop multi-objective projects beneficial to both agencies along with our constituents and also consistent with our individual missions.

The data provided in the NBCR DWP will be used by the District, along with consistently developed data in DWPs for the other five major Cook County Watersheds, to prioritize the implementation of stormwater improvement projects.